

Colorado Water

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

WATER ITEMS AND ISSUES . . .

February 1996

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In This Issue . . .

A *River of Dreams and Realities* *The Arkansas River Basin Forum*

held January 3-4, 1996

A look at the issues that confront
water users in the Arkansas River
Basin --

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Today's Reality, Tomorrow's Dream!

Editorial by Robert C. Ward

"A River of Dreams and Realities" was the theme of the 1996 Arkansas River Basin Water Forum, held January 3-4 in Pueblo. This well-planned and executed meeting generated a fascinating insight, I believe, into what Colorado may be facing in many of its future water management conflicts.

In the Pecos River basin 10 years ago, New Mexico lost a court case with Texas over water rights. Adjustments in water management practices have been implemented during the past 10 years to ensure that both states obtain the water to which they are entitled.

In the Arkansas River basin, Colorado has "lost" a court case with Kansas over water rights. Adjustments are planned in water administration practices to correct the problems identified in the court case. Again, the goal is to ensure that both states get the water to which they are entitled. I put "lost" in quotes because it is not as simple as that word indicates. David Robbins helps us better understand the issues and decisions handed down by the court in a straightforward explanation of what happened in the Colorado-Kansas case on page 3 of this issue of *Colorado Water*.

In both the Pecos and Arkansas River situations, past practices of managing western water resources are called into question. Assumptions on which we have operated for many years are being challenged. Refinements in our water administration practices are being required. Changes in our view of water are being requested. For example, the saying: "I would rather be upstream with a shovel than downstream with a water right" captures an attitude that necessarily is changing in Colorado.

The Arkansas River Forum discussed these and many more issues and concerns over the two days of presentations. It was obvious that the changes being required will cause some hardship in the valley, or at least that is the perception among some of the audience. The manner in which the changes were presented and discussed at the meeting was professional and, yet, sensitive to the concerns of the irrigators who use groundwater in the valley. As has taken place in other states where water quantity and quality problems have impacted agricultural water use, there is a clear need for the public to understand and develop options for the affected farmers. The Colorado legislature will, undoubtedly this session, see bills attempting to give the affected irrigators in the valley options relative to their future farming efforts.

We have chosen several presentations from the Arkansas Forum to transcribe and include in this issue of *Colorado Water* to give our readers an understanding of the changes taking place in the Arkansas Valley. After David Robbins gives his explanation of what was really decided by the Colorado-Kansas court case, Hal Simpson presents the administrative changes being implemented to bring Colorado into compliance with the Arkansas River Compact. Steve Witte presents an overview of water quantity in the valley, and the results of a groundwater quality survey are presented by Brad Austin. Ralph Adkins gives an excellent glimpse of the river's future (this presentation closed the Forum).

I hope the presentations help in gaining a glimpse of what the

future might hold for all Colorado river basins. It is clear that Colorado will have to tighten its conjunctive use of ground and surface waters in all river basins. This may mean that we devote more resources to administration of water rights and obtain more complete and accurate information regarding water use. Colorado also needs to find a way to fund studies and research that directly support its efforts to improve its water management system. With CWRRI losing its federal water research funding, this last issue increasingly is in need of attention.

The challenges of living and farming in a river basin can be overwhelming to individual water users when there is uncertainty over downstream water rights, growing urban water demands, and increasing awareness of the need to protect aquatic ecosystems. We need to look for ways to improve the security of water for existing water users while solving future water demands. As faculty understand the issues and concerns of the Arkansas Valley situation, they will be better able to direct their studies and research efforts to support the needs of the irrigators, the urban population, and water managers in the valley.

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Robert C. Ward, Director

THE ARKANSAS RIVER BASIN WATER FORUM: "A River of Dreams and Realities"

WHAT DID THE COURT SAY?

*David Robbins, Special Deputy Attorney General
Hill & Robbins, P.C.*

(Since 1985 David Robbins has represented the State of Colorado in the U.S. Supreme Court Case of Kansas v. Colorado. This involved the alleged violations of the Arkansas River Compact.)

My talk should probably be called, "What Did the Court Say and What Didn't the Court Say?" My partner, Dennis Montgomery, has worked diligently on this case for the last ten years as well. Dennis was instrumental in advocating Colorado's position.

