

# Colorado Water

Newsletter of the Colorado Water Resources Research Institute, Fort Collins, Colorado 80523

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December 1996

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### **BRINGING THE RIVER BACK: TO THE FUTURE URBAN AND RURAL/ WATERSHED MANAGEMENT**

**A summary of the 1996  
South Platte Forum**

*see page 16*

*Denver Mayor Wellington Webb describes South Platte River  
Corridor Project – see Page 19*

**Colorado  
State  
University**



## UNDERSTANDING COMPLEXITY

Water management today is complex! When students, either undergraduate or graduate, are studying a particular aspect of water management in Colorado, they soon discover that the aspect of their interest is interwoven with many other issues in complex and intricate ways. To complete a class assignment or finish a thesis within the time allotted, they have to limit the scope of their water study within narrow bounds.

How did water management get so complex? Problem-by-problem, law-by-law, agency-by-agency; regulation-by-regulation; discipline-by-discipline evolving over the past 150 years. To illustrate, today the water managers in the San Luis Valley face 38 separate laws that address ground water quality problems. The citizens of the Arkansas Valley must work through 16 separate state and federal agencies when addressing water problems. At the higher-education level, Colorado State has 15 departments that work with water in one way or another.

How can we better integrate the separate laws, agencies and disciplines to solve water management problems in a more efficient and effective manner? Is it any wonder that we are increasingly hearing calls for an "integrated" approach to water management? Such calls for integration, however, appear to devalue existing water-related agencies, disciplines, and uses of water. To move through the complexities and arrive at a more efficient and effective (and perhaps a more integrated) approach to water management, while protecting those who have invested in traditional ways of studying, managing, and using water, will require considerable communication and understanding among many people involved in all facets of water use and management in Colorado.

To enhance such communication and understanding, there are increasing opportunities for people representing different water problems, laws, agencies and disciplines to meet and confer. The practical impact is more water meetings and conferences today than ever.

This issue of *COLORADO WATER* reports on a number of water meetings held over the late summer and fall. It announces a number of upcoming meetings. I try to attend as many of these meetings as I can, and I find them informative and addressing water management issues and concerns in new and creative ways. The people participating in the meetings represent a broad spectrum of interests and they articulate their positions clearly and with understanding of other positions. It is obvious to me that the many water meetings, while I decry the time they take from my schedule,

are fostering communication among water users, water managers and the public in new ways. As more people gain a broader understanding of Colorado's water management system and share their understandings with others, opportunities to develop new options to solve old problems in a win-win manner are sure to emerge.

I applaud the energy and creative efforts of the meeting organizers and thank them for their efforts. Scan the list of upcoming water meetings in this newsletter and join in the discussions and conversations taking place!

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Robert C. Ward, Director





## RESEARCH OPPORTUNITIES

### NASULGC/EPA CONDUCT SEMINAR ON GRANT PROGRAM

The National Association of State Universities and Land Grant Colleges and the U.S. Environmental Protection Agency held a seminar in October to discuss the EPA's Office of Research and Development (ORD) expanded extramural grants program and graduate fellowships program. Representatives from ORD discussed their strategic plan which includes expanding the extramural grants and contracts and agreements that EPA will have with other agencies and universities. In Fiscal Year 1996 ORD invested \$55 million in competitive grants, \$22 million in exploratory grants and \$10 million in fellowships. ORD is working to increase all of the figures in future budget years. Also reported that they are interested in increasing leveraging of funds through more joint solicitations. EPA's extramural research grants programs are administered by ORD's National Center for Environmental Research and Quality Assurance (NCERQA).

ORD seeks to support long-term research that anticipates future environmental problems as well as research that fills gaps in knowledge relevant to meeting current agency goals. EPA's research programs focus on the reduction of uncertainty associated with risk and reduction of risks to human health and ecosystems. EPA also fosters the development and evaluation of new risk reduction technologies across a spectrum, from pollution prevention through end-of-pipe controls to remediation and monitoring. Requests for Applications for 1997 research grants were announced at the meeting. Information including forms, applications and updates can be accessed on the Internet at the following address:

<http://www.epa.gov/ncerqa>



## AWARDS AND SCHOLARSHIPS

### ASSOCIATION OF STATE DAM SAFETY OFFICIALS

Scholarships up to \$5,000 will be awarded for the 1997/98 school year. Successful recipients must be U.S. citizens and enrolled at the junior or senior level in an accredited civil engineering program, or in a related field as determined by ASDSO, and must demonstrate an interest in pursuing a career in hydraulics, hydrology or geotechnical disciplines, or in another discipline related to the design, construction and operation of dams. Undergraduate students planning to graduate in May/December 1998 will be eligible for the 1997 scholarship. Undergraduate students planning to graduate in May/December 1999 will be eligible for the 1997 junior scholarship. Awards made to a

person at the junior level may be renewed the following year at the discretion of ASDSO. However, the junior scholarship recipient must reapply if interested in receiving a scholarship for the senior year. Applicants must have a cumulative grade point average of 3.0 for the first two years of college and be recommended by their academic advisor. They must also submit a two-page typewritten essay describing goals and purpose for applying. DEADLINE: Feb. 15, 1997. Send applications and accompanying materials to: Association of State Dam Safety Officials, 450 Old East Vine, 2<sup>nd</sup> Floor, Lexington, KY 40507. Questions: call 606/257-5140.

### AWRA/UCOWR/HYDROLAB CORPORATION AWARDS

AWARD #1—given by Hydrolab Corporation for the best student paper presentation at the AWRA 33<sup>rd</sup> Annual Conference and Symposium, Oct. 19-23, 1997, in Long Beach, CA. This award includes a \$300 prize and one year's membership in AWRA and will be presented at the conclusion of the Annual Conference. All students who have a paper accepted for presentation at the Annual Meeting will be eligible for consideration for this award. Contact AWRA at address below for call for papers.

AWARD #2 and AWARD #3—given by the Universities Council on Water Resources (UCOWR) and the American Water Resources Association (AWRA), includes one award for best undergraduate paper and one award for best graduate paper. Each of these awards includes a \$250 prize and one-year membership in AWRA. Contact AWRA at address below for complete instructions.

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## WATER RESEARCH

### IRRIGATION WATER CONSERVATION: OPPORTUNITIES AND LIMITATIONS IN COLORADO

*A summary of a report by the Agricultural Water Conservation Task Force formed by CWRI to examine the nature of, and prospects for, agricultural water conservation in Colorado. Participants included: D. H. Smith, Task Force Chair, Department of Soil and Crop Sciences, CSU; Richard Bartholomay, Cooperative Extension, CSU; Israel Broner, Department of Chemical and Bioresource Engineering, CSU; G. E. Cardon, Department of Soil and Crop Sciences, CSU; D. F. Champion, Cooperative Extension, CSU; Ralph Curtis, Rio Grande Water Conservation District; W. M. Frasier, Department of Agricultural and Resource Economics, CSU; Kathleen Klein, Formerly Graduate Research Assistant, CWRI (presently Colorado Water Conservation Board); Rod Kuharich, City of Colorado Springs Utilities Department; D. C. Lile, Colorado Water Conservation Board; Mike Gross, Colorado River Water Conservation District; Dan Parker, Colorado Soil Conservation Board; Hal Simpson, Colorado Division of Water Resources; and Eric Wilkinson, Northern Colorado Water Conservancy District.*

There is increasing concern about how future demands for Colorado's water resources can be met, given that some watersheds are already overappropriated and that the constraints on development of large-scale storage projects are significant. Historically, agriculture has used the vast majority of Colorado's developed water resources. This is still true even though transfers of water from agricultural to urban uses have been employed extensively in recent years to satisfy demand caused by rising population. Irrigation agriculture continues to be the focal point of discussion on sources of water to meet growing demands. Calls for conservation have come from several sources, apparently prompted by assumptions that the magnitude of agricultural water use is associated with inherent inefficiencies in current use and that minimal efforts toward conservation could yield the water required for alternative uses.

As part of its 1995 research program, the Colorado Water Resources Institute assembled a task force to study issues relating to the question of whether efforts to conserve agricultural water could solve problems associated with alternative demands without adversely affecting agricultural production or existing delivery systems and users. The task force was comprised of members of the academic community and representatives of various water agencies from throughout the state. Members delineated the institutional and physical realities that govern the use of water, specified potential strategies for accomplishing agricultural water conservation, and indicated implications of these different strategies.

#### Institutional Structures Governing Colorado Water Use

**The Prior Appropriation Doctrine** — Water rights in the United States originally were based on the riparian doctrine because of the climate and geography of the areas settled earliest. In the east, rainfall is generally abundant, and the landscape is permeated with brooks, streams, and rivers. As people moved west, new situations were encountered where the riparian doctrine did not adequately address the allocation of water use. The prior appropriation system of water allocation originally developed within the mining camps and was similar to the practice of filing mining claims. The first person to put water to a productive use established the highest priority for water use from a given stream system — "first in time, first in right." The principles of the prior appropriation doctrine were quickly adapted to use in appropriating water rights for irrigation and other beneficial uses as the west was settled.

**Water Rights in Colorado** — Colorado became the first state to formally adopt the doctrine of prior appropriation as the guiding principle for water rights administration with the inclusion of the doctrine in the Colorado Constitution in 1876. The Colorado system of the prior appropriation doctrine is reliant upon the legal ownership of water rights. A water right is based on diverting a given quantity of water at a specified site under a specified priority and applying the diverted water at an identified location for a defined purpose. Water rights can be owned by individuals and a variety of entities including municipalities, water and sanitation districts, ditch companies, and state and federal agencies.





To establish, or appropriate a water right in Colorado, water must be used for beneficial purposes. Beneficial use is defined in the Colorado statutes as "the use of that amount of water that is reasonable and appropriate under reasonably efficient practices to accomplish without waste the purpose for which the appropriation is lawfully made..." (Colorado Revised Statutes, Section 37-92-103(4)). Water rights in Colorado are used for a multitude of beneficial uses including but not limited to municipal, domestic, industrial, recreational, environmental, and agricultural purposes. The use of water for the preservation of the natural environment to a reasonable degree is considered a beneficial use, but the legal right to use water for this purpose is held exclusively by the State of Colorado.

The prior appropriation doctrine also embodies the "use it or lose it" principle. According to this principle, if appropriated water ceases to be applied to a beneficial use for an extended period of time (10 years), the right to that quantity of water may be declared abandoned. The water then remains in the stream to be appropriated by another individual or entity under a junior water right.

Water rights in Colorado are adjudicated by the Colorado judicial system and administered by the State Engineer, who also serves as Director of the Division of Water Resources, Colorado Department of Natural Resources. A district court judge is designated as a water judge in each of seven water divisions in the state, and has jurisdiction to preside over water matters in the division water court. The water courts determine water right quantities and priorities, consider changes in water rights, interpret water right claims, and issue legal decrees permitting the use of water.

Water rights are quantified based on the rate of diversion (cubic feet per second) or volume stored (acre-feet). However, the amount of water yielded from a water right is affected by the availability of water in any given year. If water supply is limiting, the water right holders that are junior or of a lower priority may not receive their entire allocation of water. The value of a water right, therefore, depends on its priority.

The principles of the prior appropriation doctrine applied first to surface waters but not to ground water, because little was known at the time of their adoption about interrelationships between surface waters in streams and underlying ground water. Also, little use was made of ground water resources prior to 1940. As the hydrology of stream systems became better understood, the legal framework for ground water regulation evolved. In Colorado, legislation passed during recent years has resulted in a highly structured system of managing these waters. Where ground water use is determined to have an impact on surface stream flows that are

appropriated, the ground water and the associated surface stream flows are administered jointly as one stream system under the principles of the prior appropriation doctrine.

**Changing Water Rights** — The prior appropriation system in Colorado allows water rights to be transferred or changed, subject to certain procedures and restrictions imposed by the water courts and the State Engineer's office. Water right transfers or changes can be temporary or permanent, and can involve changes in use, timing, amount, and location of either diversion or use. Proposed changes in water use that deviate from the original water right decree require water court approval prior to implementation. Changes in water use that do not violate the original terms and conditions of the water right decree can usually be implemented without court review, but may be subject to review by the State Engineer.

The permanent transfer of water rights between different users and uses is permitted subject to the protection of other water right holders. Water right changes cannot have a detrimental impact on other vested or decreed water rights. When a change in use is proposed, other water users are protected from injury by terms and conditions that are imposed by the water court and contained in the decree for the water right change. These terms and conditions are necessary to maintain stream conditions that were present at the time other vested water rights were established. This "no-injury" rule is defined and enforced by the water courts. The State Engineer is then responsible for implementing the actions specified by the courts after a change of water right is decreed. The quantity of water that can be transferred is generally based on the amount of water previously consumed by the water user.

There is much discussion regarding the issues associated with agricultural water conservation and the administration of the existing water rights system. The Colorado water rights system provides certainty and protection to water users while allowing for flexibility in changes of use and the transfer of rights. Although the judicial process is viewed by some as an expensive and time-consuming means to resolve water rights issues, the process does allow for other water right holders to act on behalf of and protect their rights, and can be responsive to changing economic and social needs. The adjudication and administration of water rights has evolved over time and will likely continue to do so in the future. The adoption of agricultural water conservation practices by some water users can have serious impacts on other water users and existing stream conditions. This document will attempt to identify some of the key issues that must be addressed as on-farm irrigation efficiencies are improved.



## Technical Elements of Agricultural Water Use in Colorado

**Consumptive Use** — The consumptive use portion of a water right is specifically defined as water that is no longer available within a stream or aquifer system because it has been evaporated, transpired by plants, incorporated into products or crops, consumed by people or livestock, or otherwise removed from the water supply. For crop production systems, plant transpiration and evaporation from soil and crop surfaces accounts for almost all the water that is consumptively used. These combined evaporative and transpiration losses are referred to collectively as evapotranspiration. Evapotranspiration losses generally are assumed to be equivalent to beneficial consumptive water use in irrigated cropping systems. The consumptive use portion of a water right is rarely as much as the amount of water that a water right is allowed to divert for a given beneficial use. This is a significant source of confusion and contention in quantifying a water right.

With most irrigation water distribution and application systems, some water is applied in excess of the soil water-holding capacity and actual use. The excess water either percolates through the soil and becomes ground water that reenters the stream or river or flows overland through surface channels or drainages to the stream or river. These returning waters, which are in excess of water actually used or held in storage within the crop root zone, are called return flows.

Return flows are typically available for appropriation by downstream water users. When a water right is transferred to another use, water laws in most western states, including Colorado, dictate that the change in conditions resulting from a transfer (i.e., point of diversion and quantity of water diverted, for example) must not injure other vested or decreed water rights not directly involved in the transaction. This is generally interpreted to mean that only the amount of water actually consumed — the consumptive use — under a historical set of conditions and practices, can be sold or transferred and that return flows are maintained. Engineering estimates are used to establish the terms and conditions to be included in the change decree resulting from a transfer of use. Such estimates are based on historical experience with long-used crop varieties and irrigation technologies under historic hydrologic conditions and may or may not be good estimates for a specific operation.

**Irrigation Efficiency** — Many definitions of irrigation efficiency have been developed and used as measures of irrigation performance. The common factor in all these definitions is that they involve the ratio of water quantity consumptively used or stored for later use to the quantity delivered.

The term irrigation efficiency describes a ratio between water quantities, and inherently implies that water not consumed by the crop is lost. However, in irrigation, "nonconsumed" water (water not stored in the root zone) is not always lost to the system. In fact, much of the water not directly consumed by the crop returns to the stream system as return flows. Thus, irrigation efficiency values for individual operations can be misleading because they do not account for water that eventually becomes available to other downstream users in a river basin.

In Colorado, the historical efficiencies of irrigation systems are taken into account by the legal system. A reasonable amount of over-irrigation due to unavoidable losses associated with a particular irrigation system is considered a beneficial use. The water required to satisfy the consumptive use needs and also to account for these losses is generally referred to as the duty of water for a given irrigation system.

Return flows are also important because there is a time lag between an irrigation event and the time that the return flow water reaches the stream and is available for subsequent diversion and beneficial use. This time lag can range from a few hours to several months depending on whether it is surface or ground water return flow and the characteristics of the river basin and its soils. Early research by the Colorado State University Agricultural Experiment Station documented that return flows resulting from irrigation greatly increased late-season streamflows in the South Platte basin. The historical record prior to irrigation indicates that streams in eastern Colorado were likely ephemeral in many years.

In the Arkansas, South Platte, and Rio Grande basins, the apparent inefficiency of individual irrigation systems creates water storage in a shallow aquifer within the river basin. The additional inflow to the stream from this aquifer increases the water supply for downstream users in the latter part of the irrigation season. Without this temporary ground water storage, natural high levels of river flows in the early part of the growing season would flow downstream and be unavailable for later use.

Degradation of water quality resulting from repeated use of the same water is of concern also. In river basins where return flows are used several times, concentration of suspended solids and dissolved salts increase downstream. This problem is more severe in some basins than others because of natural salt-bearing soil layers.



The traditional irrigation efficiency term describes the overall performance of an irrigation system in delivering water to the crop root zone of an individual farm or field without considering the reuse of return flows. For example, if a 60% efficiency is obtained by an irrigation system on a particular field, it doesn't necessarily mean that 40% of the water delivered to this field is lost to the system. It means that only 60% of the water diverted from the source and applied to the field is stored in the root zone or used beneficially to satisfy crop requirements. The other 40% may return to the stream or ground water and become available for another user. Thus, in river basins, irrigation efficiencies of individual

fields may be low, but the overall water use efficiency of the basin can be high.

The efficiency of various irrigation practices is also important where water is pumped from deep ground water aquifers, but different factors must be considered. In these systems inefficient irrigation results in substantial water loss to the aquifer, because the time it takes the deep percolated return flows to reach the ground water aquifer is too long for this water to be considered reusable. In addition, the energy needed to pump the additional water can represent a significant cost to the overall production system.

## Water Conservation Terminology

Salvaged water and saved water are terms that refer to a fraction of a diverter's water supply that becomes available as a result of conservation practices or water system improvements. Water salvaged or reclaimed from a nonbeneficial loss of water diverted under a valid water right is called salvaged water. Such losses could include evaporation, transpiration, or seepage that does not return to the stream or aquifer system upon which other water rights depend. Evaporation and transpiration losses are common in open, unlined ditches, which are widely used to convey water for irrigation. Replacing an open ditch with underground pipe would result in conserving water by eliminating evaporation from the open ditch and transpiration from weedy plants or trees growing along the ditch. Some of the seepage from canals returns to the stream or aquifer system as return flow, and is then available for diversion by other water rights. However, this is not always the case. Using underground pipe can eliminate losses of seepage water that would not otherwise return to the stream system. In this example the water conserved would be considered salvaged water because the water conserved would not, under pre-conservation conditions, have been available for diversion and beneficial use by other water users. The owner of salvaged water may elect to change its use, irrigate additional acreage, or store it to cover seasonal shortages but, as a prerequisite, must prove in water court that any changes will not injure other water users.

Return-flow water that is conserved through more efficient diversion and application of a diverted water right is called saved water. If, in the example given above, installation of underground pipe prevented losses of seepage water or other return flow that normally would have returned to the stream or aquifer system upon which other water users are dependent for their supply, the water conserved would be considered

saved water. Saved water can be applied to beneficial use by the original diverter to eliminate or reduce periods of shortage, subject to terms of the original water-right decree, but may not be sold or transferred to new uses that are outside the terms of the original water right.

Conservation practices can impact a watershed differently depending on whether the water derived is salvaged water or saved water. Water conserved as salvaged water can potentially increase the amount of water available for alternative uses without adversely affecting other water rights. Water conserved as saved water may decrease the total amount of water available for alternative uses. If the original diverter can make beneficial use of the saved water during periods of shortage in accordance with the terms of the existing decree, the diverter's total seasonal consumptive use will increase. If the saved water becomes available to junior water right holders, those junior users will divert or consume part or all of it.

Salvaged water belongs to the owner of the water right, and can be transferred to new uses, subject to water court approval of a change in water rights. Saved water falls into two categories: 1.) if the owner of the water right is able to use the saved water to fill shortages under the terms of the water right decree and does not increase the decreed irrigated acreage or apply the water to new uses, the saved water remains under the owner's control; and 2.) if the owner of the water right is not able to use the saved water to fill shortages for the original decreed purposes, the saved water automatically becomes part of the stream system and available for diversion by other holders of water rights upstream or downstream.



## Overview of Colorado Water Use

Irrigation water use accounts for the vast majority of total water use in the state. Diversion records compiled by the State Engineer show that direct irrigation diversions are 75% of the state-wide totals, and do not include the amount of irrigation water released from storage. Municipal water diversions, which reflect a large proportion of urban water demand, average only about 4% of total water withdrawals.

According to U.S. Geological Survey analyses, withdrawals and deliveries for irrigation are greater than 90% of totals

used for all purposes on a state-wide basis. Variation in irrigation water use among the different basins is directly related to population density. Irrigation water use comprises a much lower percentage of total use in the South Platte and Arkansas basins, where population densities are greater and water use by the municipal and industrial sectors is greater than in other basins. The high proportion of irrigation water use in Colorado is comparable to that for other western states where significant irrigation development has occurred.

## Irrigation Water Conservation

Research, product development, and technology improvements occurring over the past several decades have produced a wide range of practices that have the potential of conserving irrigation water. The adoption of the various practices by agricultural producers has been a function of economic and social elements as well as institutional factors. Terminology used to describe the direct effects of various conservation practices will follow that previously established in the report. The term application efficiency refers to the amount of water diverted and applied per unit of irrigated land area.

**Types of Conservation Practices** — Decreases in irrigation water use at the individual farm level can be achieved by structural improvements in the application systems or target land, better maintenance of existing irrigation systems, information management techniques, altered tillage and soil management, or changes in the crops grown. In some cases, combinations of these different methodologies are applied in a single setting.

Structural improvements in application systems include practices such as replacing open ditches with underground pipe, lining ditches, use of gated pipe, fitting gated pipe systems with surge-flow devices, conversion from furrow to sprinkler irrigation or drip irrigation, upgrading existing sprinkler systems, and installation of tailwater recovery systems. The primary objective of adopting these practices is to increase application efficiency at the individual farm level. In many instances they also have the potential of decreasing nonbeneficial consumptive use. Similarly, structural land improvements such as construction of conservation bench terraces and land leveling are designed to improve application efficiency and decrease nonbeneficial consumptive use.

Information management and altered tillage and soil management are also practices designed to increase application efficiency at the farm level. Information management usually involves techniques that allow growers to schedule

irrigation based on moisture needs of crops. Specific techniques include monitoring soil moisture and maintaining daily records of crop water balance using estimates of consumptive water use from weather data. Conversion to minimum or conservation tillage, use of furrow diking, and practicing more timely fertilization are examples of altered tillage and soil management. Information management techniques can also be used to schedule strategic deficits in water availability during periods when crops are relatively insensitive to soil water deficits. This form of information management is generally referred to as deficit irrigation, and results in decreases in beneficial consumptive use. Various state and federal agencies have devoted significant research effort in recent years to defining deficit irrigation practices that will allow producers to either avoid or minimize economic and productivity losses. Substantial progress has been made in devising successful strategies, especially with grain crops, in which the fraction of the plant harvested for sale or direct end-use is only a fraction of biological yield.

Changes in cropping patterns also can result in decreases in beneficial consumptive water use. Examples of specific changes include reducing acreages of irrigated crops, switching entirely to dryland crops, and switching to crops with lower seasonal consumptive use.

Some conservation measures can be implemented at the system level to improve overall application efficiency within a basin and, in some cases, decrease nonbeneficial consumptive use. For example, some segments of conveyance canals maintained by irrigation companies in the Grand Valley have been lined to reduce seepage losses and decrease nonbeneficial consumptive water use by weedy plant communities along these canals. Further savings have been proposed for other delivery systems in the Grand Valley by the use of structural alterations in canals that will result in increased application efficiencies.





**Incentives for Adopting Water Conservation Measures** — Incentives for adopting water conservation practices vary regionally. In those areas pumping from deep ground water aquifers, economic incentives for water conservation exist because practices that result in increased application efficiency can frequently be justified on the basis of decreased pumping costs. In addition, institutional incentives in the form of restrictions on the rate of aquifer depletion encourage the adoption of irrigation water conservation practices.

In alluvial watershed basins where water is obtained from surface diversions or shallow aquifers, incentives for adopting practices that decrease consumptive use or result in saved water are somewhat limited unless the water conserved can be used to extend supplies under the terms of an existing water-right decree. In some situations other direct economic benefits can be realized from the adoption of water conservation measures. Examples include savings from reduced power costs associated with pumping and revenue derived from marketing the conserved water on the rental or sales market. Economic benefits are difficult to project on a general basis because the large number of variables involved requires that potential gains have to be evaluated on a case-by-case basis.

If the goal is to recover salvaged water for some other beneficial use, incentives for conservation are generally assumed to be limited because of the amounts of water available from changes in practices or potential institutional, statutory, and economic barriers to transfer of use. In the case of water conserved by reducing nonbeneficial consumptive use, the amount of water involved is likely to be so small that the economic incentive for any single operator is minimal.

Of the management practices mentioned previously, only those involving changes in cropping patterns could result in salvaging significant quantities of water by decreasing beneficial consumptive use. The changes in cropping practices involved, however, are substantial, and economic barriers to this transition in cropping can be significant. For example, shifts from feed crops (corn or alfalfa) to melons in the Arkansas River basin can result in significant water salvage because the seasonal consumptive use of melons is much lower than that of either corn or alfalfa. However, this type of cropping change involves making wholesale modifications in farm operations and entering a more dynamic marketing environment. Thus, this change in cropping practices is not likely to occur on a widespread basis. Economic barriers to salvaging water through changing cropping practices can be overcome with transition from irrigated to dryland farming upon the sale and transfer of agricultural water to urban use. This type of transition has occurred on relatively large acreages of formerly irrigated land in the South Platte and Arkansas River basins.

The existence of economic incentives for surface water users to implement practices that result in more efficient diversion depends on the disposition of the resulting saved water. Growers are free to retain control of this water if the accrued savings can be used to extend supplies under the terms of the existing decree. In many cases, irrigators are short of water for a portion of the growing season, so there is an economic incentive to use the saved water to fill shortages. If, however, the grower is unable to use the saved water in this manner, the saved water automatically becomes part of the stream system and available to other users.

The incentives for adopting deficit irrigation practices are lacking, partly because of institutional barriers to transfer of a portion of the historic consumptive use within any given decree. These barriers include problems with quantifying the portion of the historic consumptive use to be transferred and administering the resulting change. One alternative to permanent transfers of a portion of consumptive use is dry-year option contracts between agricultural and municipal users. Under these arrangements, agricultural users would be paid to fallow land during short-term periods when supplies fall far short of total demands within the basin.

**General Implications of Water Conservation Practices** — In watershed basins where water is derived from surface diversions or shallow alluvial aquifers, the adoption of conservation practices that decreases either nonbeneficial or beneficial consumptive use will have minimal effect on hydrology at the basin level, because return flows are not affected. There is concern that decreases in nonbeneficial consumptive use could threaten wetlands created by long-term irrigation.

Within any given basin, wide-scale adoption of conservation practices designed to increase diversion efficiencies has the potential of altering basin hydrology by reducing the magnitude of return flows. In areas where return flows fulfill a portion of irrigation demands, their importance is measured not only in magnitude, but also in timing. A significant fraction of the return flows from irrigation are delayed in their return to the stream system because the pathway is via porous soil media within the alluvial aquifer, which restricts the rate of water flow. On a basin-wide scale discharges from the alluvial aquifer increase late-season streamflows, which can meet irrigation demands for extended periods after peak runoff from snowmelt. The system, in effect, functions in the same manner as a reservoir, with diversions in excess of consumptive use contributing to storage and return flows functioning as releases.

Changes in irrigation practices at the basin level that would significantly increase diversion efficiencies could negatively



impact water users who depend on these return flows. In the South Platte, Arkansas, and Rio Grande basins, irrigation diversions greatly exceed streamflows, which demonstrates the dependence of downstream users on return flows and is evidence of a relatively high level of water use efficiency within the basin. Reduced return flows are not a concern in the lower reaches of some watersheds where there is no downstream dependence on these return flows if interstate compact issues are not limiting.

Another likely effect of basin-wide increases in diversion efficiency is increased consumptive irrigation water use. This would occur as a consequence of irrigators using the savings from more efficient diversions to fill shortages within their decrees. Increased consumptive use would affect basin hydrology and eventually result in reduced return flows.

Large-scale transfers of water from irrigation to alternative uses causes a transition from irrigated to rainfed (dryland) agriculture. In many cases, this can cause decreased land values because of limited alternative land uses, greater potential for soil erosion, and unreliability of dryland cropping practices because of limited and variable natural precipitation. If annual precipitation levels and soils are favorable, dryland cropping practices can be successful even though productivity levels are greatly reduced. In many cases, precipitation and soils dictate that land must be converted to rangeland to stabilize production and prevent erosion. This requires careful long-term management of revegetation, which is not generally cost-effective.

In the past, the unfavorable economic outlook for dryland cropping and rangeland restoration led to land abandonment after water transfers. This has been largely remedied by various combinations of government subsidies supporting land revegetation and water court stipulations requiring restoration. Even with these remedies in place, transfers have a significant negative impact, at least in the short term, on local economies and public institutions because of decreased economic activity and a lower tax base.

**Water Quality Impacts** — Irrigation management that results in return flows has been targeted as an important contributor to water quality problems in watershed basins

with significant agricultural development. Irrigation practices in the Grand Valley and on lands served by the lower Gunnison and its tributaries have been identified as one factor contributing to increased salinity in the Colorado River. In response to congressional action to comply with treaty obligations to Mexico, the Bureau of Reclamation has developed and maintained programs to reduce this source of salt loading in recent years.

Nutrient and pesticide loading of surface and alluvial ground water can also arise from irrigation return flows. Although potential nutrient loading from irrigated agriculture and confined animal feeding exceeds that from urban sources in the South Platte basin, nutrient concentrations in surface water are highest immediately downstream of the Denver-Metropolitan area. Because of nutrient uptake by crops, irrigation diversions actually decrease nutrient loads in surface water to the extent that the levels of nutrients leaving the basin are lower than total annual inputs from all sources. However, ground water contamination from nutrients and pesticides is apparent in the areas of the South Platte basin where irrigated agriculture is most concentrated. Although return flow from irrigation is one factor contributing to contamination, the magnitude of this contribution in relation to other factors is unknown.

**Impacts of Transfers to Instream Uses** — Another issue involved in considering agricultural water conservation is the fate of the resulting water. Irrigated agriculture is vital to the overall economy of Colorado. If water resulting from conservation is transferred to municipal or industrial uses, this will tend to enhance the value of this renewable resource to the state's economy. In addition, when agricultural water is transferred to the alternative uses indicated above agriculture users are compensated for the loss, since the right to use water is considered a property right. Instream uses proposed for water resulting from agricultural water conservation include recreation and improved habitat for threatened or endangered species. If the conserved water is to be transferred to these uses, the same economic incentives for transfer must exist. In this case, the issue of who pays becomes important. If the water is transferred for the purpose of enhancing the environment, the costs and benefits of such changes in use have to be considered.

## Concluding Statement

The demands on water resources in Colorado continue to grow even though many of the state's streams are over-appropriated and some underground aquifers are experiencing net depletion on an annual basis. Irrigation of agricultural lands accounts for more than 90% of the developed water resource withdrawals in the state. The dominant use of

water by this sector of the economy has prompted calls by some for increased conservation efforts by agriculture to meet future alternative demands.

Both institutional and hydrologic factors can affect the potential for and effects of agricultural water conservation.



Although the institutional barriers to conservation exist for the entire state, the hydrological conditions affecting agricultural water use vary greatly among and within the different basins. A significant proportion of irrigation water rights are dependent on return flows from upstream irrigation diversions in the South Platte, Arkansas, and Rio Grande basins. If water conservation measures that decrease the magnitude of return flows become widely adopted, the existing hydrologic integrity of these basins will be affected. The potential for agricultural water conservation is greater in the Colorado basin, where there is less dependence by irrigation operations on return flows. The High Plains deep aquifer basin is distinct hydrologically from the other basins because the point of use is widely separated from underground water resources.

In this region, future agricultural water conservation will depend largely on economic incentives and the need to conform to state regulations designed to limit excessive depletion of the Ogallala aquifer.

The potential for future agricultural water conservation in Colorado varies greatly among regions. More importantly, policy initiatives designed to implement conservation should be based on how water is used at the basin level rather than at the individual farm level. Consideration of the existing structure of water use at the basin level will minimize any negative implications of conservation strategies. Also, impacts of water conservation strategies on interstate compact obligations must be considered.

To obtain a free copy of the complete report, contact CWRI at:  
Phone 970/491-6308, FAX 970/491-2293  
E-mail: [cwis31@yuma/ACNS.ColoState.EDU](mailto:cwis31@yuma/ACNS.ColoState.EDU)



#### WATER RESEARCH AWARDS

A summary of water research awards and projects is given below for those who would like to contact investigators. Direct inquiries to investigator c/o indicated department and university.