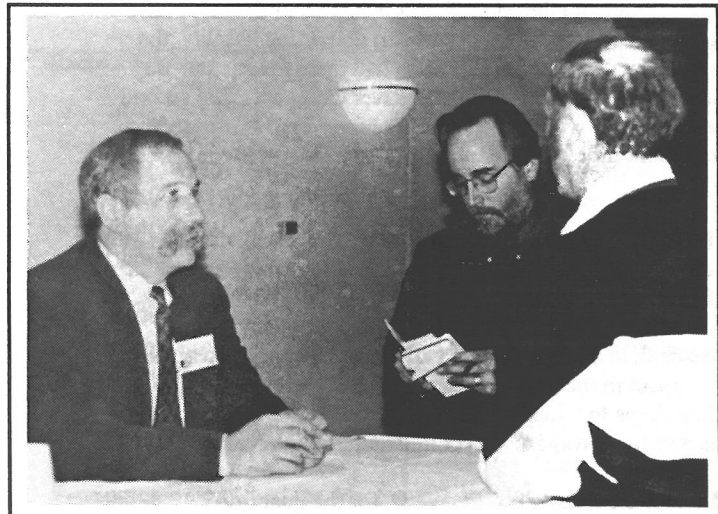
When a state sues a state, the Constitutional framers determined that that litigation would occur in the United States Supreme Court. If you think about history, you will recall that there were 13 colonies, each of which viewed itself as being sovereign and independent. They came together to form the United States. Each of those states was jealous of its prerogatives. The framers of the Constitution decided to allow the adjudication of differences of opinion among these sovereigns by the highest court of the land, and the only constitutional court of the land, the U.S. Supreme Court.

In the early days, when a state sued a state, the court actually listened to the arguments and the evidence and handed down a decision. Over the years, the increasing number of states gave rise to an increasing number of disputes, and with the increase in the number of citizens and the complexity of the laws, the court's docket became more and more crowded. Over the past 30 or 40 years a system of appointing "Special Master" was adopted. The court appoints an individual, who can be a judge or a noted lawyer in the American legal community, to sit and hear the positions of the contesting states and to render to the Supreme Court his recommendation concerning the facts that he has heard and any legal decisions he believes ought to be entered.

The Special Master is not a judge. He is an officer of the U.S. Supreme Court. To those of you who think that Kansas v. Colorado has been in some kind of federal court appellate process, it was not. The case, since 1985 when it was filed, has been under the jurisdiction of the U.S. Supreme Court, and Arthur Littleworth from Riverside, California, a noted California legal scholar in water and natural resources law, has been the Master. He presents his recommendations to the court, and the court then considers those recommendations and hears arguments of the parties. The court is then free to do whatever it likes with those recommendations. The court can throw them out, send them back, tell the Master to start over, appoint a new Master, change whatever findings it wants to change, change whatever rulings of law it wants to change, or, as in this case, it can simply say, "We think you did a good job. We adopt them."

The Constitution did another thing -- it provided that disputes among these sovereigns, who made up the United States, could

also be resolved by agreement. This was provided for in the compact clause of the Constitution. It permits states, with the approval of the U.S. Congress, to enter into compacts on issues of common interest and jurisdiction. These are areas where two or more states may assert sovereignty over a particular subject matter and sit down and work out their differences and agree on what the allocation will be. It is a constitutional mechanism that allows states to come to agreement so they are not



From left: David Robbins with Patrick Deiscoll of Denver and Don Magnuson of Cache la Poudre Irrigating. Photo by Karen L. Stewart, Arkansas Valley Journal.

constantly litigating. The Arkansas River is a classic example. The States of Kansas and Colorado both have water users who depend upon the waters of the Arkansas River both for economic well-being and for protection of environmental interests in the two states. When water demand and consumption occurs in one state, it affects the other state. A compact was entered into to try and resolve those issues.