Colorado State University, Fort Collins, CO 80523

- Population Genetics of Colorado Fishes**, ROBERT P. ELLIS, Microbiology. Sponsor: Colorado Division of Wildlife.
- Ecological Modeling in Support of County Decision Making (GIS)**, N. THOMPSON HOBBS, Natural Resource Ecology Lab. Sponsor: Colorado Division of Wildlife.
- Arkansas River Water Quality**, JOHN D. STEDNICK, Earth Resources. Sponsor: Colorado Division of Wildlife.
- Lab Analysis to Determine the Extent of Whirling Disease in Colorado**, STEPHEN A. FLICKINGER, Fishery & Wildlife Biology. Sponsor: Colorado Division of Wildlife.
- Face to Face with Wildlife**, ALAN P. COVICH, Fishery & Wildlife Biology. Sponsor: Colorado Division of Wildlife.
- Aquatic Toxicology Research**, JOHN D. STEDNICK, Earth Resources. Sponsor: Colorado Division of Wildlife.
- \*Evaluation of NEXRAD Doppler Weather...**, THOMAS H. VONDERHAAR, CIRA. Sponsor: DOC-NOAA-Nat'l. Oceanic & Atmospheric Admin.
- GOES-1M Product Assurance & Advanced Product Development**, THOMAS H. VONDERHAAR, CIRA. Sponsor: DOC-NOAA-Nat'l. Oceanic & Atmospheric Admin.
- A Multisensor Satellite Study of Upper Tropospheric Water Vapor & Clouds**, GRAEME L. STEPHENS, CIRA. Sponsor: DOC-NOAA-Nat'l. Oceanic & Atmospheric Admin.
- Temperature, Precipitation & Wind Continuity with Automated Surface Observing System**, THOMAS B. MCKEE, CIRA. Sponsor: DOC-NOAA-Nat'l. Oceanic & Atmospheric Admin.
- Effective Communication & Utilization of National Weather Service...** CHRISTOPHER R. ADAMS, CIRA. Sponsor: DOC-NOAA-Nat'l. Oceanic & Atmospheric Admin.
- Hydrologic Forecasting System Evaluation & Development Support**, LYNN JOHNSON, CIRA. Sponsor: DOC-NOAA-Nat'l. Oceanic & Atmospheric Admin.
- Very High Resolution Gridded Meteorological Forecast Development**, THOMAS H. VONDERHAAR, CIRA. Sponsor: DOC-NOAA-Nat'l. Oceanic & Atmospheric Admin.
- Severe Weather Research**, JAMES F. PURDOM, CIRA. Sponsor: DOC-NOAA-Nat'l. Oceanic & Atmospheric Admin.
- Grazing Effects on Runoff & Erosion in a Riparian Ecosystem**, MILTON J. TRILICA, JR., Rangeland Ecosystem Science. Sponsor: USDA-CSRS-Coop. States Research Service.
- Development of Hydrologic & Sediment Dynamics Models for the Rio Puerco**, JORGE A. RAMIREZ, Civil Engineering. Sponsor: DOI-USGS-Geological Survey.



- Riprap Embankment Toe Protection**, JAMES F. RUFF, Civil Engineering. Sponsor: DOI-Bureau of Reclamation (USBR).
- Flow Prediction for Crater Lake National Park**, JOSE D. SALAS, Civil Engineering. Sponsor: DOI-NPS-National Park Service.
- Stream Water Quality Modeling Technology Development**, LUIS GARCIA, Chem. & Bioresource Engineering. Sponsor: USBR.
- Effects of Four Electrofishing Currents on Captive Subadult Colorado Squawfish**, ROBERT T. MUTH, Fishery & Wildlife Biology. Sponsor: DOI-Bureau of Reclamation.
- Partitioning of Ecosystem Respiration & Vectors of Water Loss**, EUGENE F. KELLY, Soil & Crop Sciences. Sponsor: National Aeronautics & Space Admin.
- \*Modeling Biosphere-Atmosphere Interactions at Various Scales in Support of BOREAS**, ROGER A. PIELKE, Atmospheric Science. Sponsor: NASA-Goddard.
- \*Upgrading Cropflex to Windows**, ISRAEL BRONER, Chemical & Bioresource Engineering. Sponsor: USDA-Agricultural Conservation Program.
- Atrazine Analysis of Ardec Soil**, PHILIP WESTRA, Plant Pathology & Weed Science. Sponsor: USDA-ARS-Agric. Research Service.
- Quantifying the Change in Greenhouse Gas Emissions Due to Natural Resource Conservation.**, KEITH H. PAUSTIAN, Natural Resource Ecology Lab. Sponsor: USDA-NRCS-Natural Resources Conservation Service.
- \*Hydrologic Assessment of Rangelands Using Rainfall Simulation**, DENNIS R. CHILD, Rangeland Ecosystem Science. Sponsor: USDA/ARS-Agricultural Research Service.
- NBCS Model Update**, JAMES W. WARNER, Civil Engineering. Sponsor: DOD-ARMY-Rocky Mountain Arsenal.
- \*Observational & Modeling Studies in Support of the Atlantic Stratocumulus Transition**, STEPHEN K. COX, Atmospheric Science. Sponsor: DOD-NAVY-ONR-Office of Naval Research.
- \*Development of an Ocean Model Based Upon the Reduced System of Equations...**, THOMAS H. VONDERHAAR, CIRA. Sponsor: DOD-NAVY-ONR-Office of Naval Research.
- \*Development & Testing of Physical Algorithms for Cloud Forecasting...**, WILLIAM R. COTTON, Atmospheric Science. Sponsor: DOD-USAF-Office of Scientific Research.
- \*Organic Pollutants in Soils, as Studied by Nuclear Magnetic Resonance**, GARY E. MACIEL, Chemistry. Sponsor: DOD-USAF-Air Force.
- \*Clouds & Water Vapor in the Climate System...**, GRAEME L. STEPHENS, Atmospheric Science. Sponsor: Harvard University.
- Coping with Prolonged & Severe Drought in the Rio Grande River Basin**, MARSHALL FRASIER, Agricultural & Resource Economics. Sponsor: New Mexico State University.
- \*Climate Analysis & Extended Range Seasonal Prediction**, WILLIAM M. GRAY, Atmospheric Science. Sponsor: National Science Foundation-GEO-Geosciences.
- \*Interdisciplinary Approaches to Identification & Mitigation of NPS Water Quality Impacts**, JOHN D. STEDNICK, Earth Resources. Sponsor: University of Wyoming.
- Extraction & Recovery of Mercury & Lead from Aqueous Waste Streams Using Redox...**, PETER K. DORHOUT, Chemistry. Sponsor: DOE-Office of Energy Research.
- \*Development & Testing of an Aerosol Stratus Cloud Parameterization Scheme ...**, SONIA M. KREIDENWEIS, Atmospheric Science. Sponsor: US Department of Energy.
- Land Use & Climate Change Impacts on Carbon Fluxes (LUCCI)**, DENNIS OJIMA, Natural Resource Ecology Lab. Sponsor: University of Nebraska.
- \*Impact of Historical Landcover & Landuse Change on Weather & Climate**, ROGER A. PIELKE, Atmospheric Science. Sponsor: DOI-USGS-Geological Survey.
- \*Dam Foundation Erosion Study**, STEVEN R. ABT, Civil Engineering. Sponsor: DOI-Bureau of Reclamation.
- \*Colorado State-wide Riparian Inventory & Classification**, CHRISTOPHER A. PAGUE, Fishery & Wildlife Biology. Sponsor: DOI Bureau of Reclamation.
- \*Inventorying & Monitoring Natural Resources — Status & Trends in the National Park System**, JIM C. LOFTIS, Chemical & Bioresource Engineering. Sponsor: DOI-NPS-National Park Service.
- \*Economic & Ecological Sustainability on the Colorado Plateau**, WILLIAM P. SPENCER, Agricultural & Resource Economics. Sponsor: DOI-National Biological Survey.
- \*Sediment at Westlake Lake**, JAMES F. RUFF, Civil Engineering. Sponsor: Ventura County, California.
- \*Integrated Research on Hazardous Waste**, RAYMOND YANG, Environmental Health. Sponsor: HHS-PHS-Superfund Hazardous Substances.
- Riparian Ecological Classification**, LARRY R. RITTENHOUSE, Rangeland Ecosystem Science. Sponsor: USDA-USFS-Forest Research.
- Range of Natural Variability Report of Playa Lakes**, LARRY R. RITTENHOUSE, Rangeland Ecosystem Science. Sponsor: USDA USFS-Forest Research.
- \*Modeling the Effect of Global Change on Grassland Distribution & Productivity...**, DENNIS OJIMA, Natural Resource Ecology Lab. Sponsor: Oregon State University.



The University of Colorado, Boulder, CO 80309

- Wet Weather Research Assessment, James Heaney, Center for Advanced Decision Support for Water & Environmental Systems (CADSWES). Sponsor: Water Environment Research Foundation.
- A New Methodology for Assessing Glacier Mass Balances and Runoff for Global Studies of Climate Change and Sea-Level Rise, Mark Dyurgerov, Institute of Arctic and Alpine Research. Sponsor: National Science Foundation.
- Contemporary Variability, Future Changes and Human Dimensions of Snowpack Water Resources Over the Western United States, Mark Serreze, Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: National Science Foundation.
- Global Glacier Mass Balance Synthesis, Richard Armstrong, CIRES. Sponsor: National Science Foundation.
- \*Satellite Remote Sensing of Ecosystem Structural and Functional Changes..., Carol Wessman, Aerospace Engineering. Sponsor: National Aeronautics and Space Administration (NASA).
- Novel Water Pretreatment Systems with Reduced Fouling, Robert Davis, Chemical Engineering. Sponsor: Bureau of Reclamation (USBR).
- South African Water Law Reform, Elizabeth Rieke, Natural Resources Law Center. Sponsor: USBR.
- Climate Change of the Last 500 Years: Simulations Versus Data, Jonathan Overpeck, Institute of Arctic and Alpine Research. Sponsor: National Science Foundation.
- \*Potential Effects of Global Climate Change on Western River Basins Study, Edith Zagona, CADSWES. Sponsor: USBR.
- \*Endangered Species/Limnology, William Lewis, Environmental, Population and Organismic Biology. Sponsor: US Fish & Wildlife Service.
- \*Arsenic Removal by Softening and Coagulation, Mark Edwards, Civil Engineering. Sponsor: Environmental Protection Agency.

### CSU SOIL SPECIALIST RECEIVES TWO GRANTS TO IMPROVE FEEDLOT MANAGEMENT

Jessica Davis, Associate Professor of Soil and Crop Science, has received two grants totaling \$266,000 from the U.S. Department of Agriculture's Western Region Sustainable Agriculture Research and Education program for application of sustainable agriculture methods to manure management. Davis and her research team will use the first grant of \$206,000 to reduce environmental contamination from feedlot manure in the South Platte River Basin through agronomic, economic and social analysis and education. The second grant of \$60,000 will be used to improve manure management to protect water quality throughout the southwestern United States. A part of the research funded for 1996-97 by the North Carolina Water Resources Research Institute reflects that state's concern about animal waste management practices:

- *Microbial Impacts of Animal Wastes on Water Resources*, Mark D. Sobsey, University of North Carolina at Chapel Hill.
- *Effects of Management Practices on Denitrification in Soils Fertilized with Lagoonal Swine Waste*, Stephen C. Whalen, Investigator, University of North Carolina at Chapel Hill.
- *Effect of Swine Waste Lagoon Constituents on Photosynthetic and Heterotrophic Biota of Receiving Waters*, Michael A. Mallin and Lawrence B. Cahoon, Investigators., University of North Carolina at Wilmington.
- *Stable nitrogen Isotopic Tracers of Nitrogen Sources to Surface and Groundwaters Near Animal Production Facilities*, William J. Showers, Investigator, North Carolina State University.
- *Characterization of Ammonia Emissions from Animal and Poultry Operations in North Carolina*, Viney P. Aneja, Investigator, North Carolina State University.
- *Grass and Riparian Buffer Treatment of Runoff From Land Receiving Animal Waste*, J. W. Gilliam, J.R. Parsons and R. L. Mikkelsen, Investigators, North Carolina State University.

Fort Collins Coloradoan 8/2/96, Water Resources Research Institute News, University of N.C. 10./96

### AWWA RESEARCH FOUNDATION ANNOUNCES AWARDS FOR 1996

The University of Colorado has received two of eight research awards made by The Research Foundation of the American Water Works Association for its 1996 program. The recipients were Marc Edwards, Department of Civil, Environmental and Architectural Engineering, for his proposal, "The Role of Phosphate Inhibitors in Mitigating Lead and Copper Corrosion;" and Gary Amy of the same department for his proposal, "Natural Organic Matter (NOM) Rejection by, and Fouling of, Nanofiltration and Ultrafiltration: Bench-Scale and Pilot-Scale Evaluations. The AWWA, which received 51 proposals requesting over \$8 million, funded 8 projects for a total of \$1.2 million. It. The other six awards went to: Clarkson University; Yale University School of Medicine; Johns Hopkins University; the University of Alberta, the University of Kentucky, and the National Research Council of Canada.







## WATER SUPPLY

The Surface Water Supply Index (SWSI) developed by the State Engineer's Office and the USDA/SCS is used as an indicator of mountain-based water supply conditions in the major river basins of the state. It is based on streamflow, reservoir storage, and precipitation for the summer period (May-October). During the summer period streamflow is the primary component in all basins except the South Platte, where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven basins for November 1, 1996 and reflect conditions during the month of October.

<u>Basin</u>	<u>Nov. 1, 1996 SWSI Value</u>	<u>Change From Previous Mo.</u>	<u>Change From Previous Yr.</u>
South Platte	3.0	-0.9	-0.3
Arkansas	1.6	+1.0	-1.1
Rio Grande	0.0	+1.6	-0.6
Gunnison	1.7	+1.2	-1.3
Colorado	1.9	-0.1	-0.6
Yampa/White	0.3	+0.1	-2.3
San Juan/Dolores	1.8	+3.1	+1.7

SCALE									
-4	-3	-2	-1	0	+1	+2	+3	+4	
Severe Drought		Moderate Drought		Near Normal Supply		Above Normal Supply		Abundant Supply	

October precipitation in the southern mountains significantly improved the water supply conditions in that area of the state. Lack of precipitation and low stream flows in the southern mountains had been of concern during the past summer, evidenced by continued negative SWSI values in the Rio Grande and San Juan/Dolores basins since July 1. The SWSI values in those two basins have now improved to 0.0 and 1.8 respectively. No basin currently has a negative SWSI value.



## WATER PUBLICATIONS

### CWRRI PUBLICATIONS

Completion Report No. 190, Irrigation Water Conservation: Opportunities and Limitations in Colorado, A Report by the Agricultural Water Conservation Task Force, October 1996. To obtain a free copy, contact CWRRI at Phone 970/491-6308 or FAX 970/491-2293.

The following reports are available from the Cooperative Extension Resource Center, General Services Building, Colorado State University, Fort Collins, CO 80523. Phone 970/491-6198, FAX 970/491-2961.

Information Series No. 83, Proceedings, High Altitude Revegetation Workshop No. 12, Edited by Warren R. Keammerer, June 1996. The 12<sup>th</sup> Biannual High Altitude Revegetation Conference was held in Fort Collins, Colorado on February 21-23, 1996. It was organized by the High Altitude Revegetation Committee in conjunction with the Colorado State University Department of Soil and Crop Science. The proceedings include the keynote address, 19 papers grouped into six conference sessions, remarks presented by four participants in a panel discussion, and ten poster papers. Price: \$15.

Information Series No. 84, Bringing the River Back...to the Future: Urban and Rural Watershed Management, Proceedings of the 1996 South Platte Forum, October 1996. Price: \$3.





## U.S. GEOLOGICAL SURVEY REPORTS

Contact the U.S. Geological Survey, Earth Science Information Center, Open-File Reports Section, Box 25286, Mail Stop 517, Denver Federal Center, Denver, CO 80225 or call 303/236-7476.

**Bathymetric Surface and Storage Capacity of Terrace Reservoir, Conejos County, Colorado, July-August 1994**, by Kenneth R. Watts. Water-Resources Investigations Report 96-4027.

**Physical and Chemical Characteristics of Terrace Reservoir, Conejos County, Colorado, May 1994 Through May 1995**, by Robert W. Stogner, Sr.; Patrick F. Edelmann; and Katherine Walton-Day. Water-Resources Investigations Report 96-4150 (Interim Report).

**Ground-Water-Quality Data for the Land Application of Sewage Sludge at a Site Near Denver, Colorado, 1988-93**. By Kenneth J. Lull and Neville G. Gaggiani. Open-File Report 96-410.

## OTHER WATER REPORTS

Water: Colorado's Precious Resource

This reader-friendly booklet introduces Colorado's water history, law and vocabulary, and surveys the sources and uses of water in this semiarid land. Its introductory pages feature "The Big Picture," "Water's Role," "Measuring Water," "Water Quantity," "Water History," "The Law," "Water Administration," "Water at the Source," "Water Use," "Water Quality," "Caring for Water," and "Meeting the Challenges." A one-page summary about each of Colorado's seven water divisions is also included. The booklet is designed as an introduction to the subject of water in Colorado which hopefully will lead the reader to more detailed study.