I want to emphasize the purpose of a compact in the case of water. It allocates the right to use certain portions of water to two or more states. The fact that compacted water arises in Colorado is irrelevant. Colorado's Legislature, Kansas's Legislature, and the U.S. Congress have ratified a document that says what Kansas is entitled to receive. It is a law of the State of Colorado, entitled to enforcement just like any other law. It is a law of the U.S., entitled to enforcement just like any other national law. Whether you like it or don't like it, think it is fair or unfair, it is the law of the land at this time.

The Master heard claims from the State of Kansas that Colorado had violated the compact between the two states covering the waters of the Arkansas River in three particulars:

- Kansas alleged that the operation of the Trinidad Reservoir and the way in which water was stored in that reservoir was in violation of certain operating agreements entered into between Kansas, the Purgatoire River Water Conservancy District, and the Bureau of Reclamation.
- Kansas also alleged that the operation of winter water storage in Pueblo Reservoir, a feature of the Fryingpan-Arkansas Project, violated the compact by increasing the amount of depletion that occurred to the waters of the Arkansas River.
- Kansas alleged that post-compact wells, numbering some 2,000, had the effect of increasing the amount of depletion to the Arkansas River.

After the Master had heard the preliminary skirmishing, he decided to bifurcate the trial. We now have had the first phase of that bifurcated trial, and that was to determine liability, the question of whether or not Colorado had in any particular way violated the terms of the Arkansas River Compact. The second phase of the trial will be the remedy phase. That is proceeding at the present time. The purpose of the remedy phase is twofold:

First, to determine the amount of depletions in violation of the compact. How much water should have gone to Kansas from 1950 to 1994 that did not go to Kansas?

Second, to determine how Colorado will comply with the compact in the future. How will Colorado ensure the state line flows to which Kansas is entitled (referred to as usable state line flows) are not diminished in the future?

In addition, the Master has to decide, for the quantity of depletions that occurred over the last 45 years or so, what Colorado will do to remedy Kansas or make Kansas whole for the lack of supply.

I want to emphasize this again -- the fact that there is water in the Arkansas River, in the system, does not give the State of Colorado the right to consume it all. Colorado may only divert and consume its equitable share of the waters of the Arkansas River.

The Arkansas River Compact, then, signed in 1948, basically was a stand-still compact. The concept behind it was that the waters of the system were being fully used under many circumstances in both states. In fact, there was insufficient water in the system under many conditions to serve the existing water users in 1948 in both states. The idea behind the compact was that neither state would increase the amount of depletions to the river unless it could show that the increase in use did not deprive water users in the other state of supplies to which they were entitled.

Basically, the concept was to draw a line in 1948 -- anything that happens in either state after '48 that has the effect of

depriving users in the other state potentially, potentially, could constitute a violation of the compact. I want to make it clear that in 1948 and today there is unused water in the system under some circumstances, and the compact recognizes a state's right to make use of that unused water, if it can, without injury. That is an important concept.

Usability, as far as the Arkansas River Compact is concerned, is looking at water use in the mirror of 1948. Usable flows means those waters which would have been used in 1948 by the structures and conditions that existed then. In the State of Kansas, a certain number of ditches, under certain flow conditions, received water. There was a certain increment of water that went to recharge for pre-1948 wells in Kansas, and there was also water that flowed across the state line, through Kansas, and right out the other end of the compacted reach at Garden City. The compact framers thought of the water that passed Garden City without anyone diverting it as being unusable. They contemplated that both states, Kansas and Colorado, could undertake steps to try and capture that water. One of the measures to do so was John Martin Reservoir, which would capture and regulate flood flows for the benefit of users in Colorado and Kansas.

The Master, after months of trial held in Pasadena, California, found, and the court confirmed, that of the three Kansas claims the Trinidad claim and the winter storage claim for Pueblo Reservoir were unfounded and not proved and dismissed them both. In the third claim, that post-compact well pumping in Colorado deprived Kansas of water, the Master found that Kansas had proved depletions in violation of the compact, although he didn't quantify how much had occurred.

Importantly, he also found that the State of Colorado and its water officials had been in good faith and had not set about trying to damage Kansas or to take water away from Kansas. They had intended to permit the use of unusable flows in the Arkansas River under the compact, and they did not believe that wells were creating a cognizable harm to the State of Kansas. That is important. That is why the Master will give Colorado a chance to come up with a solution in the future. That is why Colorado will have a say in how to redress that injury. The Master found the injury existed, but it wasn't one that Colorado or Kansas understood or knew about until shortly before the litigation was filed.

Judge Tracey did a wonderful job of talking about the evolution of Colorado water law and some of the important issues that have arisen. Remember, Colorado is a prior appropriation state. The Constitution authorizes water users to use water in accordance with their priorities. When there is insufficient water, more junior water rights have to be shut down, so seniors are entitled to use their supply. Water in Colorado is presumed to be tributary to streams and subject to the appropriation doctrine unless shown in a specific instance to be nontributary and therefore not covered by the doctrine. As a result, wells in tributary formations, just like ditches, are subject to the constitutional doctrine of prior appropriation. That doctrine operates not against all water in the state -- it only operates against the water to which Colorado is entitled under an interstate compact. So, there is a limitation on how much water Colorado water users can divert within the priority system.

Colorado finds itself with approximately 2,000 wells that are junior to our obligations to the State of Kansas. They also are very, very junior to many senior surface water rights and ditches that have existed in the Arkansas basin from the late 1860s and early 1870s. Under any decision of a Colorado court or the current decision of the United States Supreme Court, those more junior wells should not be able to operate unless they replace any injury or depletion that they cause to water which otherwise would be available to Colorado senior surface water rights under the Colorado Constitution or to the State of Kansas under the Arkansas River Compact.

After the court decided that Colorado had in fact, although unknowingly, been in violation of the Arkansas River Compact, Kansas immediately sought to obtain an injunction requesting that wells in the Arkansas basin be immediately shut off and not be allowed to pump until such time as Colorado and the well owners had convinced the Supreme Court and the Master that Kansas would receive all of the water supply to which it was entitled. The Master, for what I think was good reason, said he would not grant that injunction. He said Colorado was found in violation, but should be given a chance to propose a solution.

Hal Simpson, the State Engineer, is responsible for the future solution, and I am not going to steal his thunder. I do want to say a couple of things, though. Both Colorado and Kansas, through their evidence, showed that the wells in the Arkansas basin were causing stream depletions which to some degree were depleting usable state line flows to which Kansas was entitled under the compact. The State of Kansas is entitled to the protection of the compact and the law of the State of Colorado, which embodies and encompasses the Arkansas River Compact. Colorado does not have a choice. It must enforce those laws so long as they remain on the books, and so we have to propose a solution to the problem.

A well permit is very similar to a driving license. It entitles you to drill a well. In that well is water. That water is subject to the constitutional doctrine of prior appropriation. You aren't entitled, simply because you have a well permit, to pump that water unless you are doing it in the priority system or in a way that does not impair senior water rights under the Colorado Constitution. You all have driver's licenses which the state gave you, but that doesn't mean you can speed. There is another law that says "no speeding," and if you speed or drive drunk you can lose your license. You can drill a well, but that doesn't give you an ironclad right to pump that well and take water that belongs to someone else in this state or the State of Kansas. That is the legal framework with which we are dealing here.

A well permit is very similar to a driving license. It entitles you to drill a well. In that well is water. That water is subject to the constitutional doctrine of prior appropriation. You aren't entitled, simply because you have a well permit, to pump that water unless you are doing it in the priority system or in a way that does not impair senior water rights under the Colorado Constitution.

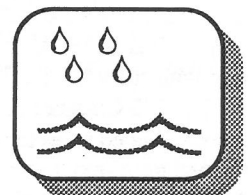
For those of you who think that merely by regulating the use of water and wells there is somehow a government taking involved, let me tell you I think you are in error. The Colorado Constitution does not give you a right to a certain quantity of water. It is a usufructuary right. First, the water belongs to the people of the state subject to your right to make a use of a portion in priority. If you have a well that is junior, you are not in priority if the result of pumping that well injures other more senior water users or users in the State of Kansas under the compact.