The booklet was compiled by a committee comprised of the following: Co-Chairs Terry Moulton, State Office of Water Conservation, and Donna Pacetti of Denver Water's Office of Water Conservation; Betty Blinde, Colorado Foundation for Agriculture; Bob Briggs, Garden Centers of Colorado; Jody Grantham, Colorado Office of Water Resources; Julia Gumper, Independent Contractor; Brent Mecham, Northern Colorado Water Conservancy District; Dan Smith, Department of Soil and Crop Sciences, Colorado State University; Greg Trainor, City of Grant Junction; Chris Treese, Colorado River Water Conservation District; and Brian Werner, Northern Colorado Water Conservancy District. Water: Colorado's Precious Resource is available from: MWCI, 8739 W. Coal Mine Avenue, Littleton, CO 80123 at a cost of \$2.00 each.

*The Snow Booklet*

*A Guide to the Science, Climatology, and Measurement of Snow in the United States*, by Nolan J. Doesken and Arthur Judson. The booklet includes information about The Science of Snow, Climatology of Snow in the United States, Measuring Snow, Common Questions about Snow, and a Bibliography of Other Suggested Readings. It can be ordered from the Colorado Climate Center, Atmospheric Science Department, Colorado State University, Fort Collins, CO 80523-1371. Phone 970/491-8545, FAX 970/491-8449. ISBN #0-9651056-1-x. Price \$10 each plus shipping and handling.

CITY OF BOULDER INTRODUCES  
XERISCAPE INFORMATION ON CD-ROM

The City of Boulder Public Works Department/Water Conservation Office is bringing xeriscape information to CD ROM. Boulder residents can view "Boulder Xeriscapes: Gardening With Our Climate" on-line at Boulder's Main Public Library. The disk is designed as a multi-level resource for xeriscape gardening. It includes a "Getting Started" section offering tips for the more advanced gardener. Additional sections offer information on basic design, local plant sources, and books and videos available on the subject. CD ROM users can "zoom in" to plant photographs for detailed views of foliage and flowers and can print individual pages for reference. The Xeriscape CD-ROM is available for in-house use at the Main library, 1000 Canyon, and at the Wild Bird Center, 1641 28<sup>th</sup> St. It is also available to check out for home or office use, FREE of charge, at the following video stores:

- Video Station 1661 28<sup>th</sup> Street
- Basemar Village Video 2610 Baseline Road
- North Village Video 3990 Broadway

For more information, please contact the City of Boulder, Colorado, Water Conservation Office, 441-4081.





## WET SPOTS ON THE WEB

### Find Water Related Information Quickly and Easily

by Julie Eyre and Cindy Brady

**Water Online**— This page includes a combination of information and products in one place. Here you can find summaries and updates on water regulations, a searchable library, product showcases, an online newsletter with a variety of topics, projects out for bid, and links to professionals and suppliers. <http://www.wateronline.com>

**EPA's Watershed Management Program**— A breakdown of the EPA's watershed management program. <http://www.epa.gov/OWOW/watershed/index.html>

**U.S.G.S. National Water-Quality Assessment (NAWQA) Publications**— Where to find the online publications of the NAWQA including one on Denver's groundwater quality (<http://webserver.cr.usgs.gov/nawqa/splt/factsheets/FSBRUCE.html>) <http://wwwrvares.usgs.gov/nawqa/pubsmain.html>

**Know Your Watershed**— Check out the Know Your Watershed new library on the web, a searchable index of publications and where to find them. Also note that their home page has moved. The new address is: <http://kyw.ctic.purdue.edu/kyw.html>

**GIS/Water Resources Symposium**— The on-line proceedings of the AWRA's GIS and Water Resource Proceedings. After February 1997 this proceedings will only be available to AWRA members and subscribers. <http://www.uwin.siu.edu/~awra/proceedings/gis32/index.html>

**Stream Corridor Restoration**— The USDA web site for the stream corridor restoration handbook. [http://www.usda.gov/stream\\_restoration/](http://www.usda.gov/stream_restoration/)

**National Small Flows Clearinghouse**— This web site has a variety of information on drinking water and wastewater for small communities. <http://www.nsfc.wvu.edu>

**Water and Wastewater Treatment at UCLA's Center for Clean Water Technology**— This page offers information on treating water with small quantities of hazardous substances, as well as stormwater runoff, inorganic contaminants in waste sediments and sludge, and wastewater reclamation at Lake Arrowhead, California using reverse osmosis. <http://cct.sears.usla.edu/cct.wv.html>



## COLORADO WATER MEETINGS



### **BRINGING THE RIVER BACK ... TO THE FUTURE: URBAN AND RURAL WATERSHED MANAGEMENT**

A Summary of the 1996 South Platte Forum

October 29 - 30, Northglenn, Colorado

by David Graf

Initiated in 1989, the South Platte Forum has provided an avenue for the multidisciplinary exchange of information and ideas important to natural resource management in the South Platte Basin. Its stated mandates are "to enhance the effective management of natural resources in the South Platte River Basin by promoting coordination between state, federal, and local resource managers and private enterprise," and to "promote the interchange of ideas between disciplines to increase awareness and understanding of South Platte River Basin issues and public values."

The 1996 South Platte Forum focused on the planning, development, and implementation of river and watershed improvement projects. The first day of the Forum provided the context for doing water-based improvement projects, while the morning of Day 2 presented a glimpse of the many ongoing efforts in the South Platte Basin. Approximately 130 people were provided the reasons, working examples, and hopefully, a few of the tools necessary for successful project implementation.



**Day 1** — To preface much of what was to come, Kenneth Salazar (former Executive Director, Colorado Department of Natural Resources), opened the Forum by presenting his experiences negotiating complex natural resources issues involving water and money (see page 22).

Two Forks, U.S. Forest Service reserved rights issues, and certain water transfer efforts have ended in the courts rather than in successful, amicable agreements. The adversarial, costly, and ultimately, ineffective process is characterized by confrontation and litigation, often at taxpayer expense.

More recently, the efforts to secure instream flow rights for the Denver South Platte Urban Corridor project have been successful because of a cooperative, non-litigious approach.



*Forum participants*

Successful negotiations, in general, result from serious participation from stakeholders, clear objectives for the negotiating process, and an understanding of the constraints imposed by negotiations with a diverse stakeholder group. In a contentious negotiation, it is ultimately the process which determines whether or not progress is made.

For the rest of the day, resource experts and practitioners put large-scale restoration efforts into political, social, economic, and ecological context. By morning's end, it was clear that improving one's creek or watershed necessarily involved some sensitivity to disciplines not traditionally involved in water management. In particular, the public appears to be gaining strength as a voice in determining the environment, disrupting traditional iron-triangle political alliances and directing natural resources management toward a more modern paradigm of 'multi-party accommodation'.

At lunch, Betsy Rieke (Director, Natural Resources Law Center, CU Boulder) compared and contrasted 'successful' versus 'less



*Susan Kirpatrick, Dept. of Political Science, University of Northern Colorado at Greeley and Chair, GOCO*





successful' endangered species recovery efforts (unfortunately, we were not able to tape her presentation). She echoed the thoughts of Ken Salazar regarding the need for an effective process, and added that in the case of endangered species, there must be some room for movement in order to make progress. In some cases, this refers to money being available for investment in species recovery (California Bay-Delta); in other efforts, this 'capital' is equivalent to unappropriated water (Upper Colorado River Recovery Program).

The early afternoon sessions provided information about the tools available for improvement projects, and a hint of the development of odd alliances (The Nature Conservancy and ranchers in the Yampa River Valley) which seem also to characterize successful, multi-party efforts. Questions were raised about the feasibility of the multi-party accommodation process in an urban watershed. Who are the stakeholders? Does money buy standing? Do all stakeholders need to be involved?

An afternoon panel discussion entitled "Land, Water, and Money" presented the issue of ag-urban water transfers in the South Platte Basin. The panel was moderated by Fort Collins Mayor Ann Azari, who as Mayor of a rapidly growing city understands the need to satisfy increasing demands for domestic water supplies. However, in an effort to also stabilize a farm economy feeling the pressure of urban development, Mayor Azari is building the coalitions necessary to proactively address ag-urban water transfers in Larimer and Weld Counties.

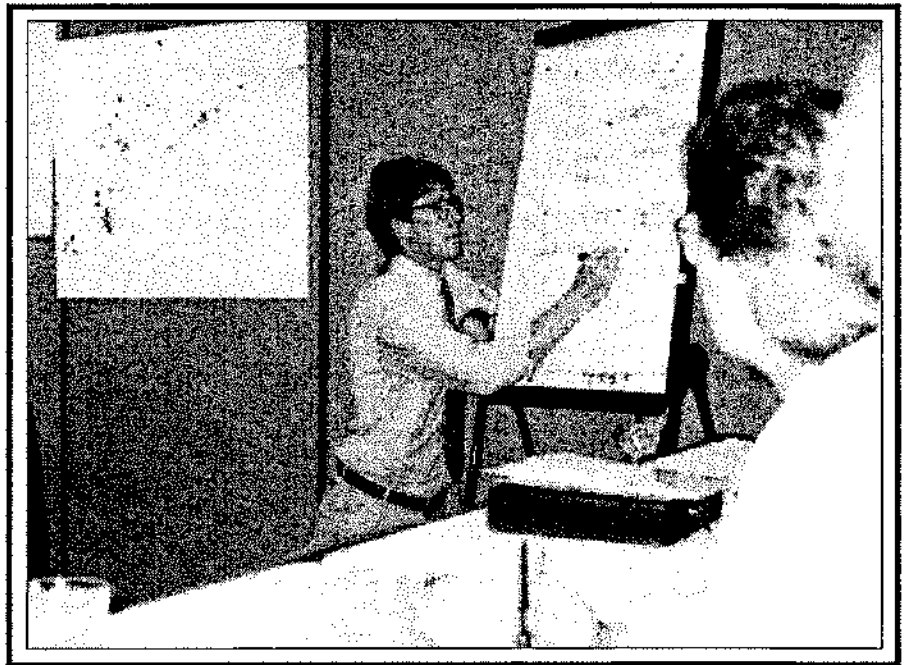
Doug Kemper (Manager of Water Resources, Aurora) spoke of his city's efforts to secure new supplies for the future and creatively manage what it already has. Charles Hoff (Mayor of Ault) spoke of the transformations he sees as his community moves from being ag-dominated to 'sub-rural', where citizens commute to work in Greeley and Fort Collins.

John Wilkins-Wells (Department of Sociology, CSU) provided details of his recent work with 'irrigation enterprises' in the western states, which indicates that districts serving rural communities need not be threatened by water transfers or growing metro areas if they can position themselves and adapt to serving new demands. These adaptations can take the form of secondary or raw water supply deliveries to new subdivisions or interruptible supply contracts. Considering the rapid growth along the Front Range, the transition from serving

agricultural sectors to urban sectors will demand that new alliances be built in the near future.

**Day 2** — Day 2 brought a diverse parade of case studies of watershed, river, and habitat improvement efforts. The scale of these efforts encompassed a single reach of creek to thousands of square miles of river and land. The morning provided an opportunity to tour creative improvement projects in the South Platte Basin from Julesburg to the Continental Divide. Ultimately, the group arrived back in the Denver Metro area, and heard two presentations on efforts which, when complete, will link nearly 20 miles of the South Platte River from Chatfield Reservoir to Commerce City.

Mayor Wellington Webb (City and County of Denver) gave the second luncheon address with a slide show presentation of the Denver South Platte Urban Corridor (see page 19). He then clearly set forth his priorities as mayor, and indicated that by providing a better environment for every individual in the



*David Graf, South Platte Forum Coordinator*

community, the entire community receives benefits. Then the formal portion of the Forum adjourned, and guided by Marc Alston of Mayor Webb's office, participants toured three South Platte River restoration efforts. The extraordinary magnitude of the Denver Urban Corridor Project was clear to all who participated in the tour: the vision, the design and implementation, the funding, and ultimately, the will and energy to keep it moving forward. Despite the cold October afternoon, it provided one tangible example of the many possibilities for the future of the South Platte Basin.







## 1996 — YEAR OF THE SOUTH PLATTE RIVER

Wellington E. Webb, Mayor  
City and County of Denver

*Speaking at the South Platte Forum, Mayor Webb described the importance of the South Platte River Urban Corridor and detailed his long-term parks and open space agenda. The goal of the South Platte River Corridor Project is to make the river a treasure for all of Denver's citizens. The project focuses on three aspects: parks and open space; youth and the environment, and improving water flows. As part of the Platte project, parks will be added or expanded in the city's northern and southern neighborhoods as well. These new green spaces will provide the entire city with playgrounds, ballfields, fishing piers, boat launches, picnic areas, and places to observe birds and other wildlife.*

The South Platte River Project is very important for Denver, and we hope that it also is a great project for people in general. There is an old saying that mayors have to be stewards for the future and we are the constituency for future generations. I raised a question once to Jennifer Moulton, my planning director: "When was the last time that we as a city had acquired a considerable amount of new park land?". She shared with me that most of it was acquired during the late 1800s and early 1900s — City Park, Ruby Hill, Washington Park, and obviously the larger span of park space in Denver's Cheesman Park, which some of the oldtimers know did not start out as a park but as a cemetery. Most of the parks were acquired and the space was land-banked.

We found an old map in the city archives that referred to a park along the South Platte River called "Riverfront Park," written in very clearly and dated 1893. It showed us that in some cases part of our goal is to implement what others years ago had dreamed and left for us to complete, but sometime along the way that was mislaid. Through the visionary work of Ken Salazar, who came to me, and Andrew Wallach from my staff who had been involved in doing the bond projects under Mayor Pena, we are saying that we will demonstrate not only that this project is meaningful and will be a priority; but it also has to be demonstrated that we are serious about its implementation.

When we first announced my vision for the South Platte River in 1995, because it was also in the midst of a political year people said, "Is this for real or is this something that we really will do?" They were not appreciative of the fact that before I was in public office I fought for a park at the Fort Logan Mental Health Center in Denver. There is a park there called Webb Park that the kids named back in 1969 right after I graduated from college and was working with them. Parks and open space have always been very important to me, and that is why, when Ken Salazar was working for Governor Romer, I pushed very hard for GOCO to come into existence.

It is my belief that for any city to be successful, it has to do two things: first, people have to feel safe and they have to have a public safety component; and second, they must have an education system that they feel comfortable with and

support. If people don't feel safe in a city and if they don't think that their children will receive a valuable and appropriate education, they will move. It is not gender, sex, class, race, ethnicity or income — they will just move to a place where they feel safe and where they think their children will receive a valuable education.

If you have the first two cornerstones, which we have provided in Denver, the third component is what you leave for future generations. What do you provide for your city, not only for the present but also for the future, that brings the community together for a higher purpose — doing something for those that come after you? We made parks and open space the third criterion for Denver.

That was part of the purpose of the South Platte River Commission. As the next step, we needed someone from the private sector who would serve with me as co-chair, and Joe Blake graciously consented to be the co-chairman for the South Platte River Commission. Now we have in place organizationally in terms of structure the co-chairs, myself and Joe; staff; and a vision of what we want to see. What I see for the South Platte is the restoration of a river that has been part of the lifeblood and heartbeat of Denver; the founding birthplace of Denver at the confluence of Cherry Creek and the South Platte that the city as a whole historically has turned its back on. Rivers, as most of you know, have been primarily used for two purposes: for refuse and for water and also water rights in terms of where you fall within the streamflow. Our goal has been to say that the South Platte River also runs through the one part of the city that everyone in Denver has talked about developing since I moved here as a kid and Herrick gave me my first job.