Colorado, although unknowingly, allowed the compact to be violated, and Colorado has to solve the problem. We have a legal obligation to deal with what has happened between 1950 and the present. In late October Kansas and Colorado stipulated that the amount of usable state line flow that had been depleted to the State of Kansas by

users in Colorado was about 328,000 acre-feet for the period 1950 to 1985. We are negotiating with Kansas today to try to resolve the 1986 to 1994 values. Colorado, at some point, will have to repay Kansas for those depletions, in water or money. In January, Kansas will file a brief. Kansas will tell us what it thinks Colorado ought to do as a legal matter to redress that compact violation. Colorado will respond in May, and Kansas will reply in July. The Master will then hear arguments and decide.

Those hearings will go on over the next several months to a year. If we fail to control post-compact well pumping, the Supreme Court and the Master will do it for us. Kansas has already asked to have a special federal master appointed to run the river. The request has not been acted on, but if Colorado fails to come up with a program that adequately ensures the Master that Kansas will receive the water to which it is entitled under the compact, he will be forced to come up with his own remedy, and Kansas will push very hard for that remedy to be a federal official who has little interest in what goes on in Colorado and has, as a sole, driving purpose, the need to be sure that Kansas gets its water.

Finally, one other point -- Colorado lives by compacts. We expect our neighbors -- Texas, New Mexico, Kansas, Nebraska, Arizona, California, Nevada, Utah, Wyoming -- to live by the terms of those compacts and to allow us to use as much water as we are entitled under those compacts. We also have an equal obligation to comply with the compacts to which we are signatory.





THE NEW RULES

*Hal Simpson, State Engineer
Colorado Division of Water Resources*

I think the reality of complying with the Arkansas River Compact is now fully upon us. One of the key provisions of the compact was that after December 14, 1948 there was to be no additional water resource development in the Arkansas basin in either state if it depleted usable state line flows. You heard David Robbins say that the Special Master, affirmed by the U.S. Supreme Court, had found that, in fact, around 1500 post-compact wells were constructed in Colorado. They were primarily irrigation wells that did violate Article 4D of the compact, so we are facing that reality. That is, as David indicated, what we are trying to deal with through rule-making.

Before I get into the new rules, I want to give you a little background on why we have to go about this type of water rights administration through rule-making. The role of the State Engineer traditionally has been to administer water rights, and that is done through the priority system that Judge Tracey described so well at lunch. However, when it comes to enforcing certain other types which are not so clear as a water right, such as a compact or bringing a well into the priority system as was required by the 1969 Water Rights Determination Act, we have to follow certain other procedures set forth by statute, and that is called rule-making, or we promulgate rules and regulations -- that is another term for rule making.

The 1969 Act had some very specific requirements or principles that I must follow if I am to promulgate rules dealing either with interstate compacts or the administration of groundwater rights. The 1969 Act brought together the surface water priority system, which dated back into the 1860s, with wells that had never been required to be adjudicated. The 1969 act required them to be adjudicated and thrust into that priority system wells that are a hundred years more junior. To do that, the statutes required that it be done through rule-making, and very specific steps have to be followed. The rules have to be specific to a river basin; they have to be specific to certain types of aquifers; and they have to be able to optimize water use while maintaining the priority system. That is difficult, when you bring wells into the priority system. The rules must be published in every county where they will go into effect at least 60 days prior to their effective date. Since time is of the essence, the water court has to hold hearings on any protest of those rules as soon as they occur.

I want to talk about the existing rules, those that were in effect through the end of 1995, so you know we just aren't stepping forward with rules for the first time in the Arkansas River Basin. In 1973 Clarence Kuiper, the State Engineer at that time, promulgated rules to respond to the 1969 act. As Judge Tracey had indicated, there had been a false start down here in the Arkansas Basin with the Felhauer case, where there were

not established procedures set forth by rules on how we were going to administer wells. The division engineer had selected 30 wells very close to the river, and shut those down. That was not acceptable to the district court nor to the Supreme Court, which directed the State Engineer to promulgate rules. In 1973, after the Felhauer case had gone to the Supreme Court and been decided, Mr. Kuiper promulgated rules that basically curtailed pumping in the Arkansas River basin four days per week, allowing pumping three days. They were effective in 1973, and the rules were not protested.