There was always talk about doing something for the Central Platte Valley: talk about merging east and west; doing something with the railroad yards and the river in the middle and people turning their backs on the river. Back porches were always to the river and the front parts of houses always faced away from the river. Now that is being reversed. You can see it in other parts of the country — river boats and casinos now are right on the river — now the front porch is on the river and the back porch is away from the river. There is



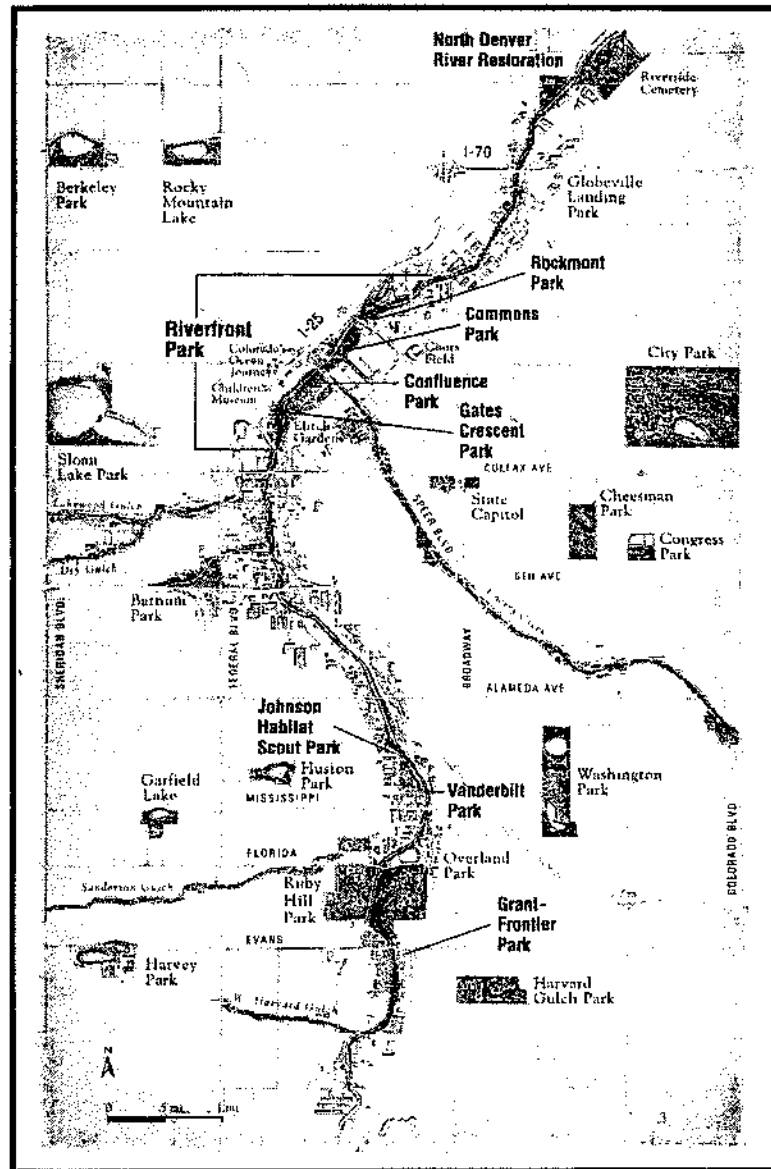
now a deeper appreciation for the waterways of our country.

We need to create an environment for urban kids along the South Platte River. Kids who live in Sun Valley, a housing project next to the river, have never gone to the river because they are taught when they are young to stay away because they might fall in. They walk away from the river and go into the city. Why not take this resource and turn it into a recreational outlet for Boy Scouts, Cub Scouts, Girl Scouts, boys' and girls' clubs and other groups so they can learn to appreciate it, to save it, to restore it, to care for it, and learn what else is available there including the wildlife habitat that is within walking distance for them so they don't have to drive to the mountains.

Secondarily, we have the ability to create jobs for young people in terms of restoration and cleanup along the river. Then, through all the many public agencies, federal, state and local, which by definition supposedly have been working on the restoration of the Platte anyway — whether through mitigation of the floodplain, connecting of the greenway trail, work along highways or bridges to be built — we all can work together in a cooperative fashion that maximizes tax dollars. This, as opposed to one agency doing its work, another agency then doing its work, and by the year 2050 another group of bureaucrats that has taken our place comes in and works on the same project. Why not do it while we are alive and can see it? Why not do it while we can take pride in our work, let people judge us by the results of our work, and let the future judge us upon the deeds that we have left for the future? So, now we have combined all these agencies working cooperatively together to leave a legacy for the city.

It is my belief that we should provide park space and open space, and if we don't do it while we have it, the push for commercial development will take that property and develop it. The best time to save property for future generations is before it becomes available for development. Our goal is to take that 10.5-mile stretch along the South Platte River and create a series of parks, so that we create Centennial Park right next to the amusement park, so that families can go there and picnic before they go to the amusement park and take that crazy ride that you are supposed to enjoy that turns you upsidedown and drops you 500 feet.

There will be walkways or bridges across the river to the other side so that you can see Gates Crescent Park next to the



### SOUTH PLATTE RIVER, DENVER LEGACY PROJECT

Children's Museum. A little further down from the Children's Museum you can take the family through Colorado's Ocean Journey, the new aquarium. You can come back on the other side in front of Union Station where we now have been successful in acquiring the buildings that are still standing — Post, Appleman and Grinnell. In 1997 we will take Grinnell down; in 1998 we will commence taking the other buildings down, and we will have a land mass for Commons Park, a 25-acre park. With a donation from Trillium Corporation we will have another five acres which gives us a 30-acre park in the heart of the city between the South Platte River and Union Station.



If we proceed north, we have Rockmont Park, another 30 acres of parkland right in the central part of the city. When you start adding up 30 acres here and 30 acres there, in all with Gates, Crescent, Fishback, Centennial, Confluence, Commons and Rockmont Parks, there will be more than 70 acres of new parks in the Central Platte Valley covering both sides of the river. Then if we go south to Grant Frontier Park – the neighborhood just voted last week 45-5 to close Platte River Drive so that there is only one entrance along the Platte River and to create more park space for that neighborhood. Residents are very excited about seeing an amenity brought to their neighborhood which they never thought would take place. On the northern border of the city, we will hold a groundbreaking to commemorate extension of the greenway trail, river channel, and bank restoration, and locating a National Guard Armory on the site of the abandoned City Wastewater Treatment Plant. As many of you know if you run the greenway trail, as you go through the trail system when you get to the north part of Denver the trail runs out. You have gravel, dust and dirt, and must run around to the street to get over to the Adams County side where the greenway trail picks up again. We will be completing the greenway trail connection by Spring.

I think several things will happen. The 16<sup>th</sup> Street mall will be expanded into the valley; Trilium Corporation, downtown and other neighbors will look at this new amenity within the central part of the city that now has more than 70 acres of parkland in the heart of Denver that will be preserved for future generations. We will accomplish this where people could see it in less than four years, which by anyone's standard, public or private, is an achievement.

As you look at what we are trying to achieve, this could not have taken place without the cooperation of many individuals. Great Outdoors Colorado (GOCO) has been an instrumental player for us by recognizing that having park space in urban cities is not only okay but vitally necessary to provide openness and to allow people to move, breathe, and have recreational enjoyment right in the heart of the city. The South Platte River allows us to do that. I am very excited about where we are. I am also very excited about the cooperation that has been extended by the Denver Water Board that allowed us to do this. Through the Board's efforts we now have finalized contracts between both upstream and downstream users so that between June 15 and September 15 we have increased the minimum streamflow for kyaking, boating, rubber rafting, fishing, and just general enjoyment on the Platte. It again demonstrates the cooperation that we have received from all of the different entities that we have engaged in this project.

Denver, by and large, as the kids would say, is HOT. We are on a roll, and I think that our goal is to keep the vision clear and focused so we can demonstrate that through consensus and people working together we have the ability to achieve some extraordinary accomplishments in a very short period of time. I am very excited about where we are, and I know I echo your feelings. There were those who thought that we would not be able to pull this off because of (1) the investment of dollars; (2) the amount of cooperation that it needed; and (3) just that something of this undertaking normally doesn't come off right. All of the negative projections have proven to be false and we continue to move forward. The South Platte River Project will preserve open space and park space for many, many generations to come.

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**Q:** What particularly drove you to take this initiative and highlight it in your administration?

**A:** I like parks. I grew up as a young child in Chicago, and the closest park to us was called Jackson Park. In many urban cities you see small flower pots on the window sills. There was always a deep appreciation of flowers and green space that in many cases certain neighborhoods never had. Coming to Denver, I was always amazed at how many neighborhood parks there were. For me, open space has always been very important, and I think it is equally as important to have it in the city because it provides what I like to call "breathing room." It provides the opportunity for each neighborhood to develop an affection for its own park.

It is also a uniqueness of Denver, those 4,000 acres of parkland we have in the city and the 14,000 we have outside the city. As an amenity, it is something that we have to build upon. For me, parks and open space is always on the agenda. What we also will do is land-bank at Stapleton, at Lowry, and at Gateway. The South Platte River, however, will be the crown jewel. Also, I am demonstrating to city agencies that they have the ability to be a part of doing something during their lifetime that they can see. That is why the rush to knock down the buildings and put the signs out, so they ask "When do we do the next part?" We also want to do it a little smarter than some of our predecessors, so that when we decide that the sprinkling system is not working, we actually have the blueprints for where the sprinklers are. We want people to say that when Denver, for the first time in a very long time, had an opportunity to acquire new space, they didn't goof it all up. They left some for other people.



**COOPERATION AND COMPROMISE  
— A PUBLIC PRIVATE IMPERATIVE  
FOR THE SOUTH PLATTE RIVER**

*Ken Salazar*

*Parcel, Mauro, Hultin & Spaanstra, P.C.*

**B**ringing the River Back...to the Future is an appropriate topic, because we can have no certainty about what the South Platte will look like in the future. Nor do we know how the enormous challenges facing the South Platte within Colorado and beyond its borders will be resolved in the years and decades ahead.

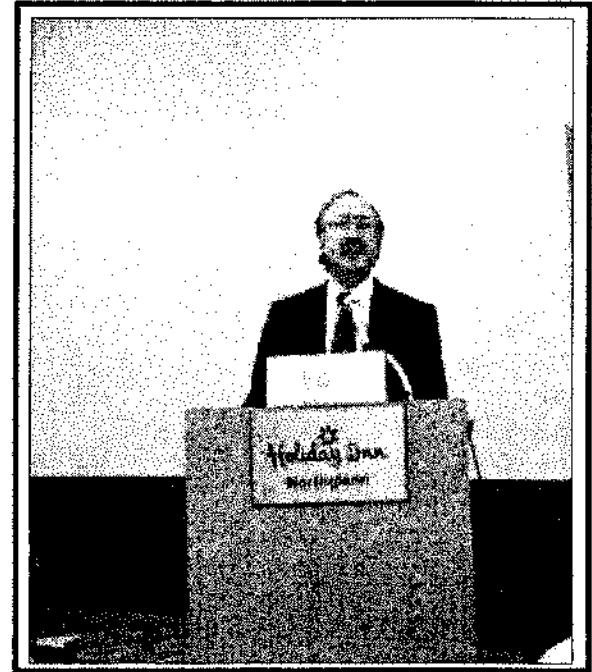
What we do know is that we humans have changed the river forever through dams and reservoirs and transmountain diversions, and that the river cannot return to its predevelopment condition.

We also know that the demand for water in the South Platte and conflicts over that water will continue to escalate. The South Platte Basin contains two-thirds of Colorado's population. Growth throughout the South Platte Basin makes it one of the fastest-growing regions in the country.

Moreover, environmental demands for water are now a part of the radar screen for predicting the future of the South Platte River. These environmental realities are now part of the legal and political landscape. Twenty-five years ago these environmental demands were nonexistent.

The recent history of the river on conflict resolution should provide us all with some valuable lessons on what to avoid in dealing with the scarce water resources of the South Platte. For example, more than \$10 million in private and public monies was spent fighting the United States Forest Service in its ill-conceived efforts at establishing reserved rights in the national forests within the basin. In planning and development of the Two Forks project, more than \$40 million was spent only to have the project vetoed by the Environmental Protection Agency. And many more battles have been fought between municipalities and farmers in the transfer of water from farms to cities.

As we look at that past, we can anticipate that many of the current challenges on the River will fact a similar litigious and expensive reality unless the stakeholders are able to develop cooperative processes that define common objectives for the future of the river. For cooperative efforts to succeed, solutions must be identified that can be embraced by agriculture, municipal water providers, environmentalists, and state and federal agencies.



*Ken Salazar*

**I**n a recent June, 1996 *Denver Post* editorial entitled "An Overworked River" the challenge was stated as follows:

*The high-altitude desert known as Colorado depends mightily on a poor excuse for a river called the South Platte. The river provides drinking and irrigation water, carries away sewage and industrial and farm waste, shelters wildlife, and serves as a nature lovers' playground. Such uses will be increasing conflict as Colorado's population grows. The river can't do everything humans want it to, so citizens must make tough choices about which roles are more important. That quandary will test the limits of public compromise and cooperation.*

As we look at possibilities of public compromise and cooperation on the South Platte, we should keep some key facts in mind:

- The South Platte supports more than 2.5 million people with their household water supply.
- The South Platte irrigates almost 800,000 acres in Colorado and Nebraska.
- The South Platte has more than 700 dams and reservoirs.
- The South Platte is becoming increasingly a place for people to fish, boat, bike and hike.



- The South Platte has five native fish in the river which could end up on the national list of endangered species – those species are the Plains Minnow, Plains Top Minnow, Sucker Mouth Minnow, Grassy Minnow, and River Shiner.
- The South Platte system is made even more complex by the fact that water users on the eastern plains import 400,000 acre-feet of water per year from the Western Slope of Colorado through a series of reservoirs, pumps, tunnels and canals.
- Beyond Colorado, the complexities on the river are compounded. For example, the U.S. Fish & Wildlife Service and the States of Nebraska, Wyoming, and Colorado are attempting to address the recovery of the Whooping Crane in Nebraska to avoid a train wreck between the Endangered Species Act and property rights and interstate compacts. At issue is the effort of the U.S. Fish & Wildlife Service and its authority under the Endangered Species Act to address the needs of three rare bird species – the endangered Whooping Crane, the Least Tern, and the threatened Piping Plover – whose critical habitat lies 150 miles past the Colorado border. Unless a solution is crafted among Colorado, Nebraska, Wyoming and the Fish & Wildlife Service, the Endangered Species Act will be used in an effort to block future water development and the relicensing of dams, reservoirs and pipelines in the three states.
- And finally, the South Platte is looked at as a source of water supply for the Denver metro area. Today, a large part of the Denver metropolitan area has little or no security with respect to its future water supply. For example, Douglas County, which is the fastest-growing county in the United States, depends largely on the mining of nontributary groundwater from the Denver Basin. As the metropolitan area continues to grow, water supplies will be sought from the South Platte and from other basins including the Arkansas, the Rio Grande, and the Colorado River. In addition, farmers and agriculturally dependent communities downstream of Denver will continue to look at the metropolitan area as a threat because agricultural communities are afraid that their agricultural lands will be dried up as waters move from agricultural to municipal uses.

In this context of difficult realities and challenges, it is probable that many of the current and future issues on the South Platte will provide us still with more lessons on the costs associated with using the courts as a forum for the resolution of disputes. However, there is also hope that cooperative approaches and solutions can be found to avoid

the waste that occurs in addressing water resource challenges on the South Platte through the courts.

Denver's South Platte instream issues effort is an example of a cooperative approach on the South Platte. Nearly two years ago, Mayor Webb and Andrew Wallach launched the South Platte River Corridor Project labeled "Imperative 2000: A Vision for the South Platte River." Mayor Webb understood that improving the 10.5 mile corridor of the South Platte through Denver for people, recreation, and wildlife could not be addressed without addressing the water needs of the South Platte. In that regard, under the Mayor's leadership, he convened a group of stakeholders that included the Denver Water Department, state agencies such as the Division of Wildlife and the Colorado Water Conservation Board, local agencies such as the Urban Drainage and Flood Control District and the Metropolitan Wastewater Reclamation District, the EPA and the U.S. Fish & Wildlife Service and representatives from nonprofit and private organizations. You will hear more about the remarkable progress of Denver's South Platte River restoration project from Mayor Webb and other speakers at this conference. I will focus briefly on the instream issues component of that effort.

The Instream Issues Task Force defined a goal for the river as follows:

*Water of sufficient quantity and quality is needed at the appropriate times to support practical urban uses of the river and to support the plants, fish, and wildlife appropriate for this particular urban river.*

As part of the undertaking, under the leadership of Mayor Webb and the Denver Water Department, Denver initiated an interagency effort to examine levels and timing for instream flows and to evaluate how the levels might be changed in a manner that would not adversely impact the metro area's water supply. The Denver Water Department assumed responsibility for leading the effort.

Today, as a result of those efforts, the Denver Water Department is piloting a project with downstream water users to maintain a flow of water at a level of 150 cfs for the summer months. In addition, Denver Water is initiating a stakeholders' group that will explore ways to maintain a wintertime flow to meet the aquatic goals defined by the Task Force.

Before the Task Force could make recommendations on instream flows for the South Platte, management goals for the urban corridor needed to be defined in order to determine what factors, including instream flows, needed to be addressed to achieve those goals.





The Task Force defined five goals for the management of the South Platte River Corridor through Denver. Those goals are:

1. Develop a warm-water fishery through Denver that supports a healthy fishery;
2. Maintain healthy populations of key terrestrial wildlife species;
3. Provide safe and dependable boating, kayaking, and rafting opportunities;
4. Provide off-channel recreational opportunities; and
5. Ensure coordination of activities and investments in the River Corridor to foster the achievement of the fishery, aquatic, and terrestrial wildlife, and recreational goals.