At the beginning of 1974 Mr. Kuiper amended those rules and filed another set through the procedure set forth in the statute to start curtailing pumping more. In 1974 there would be five days of no pumping, in 1975 six days, and total curtailment in 1977. These rules were protested vigorously by the groundwater users. There was a trial before the water court in Pueblo. Judge Gobin, the water judge, ruled that the State Engineer had not allowed the 1973 rules to operate long enough to determine through experience and investigations whether in fact they were acceptable or suitable without tightening down on well owners more. The State Engineer appealed that decision to the Colorado Supreme Court, the Supreme Court affirmed Judge Gobin saying, "You didn't conduct the necessary investigations or allow the 1973 rules to operate long enough."

Because of that decision and the fact that there were no requests from well owners or surface water users to change the rules, they have been in effect through the end of 1995 or about 23 years. But in response to the litigation with Kansas, which filed its action in December of 1985, and the trial, which I believe began in 1990, we had a four-year period of very intense studies by both states to develop the basis for the litigation, and those investigations were important to any future rule-making because they provided evidence that could be utilized in future rules. Both states initiated very detailed and similar studies using computer models to evaluate the effect of post-compact wells and the effect of the winter water storage program. Both issues had been alleged to violate the compact by Kansas.

We both quickly learned that the data necessary to drive good computer models was lacking in the basin, so a lot of assumptions had to be made, and both models had their shortcomings. The area of focus for the modeling efforts of both states was the area from Pueblo to the state line. It basically covered the valley fill or alluvial aquifer of the Arkansas River as well as aquifers to the outside of these called bench aquifers or surficial aquifers. Basically, it is an area where there are about 2,000 irrigation wells in existence that have pumped upwards of 250,000 acre-feet (af) of water in certain years. The models were set up in a manner to evaluate both the effect of pumping and then turning off

certain switches in a model to evaluate the effect of what the river would have seen in the way of additional flows had there not been pumping. Where would that water have been diverted? Would the senior surface rights have diverted more, or how much really would have reached the state line?

The study period was 1950 to 1985, and both states came down with similar results. It is not surprising, when you think about the hydraulic connection between the alluvial or surficial aquifer and the stream system. If you pump groundwater, and if you consume it in growing crops, you are going to deplete streamflow. That is a fact of physics that you really can't overcome no matter how much you would like to. Both states had similar results, although Kansas' model showed lesser depletions of usable state line flow than Colorado's model, and the Master in his report indicated that he would support using the Kansas model since it showed the lesser depletions and Kansas was the complaining party.

He further found that the 1973 rules were not effective. In other words, that reduction or curtailment of pumping to just three days of pumping per week didn't really reduce pumping, in his opinion. In fact, every year after 1973 the pumping increased or was greater than the 1973 level of pumping. In his report that he filed July of 1994, the Master found, just to reemphasize, that most compact well pumping did deplete usable state line flows. The 1973 rules were not effective. The augmentation plans that allowed certain wells to pump seven days a week were not sufficient in offsetting depletions caused by post-compact pumping. There were some offsets but not complete offsets, so he was critical of the augmentation plans that had been approved in the intervening period. Year by year, the division engineer under the 1973 rules would allow certain groups, if they submitted a plan, to pump seven days a week -- and there was augmentation, but not total augmentation.

One of the more limiting determinations of the Special Master was that the 700 existing pre-compact wells could not pump unlimited with respect to the compact. His finding was that in the period just prior to the signing of the compact the pumping averaged about 15,000 af per year. Colorado had argued that it could have been as much as 40,000 af per year in dry years, and that it should be allowed to pump what was necessary based upon the decree of the pre-compact well. The Master put an annual limit not to exceed 15,000 af on those 700 wells, and so one of the responsibilities under the new rules is how to allocate the 15,000 af to those 700 pre-compact wells.

You heard from Jim Lochhead just before lunch about the Arkansas River Coordinating Committee and how important it was in bringing together all the diverse interests of the valley. I want to say briefly that the committee was, in my opinion, a real success, because the water users, after about three or four months of sparring, sat down around the table and for the next six or eight months worked hard on helping develop workable rules and regulations, helping to find solutions on where we could find augmentation water, and generally working together in a manner I hadn't seen in the Arkansas River Basin in the past. It is the leadership of those 30 individuals who were

willing to meet monthly without compensation, some of them driving from near Leadville to Lamar at times just to be public servants, that I think can be credited for the success we had thus far.