In examining how to achieve these goals, it became evident that factors beyond flows in the South Platte needed to be addressed to achieve these goals. Some of those non-flow dependent factors included channel configuration, instream and riparian habitat, and water quality. For example, because there is no place for fish to take refuge in the river during high spring flows and storm events, any effort to create a fishery would be destroyed during the high flows in the Spring or other storm events. Thus, part of the solution includes the placement of structures in the river that will provide shelter for the fish during high flows. At the same time, discussions have been held with the Corps of Engineers about the regulation of the upstream reservoirs in a manner that can help with the fluctuation of flows.

In addition, because of the very wide channel of the South Platte through Denver, it is impractical to maintain a flow of water in the channel for a fishery or to provide a quality boating experience without dedicating an impossible amount of water for that purpose. In that regard, the Task Force recommended that Denver create a low-flow channel as part of Denver's river restoration plans. As a result, the Denver project includes a nearly one-mile stretch of river downstream from Confluence Park where jetties will be constructed in the river to create a quality boating experience at 150 cfs. In addition, a 1.3-mile stretch of the river in North Denver will also include structural components for creating a low-flow channel for recreation and wildlife. These structural improvements will enhance wildlife habitat and recreational opportunities.

As a result of the work of the Instream Issues Task Force, efforts are underway to address water quality, riparian habitat restoration, and the appropriate management of wildlife and recreational goals for the river.

The City and County of Denver as a distinct entity from the Denver Water Board has considered pursuing other legal alternatives to secure rights to protect a flow in the river

through Denver. For example, the City and County of Denver might pursue a filing in Water Court for a water decree for recreational and piscatorial purposes based on boat chutes constructed in the river through Denver. However, that option would result in years of litigation and, as some observers have remarked, would have "put the South Platte River on fire." Moreover, the ultimate solution in creating a permanent managed flow regime for the Platte River through Denver depends on the cooperation of other water users in the metropolitan area. Therefore, the City and the Denver Water Department have wisely embarked on a cooperative nonlitigious effort to devise a management regime for flows within Denver to achieve the goals described by the Task Force.

Three key lessons concerning dispute resolution through cooperative approaches are:

First, an action-oriented process must be carefully defined at the outset and all the stakeholders must be included in that process. If the process is not well-defined, stakeholders will become quickly disillusioned with the process. If important stakeholders are not included, those stakeholders will become obstacles to implementation of any action plan. If the process is not action-oriented and results-driven, the process will become cumbersome and wasteful of time and resources. We all have been involved in many processes and meetings which are simply a waste of time.

Second, the stakeholders in the process must include decisionmakers. If the decisionmakers are not included in the process, the efforts will meet bureaucratic delays and obstacles that will frustrate all involved.

And third, access to financial resources is key. Without funds for implementation, the results of the cooperative effort may be just another "study" that gathers dust in the archives of public records and wastes the valuable time of all involved.

As the future of the South Platte River is defined, cooperative approaches among water users and local, state, and federal agencies can develop solutions to the challenges and problems faced by those who use the river. The alternative is bloody warfare through the courts that ultimately will never create more water nor resolve any of the competing water resource issues within the South Platte.

In "Centennial," James Michener described the South Platte in the early days as "A sad, bewildered nothing of a river." Yet this "nothing of a river" has tremendous importance for each of us who live within the basin. In the decades ahead, I hope that the stakeholders of the South Platte will find cooperative approaches to addressing the very important and complex challenges of our very important river.



## COLORADO WATER CONGRESS OUTLINES MASTER PLAN

The Colorado Water Congress was formally established on July 17, 1958, in Durango. The organization grew out of a need, on the part of Governor Steve McNichols and Attorney General Duke Dunbar, to identify the water topics (primarily water development projects at that time) on which there was general agreement to move forward legislatively, both in Congress and in the Colorado Legislature. Likewise, the Colorado Water Congress could also identify topics of substantial disagreement. The Governor and Attorney General intended to move forward quickly where there was agreement. Up to this point, there was no formal way to identify issues where enough agreement existed to legislatively move forward.

Today the Colorado Water Congress membership consists of 347 sustaining members and 58 individual members. The CWC has changed from primarily an agriculture-oriented organization to one today with a diversified membership of water users and interests. Richard D. "Dick" MacRavey has been Executive Director of the CWC since 1980. As have many water organizations in recent years, the CWC has been involved in a strategic planning exercise over the past year. At the CWC Summer Meeting, held August 21 in Breckenridge, the following Master Plan was presented and discussed.

### **DEVELOP PROACTIVE PROGRAMS TO DEAL WITH LEGISLATIVE, REGULATORY AND INITIATIVE ISSUES.**

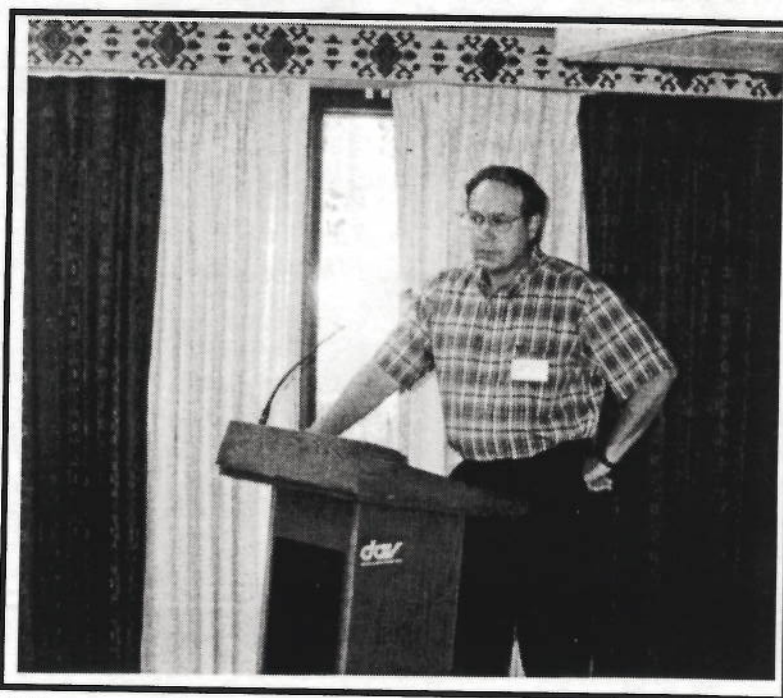
- Establish a Ballot Issue Advisory Committee to review response/proactive stance of CWC
- Strengthen and increase participation to provide a strong basis for CWC policies that reflect diverse membership interests.
- Reestablish the Federal Affairs Committee to coordinate with (1) Congressional delegations and staff, and (2) national water-interest organizations.

### **ESTABLISH AN URGENT ACTION PROCESS.**

- Develop more timely communication among members. Establish a subcommittee to modernize options.
- Improve coordination and communication among compatible lobbying organizations.

### **BECOME ADVOCATES OF WATER POLICY IN THE MEDIA.**

- Initiate periodic meetings with editorial boards of the major media.
- Become a resource for media reference.
- Establish a media committee to develop CWC press releases, positions within the media, and to respond to editorials or letters.



*Hal Simpson provides an update on issues facing the State Engineer's Office*

### **DEVELOP LEADERSHIP IN PROVIDING WATER EDUCATION TO PUBLIC OFFICIALS AND K-12 EDUCATORS**

- For legislators, continue complimentary registration at CWC seminars and conventions and provide access to information about water issues on a regular basis during the legislative session.
- For K-12 educators, establish CWC as a resource for water information.

### **INTEGRATE THE PURPOSE AND STRUCTURE OF CWC TO PROMOTE PROTECTION OF ESTABLISHED WATER RIGHTS.**

- Promote input and draw talent from the water-user





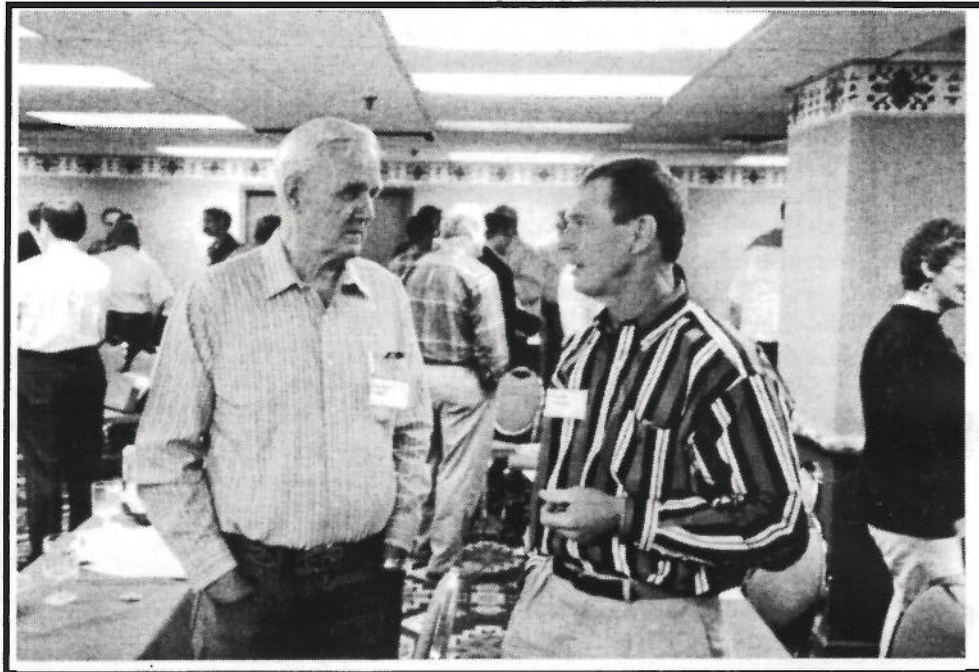
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community in Colorado.

- Establish subcommittee to review Articles of Incorporation in light of changing economic and demographic status of users of existing water rights in Colorado.
- Develop staff recommendations to reflect changing duties of CWC Executive Director as developed in the plan.

**PROVIDE FOR FINANCIAL SECURITY OF THE CWC TO ALLOW IT TO FULFILL ITS MISSION STATEMENT.**

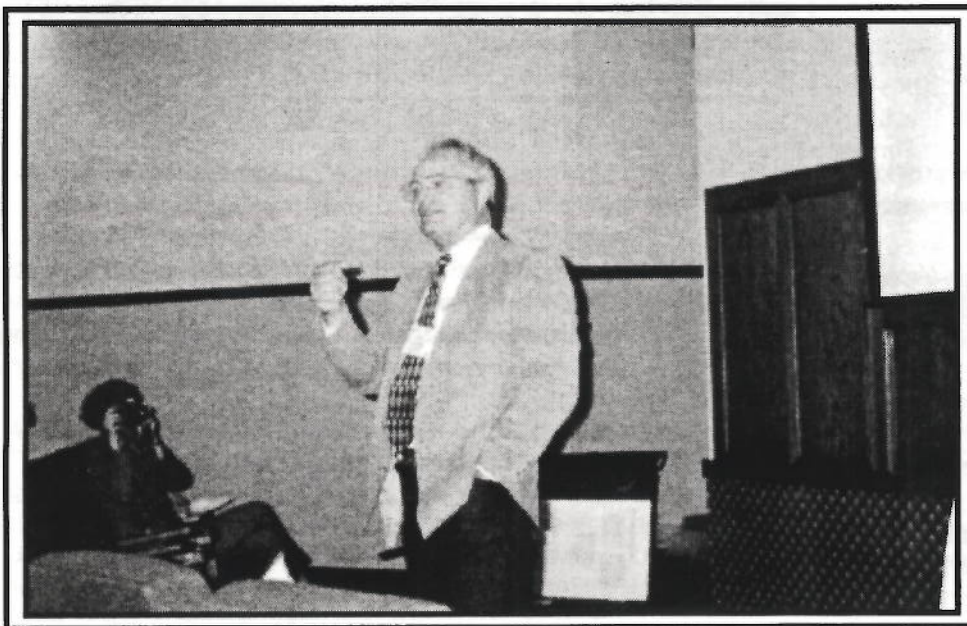
- Reinvigorate the Board of Directors and develop new members.
- Develop recommendations for CWC fees for services.
- Consider staff requirements to implement the CWC plan.



*Ralph Curtis, Manager, Rio Grande Water Conservancy District, and Dan Smith, Dept. of Soil and Crop Sciences, CSU, discuss water issues at CWC Summer Meeting*

If you want to learn more about the CWC and how to join, please contact: DICK MACRAVEY, COLORADO WATER CONGRESS, 1390 LOGAN STREET, SUITE 312, DENVER, CO 80203. Phone: 303/837-0812; FAX 303/837-1607.

(Two histories of the CWC were used in developing this article: "The Early History of the CWC: 1957-58," by John Barnard, Jr., and "A Short History of the CWC," by Dick MacRavey.)



*Colorado Senator Don Ament*

**WATER** COLORADO  
NONPOINT SOURCE  
POLLUTION CONFERENCE

Water quality and quantity are critical themes to sustainability in the arid West, and nonpoint source pollution can have tremendous impacts on our water supplies. As Colorado experiences explosive economic and population growth, nonpoint source pollution issues arising in urban and rural environments have never been

more critical. Perhaps this potential conflict is most evident with water quality and quantity issues in the urban-rural interface, where new urban development water needs may differ from the existing agricultural needs.

This was the theme for the first Colorado Nonpoint Source Conference held September 24-25, 1996. Over 150 people participated in the conference held in Longmont. Speakers from the private and public sector, state and federal government shared case histories, information, and policy perspectives. Speakers in the first session started by giving a national perspective on water quality issues.

These speakers were followed by presentations on the extent of the problem in Colorado. Speakers from Colorado included representatives of the U.S. Environmental Protection Agency, Urban Drainage and Flood Control, Colorado Department of Agriculture, Denver Regional Council of Governments, and a farmer's water supply company.

A later session included presentations on what may be on the horizon with respect to new or reauthorized water quality legislation at the federal, state, and local government levels. Analysis of market incentives to improve water quality was presented by a speaker representing a corporate perspective and a speaker representing an environmental advocacy group. Seemingly, we all are starting to talk the same language in water quality.

The technologies currently available for urban and rural water quality improvements, or best management practices (BMPs), were presented by the people using them. Speakers ranged from a local farmer to a representative of the City of Boulder. One session consisted of presentations that served as a prelude to a field trip in the Boulder Creek area to examine first hand the currently available practices that are being used to address water quality issues in the urban - rural interface. The Northern Colorado Water Conservancy District presented several of its projects. to examine first hand the currently available practices that are being used to address water quality issues in the urban - rural interface. The Northern Colorado Water Conservancy District presented several of its projects.

A poster session and reception was held the first evening. The variety of poster topics and the number of posters attested to the many projects in nonpoint source water quality that are being conducted in the state. This format provided the opportunity to learn more about the water quality issues in the state and to meet the people that are doing the work. The reception provided a casual environment that participants enjoyed.

The organizing committee, chaired by John Stednick, Department of Earth Resources, Colorado State University and




*Chris Rudkin of the City of Boulder explaining in-channel structures.*

Lorraine Peavy, Colorado Department of Public Health and Environment, considered the conference a success. This is the first *State of Colorado* polluted runoff conference, and represents the start of a series of seminars addressing different polluted runoff topics. Major financial support was provided by the US Environmental Protection Agency and Coors Brewing Company. Additional support was also provided by several state and private organizations and CSU's Environment and Natural Resources Policy Institute. A conference addressing the effects of mining activities has been proposed as the next nonpoint source conference.






**WORKSHOP ON THE MANAGEMENT OF  
SECONDARY WATER SUPPLY SYSTEMS BY  
IRRIGATION DISTRICTS AND MUTUAL IRRIGATION COMPANIES \***

*by John Wilkins-Wells*

One of the most important business innovations occurring in both small and large irrigation districts and mutual ditch and irrigation companies (irrigation enterprises) throughout the West is the development and management of secondary water supply systems. The concept of secondary supply involves the delivery of raw, untreated, water for uses other than for irrigated agriculture. In addition to furnishing water to irrigated farms, irrigation districts and mutual companies are now entering the business of providing a portion of their untreated water supplies to housing subdivisions for lawns and gardens, and for other non-irrigated agricultural customers moving into the traditional service area boundaries of these enterprises. This new business innovation is most frequently a result of, or adaptation to, the urbanization of irrigated lands. On October 21-22, at the Holiday Inn in Fort Collins, Colorado, a workshop devoted to a practitioner's discussion of secondary water supply management was attended by irrigation district and mutual company managers, superintendents, and board members from six states. The workshop covered opportunities and constraints associated with this business innovation, the affect this venture is having on the revenue base of these irrigation enterprises, and what issues associated with secondary water supply management may lay ahead in the future.

In order to maintain reliable and timely water service to traditional agricultural customers, maintain secure water rights into the future for irrigated agriculture, respond to urban growth trends, and prepare for potential growth in local water markets, irrigation enterprises are now becoming more business-oriented than ever before. This has included the search for new sources of revenue to maintain and upgrade their irrigation

systems to meet a variety of new water service needs and Federal and state environmental initiatives. Regarding the latter, the development and implementation of successful and equitable environmental policy appears greatly dependent upon the continued economic viability of these nonprofit irrigation enterprises in the future; for they are the ones that directly manage most of the West's water resources. There is a rapidly growing liability cost of operating irrigation enterprises in urban corridor areas. In addition, the cost of legal fees, engineering improvements to meet water conservation and urban growth, fielding a professional water delivery workforce, and financing rehabilitation and betterment projects have risen dramatically for these nonprofit enterprises in the past two decades. The search for alternative forms of water service revenue is a logical outcome of these trends. For all these reasons, it is anticipated that this small business sector of irrigation districts and mutual companies



*John Wilkins-Wells and Phil Bertrand, Superintendent, Grand Valley Irrigation Company, Grand Junction*

will soon experience a major shift into secondary (raw water) supply management. In fact, it is already occurring, as the workshop clearly demonstrated.

A presentation was given by the Kennewick Irrigation District, Kennewick, Washington on various engineering and organizational aspects of their secondary supply system. The Kennewick Irrigation District is now providing service to 145 subdivisions organized as local improvement districts (LIDs) within the irrigation district service area. The district began in the late 1880s. Farmers are still the #1 customer in the district, although the revenue generated from the delivery of untreated water to subdivisions is helping pay for many new improvements to the irrigation system, and therefore maintaining the economic viability of irrigated agriculture in the area. The secondary supply system also functions to assist the City of Kennewick in providing water for outdoor use to

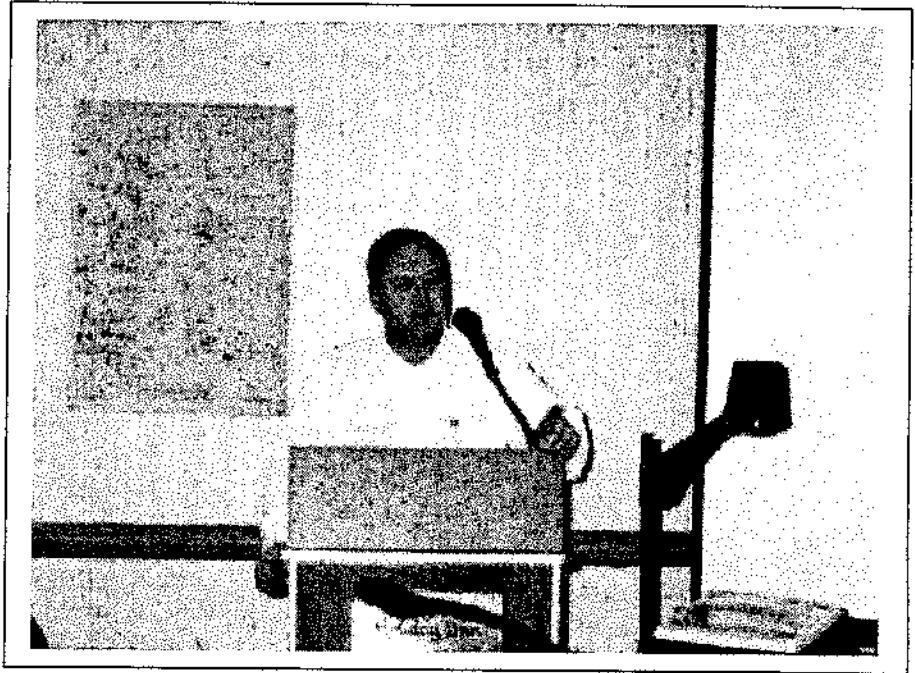




both incorporated and unincorporated areas of the community, thereby reducing the amount of expensive treated water used on lawns and gardens. The Kennewick Irrigation District finances the development of LIDs and sets a water rate structure and delivery schedule for them. The LIDs pay regular water assessments to the Kennewick Irrigation District for operation and maintenance, and to amortize the financing of the LID. Water service to LID customers typically occurs through 3/4 inch risers located in the backyards of subdivision

A presentation was given by the Solano Irrigation District, Vacaville, California, on their secondary supply system. The district has been in existence since 1948 and supplies water to 53,000 acres of irrigated land. Secondary water supply management started in 1967. The district deals directly with developers of subdivisions who install the secondary supply system under the supervision of the irrigation district, and according to the plans and inspection criteria developed by the district. The district grosses about 1.7 million annually from irrigated lands and about 456,000 from secondary supply water sales. Revenue from both types of water service are used by the district to upgrade its irrigation system to better serve irrigated agriculture and the preservation of agricultural lands. This has also included entering into agreements with local municipalities to forego annexing agricultural land in return for the district's assisting municipalities in providing untreated water for lawns and gardens in unincorporated areas. Some raw water deliveries are also made to homeowners who operate their own point-of-entry water treatment facilities. Although the district is very happy with their secondary supply system, they advise against serving point-of-entry treatment facilities, and emphasize the need for the secondary supply system to serve the interests of maintaining the viability of irrigated agriculture in the area.

A presentation was given by the Davis and Weber Counties Canal Company, Sunset, Utah on their secondary supply system. The company was started in 1881 and now serves about 40,000 acres of irrigated land and several hundred homeowners in subdivisions. The mutual company borrowed money from the state Water Resources Board to develop their secondary supply system. The mutual company board of directors voted to dedicate .5 acre feet per share for developing a pool of water to serve the secondary supply system which now provides raw water to subdivisions in several neighboring municipalities northwest of Ogden, Utah. The secondary supply system is for lawn and garden use only.



*Marc Catlin, Assistant Manager, Uncompahgre Valley Water Users Association*

As the mutual company comes into agreement with local developers or municipalities for secondary supply service, the municipalities bill the homeowners. The municipalities send out a monthly utility bill to all homeowners for water, sewer and garbage. They add the charge of the mutual company secondary supply to this monthly bill. Each month the municipalities then send a check to the mutual company to reimburse it for raw water service provided to homeowners.

Several other irrigation districts and mutual companies in Idaho, Utah, and western Colorado then gave presentations on their efforts to enter into secondary water supply management. This was followed with a presentation by J-U-B Engineers, Inc. of Orem, Utah on key engineering issues surrounding the development of secondary supply systems. The workshop concluded with a presentation by William Brown, an attorney in Fort Collins, on selected legal issues possibly affecting secondary supply development in Colorado.

For further information on the workshop, and to receive a newsletter, please contact John Wilkins-Wells, Department of Sociology, Colorado State University.

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\*This Workshop is part of an ongoing effort by the Irrigation Enterprise Management Practice Study located at Colorado State University to better understand business trends and new innovations associated with environmental policies in this important agriculturally-related nonprofit business sector. The research project is funded by the U.S. Bureau of Reclamation.

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## WATER NEWS DIGEST



### WATER SUPPLY AND DEVELOPMENT

#### **Court Rules on Thornton/Northern Colorado Case**

In a 4-2 ruling, the Colorado Supreme Court has upheld a lower court's decision giving Thornton conditional water rights on the Cache la Poudre River. The case dates back to 1986, when Thornton announced it had bought about 100 farms in Larimer and Weld counties to gain the farms' water rights. Initially, a state water court allowed Thornton to deliver about 50,000 acre-feet of water each year from the Cache la Poudre Basin. Both Thornton and Northern Colorado users were unhappy with the results and appealed to the Supreme Court. The ruling had also held that Thornton it must replace historic "return flows." Thornton disagreed, claiming that part of the irrigation water originated outside the Cache la Poudre basin, reaching the farms only because of transmountain water diversion. Thornton said it shouldn't be responsible for replacing the transmountain water, at least 5,000 acre-feet, into the Poudre. The Supreme Court backed Thornton, allowing it to retain transmountain water and not return it to the Poudre.

In Thornton's favor, the court:

- Affirmed the conditional water rights, which means Thornton can proceed with plans to deliver water.
- Gave Thornton even more water rights than the water court initially decreed, someing like 60,000 feet.

In opposition to Thornton the court:

- Upheld the water court decision that Thornton must revegetate any farms that are dried up when the water is diverted.
- Upheld a provision that Thornton could not use water from the Colorado-Big Thompson Project outside the boundary of the Northern Colorado Water Conservancy District.
- Returned the case to the water court, telling it to adapt its original decision to the opinion of the Supreme Court.

Thornton's project includes a small reservoir and miles of pipelines, expected to cost \$470 million.

*Fort Collins Coloradoan* 10/16/96, 10/23/96

#### **Northern Colorado Considers Local Water Commission**

Fort Collins Mayor Ann Azari and Larimer County Commissioner Janet Duvall want to establish a local water commission to preserve Northern Colorado water supplies and preserve the Poudre Canyon. Azari and Duvall hold that there are feasible

alternatives for conserving and developing supplies: water banks where farmers lease water to urban areas during droughts, reservoir exchanges and at-home conservation.

*Fort Collins Coloradoan* 10/12/96

#### **Water Judge Rules on Gunnison River Union Park Project**

A Colorado water judge, in a pretrial ruling, has concluded that the federal government has rights to all but a small amount of Gunnison River water, creating a new obstacle to Arapahoe County's proposed Union Park Project. Brown concluded that the Gunnison River water rights owned by the United States, including Blue Mesa reservoir and the downstream Crystal and Morrow Point reservoirs, can prevent diversions of water for the Union Park Project. The federal government's rights include enough water to operate electric generators at Blue Mesa Dam and to fill the reservoir behind the dam for recreation. A trial to begin next summer will determine whether there is enough water for the project. Gunnison basin residents oppose the project, and regardless of the outcome, the loser is expected to appeal.

*Denver Post* 11/9/96

#### **Colorado Will Sue if Utah Leases Colorado River Water**

Utah's annual share of the Colorado River is 1.4 million acre-feet, of which it uses about 90,000 feet. The state has floated the possibility of leasing some of its excess water, for maybe 50 or 100 years, to a fast-growing area such as Las Vegas. Utah will be sued if it leases some of its unused share to Las Vegas or California, says Bennett Raley of the Northern Colorado Water Conservancy District. He contends the practice would jeopardize the river law and could make water-rights holders susceptible to claims from environmentalists and Mexico for more water.

*Denver Post (Associated Press)* 11/28/96

#### **Manmade Colorado River Flood Helped Restore Ecosystem**

Scientific studies have concluded that the weeklong flood in March helped revive natural habitats along the Colorado River. An Interior Department report of studies done by more than 100 scientists shows the manmade flood increased sand bar volume by about 53 percent, created 82 new beaches, restored several major rapids by removing debris, and increased backwater canyon habitats for endangered fish by 20 percent. On October 9, Interior Secretary Bruce Babbitt signed new regulations giving environmental concerns precedence over power needs in managing the Colorado River's flow through the Grand Canyon.

*Fort Collins Coloradoan* 10/9/96, *Denver Post (Associated Press)* 10/10/96

#### **Lead Scientist in Grand Canyon Flood Quits**

Meanwhile, the scientist who oversaw the Colorado River manmade flood has quit after more than 20 years with the U.S.





Bureau of Reclamation. Dave Wegner said he decided to quit after the department disbanded the research group he had overseen, the Glen Canyon Environmental Studies Group. The group was described as the nation's premier source of research and information on the impact of dams on the environment. Wegner said he thought his group would be "taking our expertise...and applying it to other rivers and dams...throughout the United States." Reclamation officials said the department was disbanded because its mission was completed. In its place will be the Grand Canyon Research and Monitoring Center, which will oversee new operations at Glen Canyon.

*Denver Post 11/26/96*

#### Animas la Plata Project Gets \$9 Million

The 1997 Water and Energy Development appropriations bill, signed by President Clinton on October 2, includes \$9 million for the initial construction of the \$710 million Animas la Plata water project in southwest Colorado. The funding includes \$500,000 to continue recovery efforts for endangered fish in the San Juan River.

*Denver Post 10/2/96*

#### El Paso County Water Providers Join Forces

About a dozen water districts have agreed to form the El Paso County Water Authority, an entity that will be able to pool its money to buy water rights and build reservoirs or water delivery systems. Local officials studying creation of the authority have already heard from two groups trying to sell water from outside El Paso County - one that calls for pumping water from the Gunnison River, and another that would send groundwater from the San Luis Valley. *Danielson?*

Water districts in Douglas County formed an authority nearly four years ago, studying ways to change the county's almost complete reliance on nonrenewable groundwater. Jim Sullivan, Douglas County commissioner, said authorities in Douglas, El Paso and Arapahoe counties could eventually work together, even teaming with the Denver Water Board and Colorado Springs utilities to tackle water supply challenges for the entire Front Range. Sullivan said such an alliance could pressure the State Legislature to seek an end to competition for water and demand creation of a statewide water plan. Officials with Colorado Springs Utilities, however, say they have plenty of water and don't need to become involved with an entity they believe will spend most of its energy seeking new water sources.

Whatever Colorado Springs' involvement, authority advocates say its creation is a rare example of planning for area's future. In the meantime, the newly formed El Paso authority likely will deal with issues like how to link local water districts so they could send water to one another during droughts or individual system breakdowns.

*Colorado Springs Gazette Telegraph 11/11/96 GT Online*

#### San Luis Valley Again Faced With Developers

Once again San Luis Valley residents are indicating their commitment to keep water developers from taking water out of the valley. Four days after residents opposed to a water development project took out a statewide newspaper ad against it, the project's developer ran an ad of its own. The dueling advertisements portend an intense fight once Stockman's Water Company files its proposal in state water court, possibly by year's end. Stockman's would sink wells on Baca Grant No. 4 ranch, which company president and Crestone rancher Gary Boyce bought after AWDI's water proposal failed. Boyce insists there is enough unused water on his 110,000-acre spread to sell up to 32.6 billion gallons a year to Front Range cities without hurting the valley.

*Denver Post 10/20/96, 10/26/96*

*32,600  
100,000 Acft/yr*



#### RIVER PRESERVATION//HERITAGE PROGRAMS

##### Parks/Public Lands Bill Protects North St. Vrain

The Federal Parks and Public Lands bill contains a provision that permanently protects 17 miles of North St. Vrain Creek from dams and diversions. The stretch runs from the Continental Divide in Rocky Mountain National Park down to Button Rock Reservoir near Lyons. Originally sought a decade ago as a wild and scenic river, U.S. Rep. David Skaggs avoided controversies over water rights and land use in the stream corridor by writing the protection act as an amendment to the bill that created Rocky Mountain National Park. A measure to convert the Black Canyon of the Gunnison National Monument to a national park was dropped, as was a land exchange for the City of Greeley and a study of the lower Cache la Poudre River. The bill now goes to President Clinton, who has said he will sign it.

*Grand Junction Daily Sentinel/Rocky Mountain News 10/4/96*

##### Congress Approves Cache la Poudre Corridor

Congress's final act was to approve the Cache la Poudre Corridor legislation, sponsored by Sen. Hank Brown. The measure protects a 40-mile stretch of the river flood plain from development between Fort Collins and Greeley. It creates a volunteer 15-member commission that will advise the federal government on the management of federal land inside the corridor. The commission will include members from the cities of Fort Collins, Greeley and Loveland; two members each from Larimer County and Weld County; a member from Colorado State University; a member from the Northern Colorado Water Conservancy District; representatives of the Secretary of the Interior, the U.S. Forest Service, and the State of Colorado; and three general public members chosen by the Governor. Brown's law will have the people along the river swap their holdings for federal property the government doesn't need. The 15-member commission will recommend land exchanges along the flood plain. The Cache la Poudre will be the only river designated as wild and scenic in the state.

*Denver Post 11/25/96*



### GOCO Funds Awarded

The Great Outdoors Colorado trust board announced in October that it will make awards of state lottery funds to the following projects:

- \$3.4 million to The Poudre-Big Thompson Rivers Project—a \$25 million project that includes land and wildlife preservation, environmental education, and the construction of recreation trails in Fort Collins, Loveland, Estes Park, Windsor, Greeley, and the nearby mountains.
- \$2 million to The Pikes Peak Greenway Project in Colorado Springs—which will protect the Monument-Fountain Creek corridor including the purchase of open space and the construction of a recreation trail connecting parks in Monument, Palmer Lake, Colorado Springs, Fountain, Security and Widefield.
- \$2 million to The Roaring Fork River Corridor Project—which will allow communities to buy an old rail line, developing the land into a 33-mile greenway and recreation trail. The trail will link eight communities between Glenwood Springs and Aspen and will offer access to the river.
- \$450,000 to Improvements at Steamboat Lake—to be used for a \$350,000 visitor's center and \$100,000 for a trail maintenance project.
- \$119,000 to Pearl Lake—for major campsite renovations.
- \$196,557 to Colorado State Parks—to help pay for costs associated with a Legacy project at Elkhead Reservoir.

Earlier this year, the Yampa Valley was one of a handful of areas throughout Colorado to receive the first Legacy grants. The grants are major investments for large, interjurisdictional projects. The Yampa Valley's award was \$6 million. Before the valley receives any of the \$6 million, local matching funds must be secured.

*Denver Post 10/24/96, Local Headlines, Microsoft Internet Explorer*



### WETLANDS

#### Quick Permit Program Opposed

A Corps of Engineers proposal to extend the quick permit program for five years is drawing criticism from a host of other federal agencies, several states and environmental organizations. The federal government for years has required developers to get permits under the Clean Water Act before dredging and filling land. The red tape associated with the program often took months to complete, and the expedited procedure came about because of pressure from developers. Critics say that tens of thousands of acres are being drained all over the country under this program. Environmental groups are threatening to sue if the program is not significantly scaled back and if its broad ecological effects are not fully studied, and federal officials tell the COE that the program needs to be overhauled.

*Denver Post 10/27/96*

#### Fort Collins Favors Wetlands-Sensitive Developers

The Fort Collins development-review process favors developers who are sensitive to wetlands and other natural-resource areas. One project, revised after strong opposition by neighbors, will preserve wetlands and wildlife corridors and allow public access to them. David Cooper, research scientist with the Department of Fishery and Wildlife Biology at Colorado State University, says developers need an understanding of an area's history and its original water source. Cooper says that in addition to the wetlands role in biodiversity, another important function is protecting water quality by filtering excess nutrients, pollutants and sediment out of urban and agricultural runoff. Natural areas sales taxes began in Fort Collins in 1993 and in Larimer County in 1996. Each city in Larimer County receives a portion of the county tax, and some goes toward natural areas on unincorporated land. The City of Fort Collins has identified about 8,000 acres of wetland, prairie and endangered species habitat it would like to purchase.

*Fort Collins Coloradoan 10/28/96, 10/28/96*

#### Telluride/EPA Settlement Reached

Under the latest settlement, a \$1.1 million fine against the Telluride ski area is the largest ever imposed for wetlands destruction, but would make the resort restore only 16 acres of wetlands near Telluride. In 1984, the Telluride resort began illegally developing 58 acres of federally protected wetlands. Federal agencies discovered this six years later, and the company said that it did so unknowingly. Told by the President to negotiate such cases instead of filing a lawsuit, the resulting deal with EPA would have imposed a





minimal fine of \$142,000, but the company would have to restore almost 16 acres of wetlands at the resort and construct another 26.5 acres of wetlands at a new site 60 miles away. In 1993 the EPA formally filed suit against the resort and simultaneously announced its proposed settlement. But in 1994, a district judge ruled that the deal let the resort off too easily. Shortly afterward, the federal statute of limitations ran out, so EPA could negotiate only over 17 acres. EPA says the resort will restore another 15 acres of wetlands near the town if the agency wins its appeal about the statute of limitations.



### FISH RECOVERY PROGRAM

#### Selenium Threatens Fish Recovery Program

A year-long study of razorback suckers suggests that levels of selenium found in the Grand Valley make it almost impossible for the endangered fish to reproduce. Selenium is found naturally in Mancos shale, and a certain amount has always been present in area rivers as a result of spring runoff. Scientists believe irrigation has flushed it out of the shale and raised levels in many areas in the West. Selenium also is present in backwater ponds and wetlands that serve as nurseries for the endangered species that are native to the rivers. None of the razorback larvae in the year-long study survived when spawned in water containing only 4 to 7 micrograms of selenium per liter.

*Denver Post (Associated Press) 10/14/96, 11/13/96*

#### COE Will Continue Surface Collector Tests

Despite inconclusive results, the Corps of Engineers isn't giving up in its efforts to help young salmon swim safely over hydropower dams. COE's 350-foot long steel prototype surface collector is designed to divert fish away from turbines and help them over the spillway of the Snake River dam in Southeast Washington. The COE is expected to spend an additional \$6 million next year to test the device through the entire spring and summer runs of threatened fall Chinook. Driving the surface-collector tests is a 1995 National Marine Fisheries Service biological opinion on hydropower operations. The opinion sets a goal of getting 80 percent of Idaho threatened or endangered fish through the Snake and Columbia river dams. An operating collector at Wells Dam, upstream from Wenatchee, Washington, sends as much as 95 percent of ocean-bound salmon over that dam's spillway. Its success rate is due partly to the dam's design, with the spillway over the powerhouse rather than alongside like the Snake River dams. An advantage of surface collectors is that they require only a small amount of the water rushing through dams. The COE is also studying reservoir drawdowns and improvements to diversion screens in front of turbine intakes.

*Denver Post (Associated Press) 11/2/96*

#### Steamboat Springs Will Dedicate Water to CWCB

The City Council of Steamboat Springs is considering an ordinance dedicating 200 acre-feet of water from the expanded Fish Creek Reservoir to the Colorado Water Conservation Board. Steamboat Springs Water decided to dedicate the water after the engineers who designed the expansion discovered the reservoir would hold 200 acre-feet of water more than they thought it would. It was the intent to dedicate some water for instream flow purposes during the expansion, but it wasn't known how much water would be dedicated.

*Local Headlines, Microsoft Internet Explorer, Steamboat Pilot 11/5/96*



### WATER QUALITY

#### Lowry Range Wells Are Contaminated

Tests have shown the presence of perchloroethylene in levels 20 times higher than the state standard in groundwater around a missile silo at the former Lowry Bombing and Gunnery Range. State health officials are asking the Corps of Engineers to speed up and expand testing there. More testing is required to determine if there is a health risk to humans. Tests on three other silos are pending. The study is part of a nationwide investigation to determine whether old defense sites are contaminated.

*Denver Post 10/9/96*

#### Canadian Judge Rules Against EPA

A Canadian judge in early November issued a ruling lifting the freeze on \$152 million in assets belonging to Robert M. Friedland, the mining promoter who played a key role in the development of the Summitville project. The judge's ruling also ordered the Environmental Protection Agency to pay all of Friedland's costs and attorney fees, and allows Friedland to make a future claim against the EPA for damages to his income, stock holdings and reputation. It had been EPA's contention that Friedland had a major role in the mine's operation and was personally responsible for environmental problems at the site, an assertion Friedland denied.

*Denver Post 11/10/96*

#### Tougher Regulations for Beach Water

The Colorado Department of Public Health and Environment and reservoir operators, because of numerous occurrences of high levels of fecal bacteria at swim beaches, have proposed major changes State parks already are required to test water quality five times per month. Among proposed regulations the state is considering is mandatory testing for E. coli bacteria.

*Fort Collins Coloradoan 11/27/96*







## MEETINGS



### 3<sup>RD</sup> ANNUAL ARKANSAS RIVER BASIN WATER FORUM January 22-23, 1997 – Pueblo, Colorado Occhiato Student Center, University of Southern Colorado

**PLAN TO JOIN YOUR COLLEAGUES AT THE ARKANSAS RIVER BASIN WATER FORUM. TAKE THIS OPPORTUNITY TO SHARE YOUR IDEAS AND LEARN MORE ABOUT THE DEMANDS ON COLORADO WATER.**

The Arkansas River Basin Water Forum has and will continue to serve as a gathering place for sharing of ideas and methods of addressing opportunities presented by the various needs for the water flowing in the Arkansas River. Topics this year will focus on agricultural and environmental issues. An update of the Kansas vs. Colorado litigation plus a look at the effect of augmentation rules and the replacement of water to the Arkansas River will highlight this year's program. The Forum is designed to accommodate interests of individuals involved in recreational, agricultural and municipal uses and environmental concerns of Colorado water, especially in the Arkansas River drainage basin. This year the committee has arranged for a web site for continued participation before, during and after the forum. The web site address is: <<http://www.uscolo.edu/arkriver>>. The e-mail address for more information on the Forum and registration is: <[pueblo@coop.ext.colostate.edu](mailto:pueblo@coop.ext.colostate.edu)>.



### COLORADO WATER CONGRESS ANNUAL MEETING

Holiday Inn, Northglenn, Colorado  
 I-25 & 120<sup>th</sup> Avenue  
 January 30-31, 1997

For information contact:  
 Colorado Water Congress  
 Phone 303/837-0812  
 FAX: 303/837-1607



### The League of Women Voters Education Fund presents: TOOLS FOR DRINKING WATER PROTECTION — A community call to action - live via satellite March 19, 1997 – 2:30 - 4:00 p.m. ET on PBS

Citizens and decisionmakers will get the practical planning and management tools they need to create successful water protection programs. Plus, participants will have access to the country's top water quality experts via phone, fax and the Internet! Topics:

- How to make land use decisions and identify permitted and prohibited uses within drinking water source areas;
- How to organize public education and awareness efforts, including how to involve citizens;
- How to establish and maintain monitoring programs within sensitive areas to monitor water quality;
- How to involve a broad range of local decisionmakers in preparing contingency plans in case of contaminant release or other emergency; and
- How to build leadership and secure funding for land use planning, public education, water quality monitoring and contingency planning.

PBS Adult Learning Satellite Service will distribute the videoconference via satellite transmission and provide a set of promotional and print materials that can be duplicated for use with the videoconference. For information on how to receive a videoconference license call 1-800-257-2578. Visit the Tools for Drinking Water Protection Web site at [www.drinkingwater.org](http://www.drinkingwater.org). To submit your license request electronically, visit the PBS Adult Learning Service Web site at [www.pbs.org/als/programs/vc/water](http://www.pbs.org/als/programs/vc/water).





## CALLS FOR PAPERS

### **1997 Platte River Basin Ecosystem Symposium February 18-19, 1997 Kearney, NE**

Reports on completed research are encouraged. Progress reports will be considered. Posters will be accepted for dedicated poster sessions. For more information contact: Tom Franti, Platte Watershed Program, 234 L.W. Chase Hall (East Campus, University of Nebraska, Lincoln, NE 68583-0726, Phone 402/472-9872; FAX 402/472-6338. Deadline: Jan. 10, 1997.

### **7<sup>th</sup> International Drainage Symposium March 8-11, 1998, Orlando, FL**

In conjunction with the 8<sup>th</sup> National Symposium on Individual and Small Community Sewage Systems. The symposium provides a forum for communication between science, industry, and practice in the areas of agricultural drainage and water management. For the call for papers contact: American Society of Agricultural Engineers, Voice: 616/429-0300, FAX 616/429-3852, E-mail [buntjer@asae.org](mailto:buntjer@asae.org). Deadline: Jan. 10, 1997.

### **17<sup>th</sup> Annual Hydrology Days April 14-18, 1997 Colorado State University, Fort Collins, CO**

This five-day program will include volunteered papers (mostly); invited papers (a few); student papers (one full day at least), and a poster session. Papers are welcome on all topics in hydrology and hydrologic engineering. Send three copies (original plus two) of abstract(s) on a single page with full mailing address (include telephone, fax and e-mail) and student status (MS, PhD), if applicable with presentation preference (Oral/Poster). Abstracts are due by January 24, 1997 to: Professor Morel-Seytoux, HYDROLOGY DAYS, 57 Selby Lane, Atherton, CA 94027-3926 Phone and FAX: 415/365-4080. E-mail: [morelsey@usgs.gov](mailto:morelsey@usgs.gov)

### **Tools for Transforming Tomorrow August 10-14, 1997, Minneapolis, MN**

The American Society of Agricultural Engineers (ASAE) announces a Call for Presentations for its Annual International Meeting. The meeting will include both Lecture Sessions and Poster Sessions. General Presentation Topic Areas are: Power & Machinery; Soil & Water; Information & Electrical Technologies; Structures & Environment; Forest Engineering; Food & Process Engineering; and a session for Other Topic Areas. You can obtain an electronic copy of the presentation proposal form by e-mail or download from the World Wide Web at <http://asae.org/meetings/am97/form.html>. When you send an e-mail message to [am97form@asae.org](mailto:am97form@asae.org), you will automatically receive a message that contains the ASCII text version of the form. For a list of session topics send e-mail to [am97sessions@asae.org](mailto:am97sessions@asae.org). For questions or additional information, including instructions for preparation of proposals, contact: ASAE Meetings Department at Voice (616/429-3852 or e-mail [buntjer@asae.org](mailto:buntjer@asae.org). Deadline: January 10, 1997.

### **1997 Rocky Mountain Symposium on Environmental Issues in Oil and Gas Operation July 14-15, 1997 — Golden, CO**

The Colorado School of Mines and the U.S. Bureau of Land Management will sponsor the third symposium on all aspects of environmental protection, remediation, and reclamation involved with oil and gas operations. For abstract instructions contact CWRRI or Office of Special Programs and Continuing Education, Colorado School of Mines, Phone 303/273-3321, FAX 303/273-3314, or email [space@mines.edu](mailto:space@mines.edu). Deadline: January 3, 1997.



## CALENDAR

- Jan. 8-10 ANNUAL CONVENTION, FOUR STATES IRRIGATION COUNCIL, Fort Collins, CO. Contact: Brian Werner or Candee Werth, Northern Colorado Water Conservancy District, Phone 970/667-2437 or FAX 970/663-6907.
- Jan. 13-17 TAILINGS AND MINE WASTE '97, Colorado State University Fort Collins, CO. Contact: Linda L. Hinshaw, Civil Engineering Department, Colorado State University, Fort Collins, CO 80523-1372, Phone 970/491-6081, FAX 970/491-7727, E-mail: [lhinshaw@vines.colostate.edu](mailto:lhinshaw@vines.colostate.edu).
- Jan. 22-23 ANNUAL ARKANSAS RIVER BASIN WATER FORUM, Pueblo, CO. Use the e-mail address or check the web site below for more information on the forum. E-mail: [pueblo@coop.ext.colostate.edu](mailto:pueblo@coop.ext.colostate.edu). URL: <http://www.uscolo.edu/arkriver>.



- Jan. 28-29 WORKING WITH WETLANDS & WILDLIFE, Houston, TX. Contact: Wildlife Habitat Council, Phone 301/588-8994, FAX 301/588-4629, E-mail WHC@CAIS.COM, Web site <http://www.wildlifehc.org/wildlifehc>.
- Feb. 16-21 1997 ANNUAL MEETING, SOCIETY FOR RANGE MANAGEMENT, Rapid City, SD. Contact: 1997 SRM Annual Meeting, P.O. Box 575, Huron, SD 57350, FAX 605/352-1270.
- Feb. 25-26 WORKING WITH WETLANDS & WILDLIFE, Atlanta, GA. See above for contact information.
- Mar. 10-12 THE OGALLALA AQUIFER – MANAGING FOR DROUGHT AND CLIMATE CHANGE, The Great Plains Symposium 1997, Lincoln, NE. Contact: Robert Kuzelka, Phone 401/472-7525, FAX 402/472-3574, e-mail to [rkuzelka@unlinfo.unl.edu](mailto:rkuzelka@unlinfo.unl.edu).
- May 7-9 COMMUNITIES WORKING FOR WETLANDS, Alexandria, VA. Contact: Terrene Institute, 4 Herbert Street, Alexandria, VA 22305, Phone 800/726-4853 or 703/548-5473, FAX 703/548-6299, E-mail [terrene@gnn.com](mailto:terrene@gnn.com).
- May 28-31 IAIA '97 - REFLECTIONS ON WATER: LEARNING FROM HISTORY AND ASSESSING THE FUTURE, New Orleans, LA. Contact: International Association for Impact Assessment, NDSU-IBID, Hastings Hall, PO Box 5256, Fargo, ND 58015-5256, FAX 701/231-1007.
- Aug. 5-8 HYDROPOWER: NEW CHALLENGES, OPPORTUNITIES AND PARTNERSHIPS, Atlanta, GA. For information contact: American Society of Civil Engineers at Direct Line 703/295-6000, Exhibits 703/295-6009, FAX 703/295-6144, Website: [www.asce.org](http://www.asce.org).
- Oct. 18-22 WEFTEC '97, Chicago, IL. Contact: Water Environment Federation, Phone 800/666-0206; FAX 703/684-2471; E-mail [confinfo@wef.org](mailto:confinfo@wef.org).
- June 29- July 3 AWRA/UCOWR ANNUAL SYMPOSIUM, WATER RESOURCES EDUCATION, TRAINING AND PRACTICE: OPPORTUNITIES FOR THE NEXT CENTURY, Keystone, CO. Contact: John Stednick, General Chairperson, AWRA, Phone 970/491-7248, E-mail [jds@cnr.colostate.edu](mailto:jds@cnr.colostate.edu); or Robert Ward, General Chairperson, UCOWR, Phone 970/491-6308, E-mail [rward@vines.colostate.edu](mailto:rward@vines.colostate.edu).
- July 14-15 1997 ROCKY MOUNTAIN SYMPOSIUM ON ENVIRONMENTAL ISSUES IN OIL AND GAS OPERATION, Golden, CO. Contact: Continuing Education, Colorado School of Mines, Phone 303/273-3321; FAX 303/273-3314; E-mail [space@mines.edu](mailto:space@mines.edu).