I want to take a few minutes to talk about the new rules to let you get a flavor of what we are trying to accomplish, our time lines, and where we are right now. There are two key points that I want you to really understand about these new rules. One is to bring about compact compliance. David Robbins indicated to you that we have no choice. It is the law of the State of Colorado and it is the law of the federal government. It is a compact. We have been found to be in violation, by primarily the pumping of 1500 post-compact wells.

The second issue, which I think is just as important, is that we have about 2000 wells total -- 2200, since some of them are not always pumping in a given year, that also affect senior surface water rights in Colorado. As I indicated, Mr. Kuiper in 1973 started down a path to bring the pumping by junior wells under control and require augmentation. He was not successful, but we cannot overlook all the information we have developed through the investigations related to the litigation with Kansas.

The modeling studies clearly show that when you pump wells in Colorado the primary party affected is the senior surface-water user in Colorado, much more so than any benefit to Kansas under the 1948 compact. You can't overlook that affect, and you can't do rule making, in my opinion, just dealing with the state line or compact issue. They are so intertwined that you have to deal with them together at one time, so the new rules that were filed with the water court in September of 1995 in fact deal with both. I will try to walk through some of the key parts of those rules with you so can understand how we are attempting to bring about compact compliance and also deal with the issue of protection of senior vested water rights in Colorado.

I would like to talk about the scope of these rules. What do they cover and what do they not cover? It is very clear that you understand that they are not totally comprehensive, covering every well in the Arkansas River Basin. They deal first of all with pumping of tributary groundwater, so there are certain types of other groundwater that are not affected, and I will talk about those.

First is wells that divert non-tributary groundwater. They are either decreed or permitted to be pumping non-tributary groundwater. Certain designated groundwater basins exist in the Arkansas River Basin -- the Southern High Plains designated basin, the Upper Big Sandy designated basin, and the Upper Black Squirrel designated basin. Groundwater in these basins is not hydraulically connected to the Arkansas River in any significant way. They are under the jurisdiction of the Colorado Groundwater Commission. Wells in these areas are not subject to these rules.

Certain small-capacity wells for domestic stock watering are exempted from administration in 37-92-602 of the statutes.

Any wells that fall under what we call the "exempt wells" under 602 are not subject to these rules. Certain wells in the Denver Basin aquifers operate under rules promulgated in 1985, and as such they operate outside of the proposed new rules. They pump basically nontributary or not nontributary groundwater from the Arapaho, Laramie Fox Hills, Denver or Dawson aquifers.

Finally, we allowed two other aquifers not to be included in these rules -- the Cheyenne and Dakota aquifers. They are located in the eastern part of the basin and used primarily for domestic supply. The connection with the Arkansas River is very indirect, and so we felt we didn't have the information at this time to include those aquifers in these rules. A number of rural water associations in the La Junta, Lamar, Las Animas area use these aquifers because of the quality. They are not subject to these rules. If you represent any of those areas, I want to make clear that if you have a Cheyenne or Dakota well you are not subject to the new rules.

The rules are numbered 1 through about 18, and I want to talk about three that are the key components -- rules 3, 4 and 5.

Rule 3 deals with the compact issue. How do we bring about compact compliance and stop depletions to usable state line flow? They have a geographic area that is very specific. It is the area that was modeled and studied in the litigation with Kansas, and it covers the valley fill and surficial aquifers between Pueblo and the state line. It involves post-compact irrigation well pumping, and basically the rule says that after April 1 of 1996 these wells cannot pump any longer, or in the alternative they can pump if they operate pursuant to a plan approved by the state and division engineers whereby depletions to usable state line flow are replaced.

Rule 3 also talks about how we allocate that 15,000 af of pre-compact pumping to the 700 or so wells that are pre-compact in nature. The rule clearly sets forth a procedure. We have published a table indicating how much each of those wells would be entitled to pump in the future with respect to the pre-compact pumping allowance. Copies are available through Steve Witte, the division engineer.

The rule uses the Kansas hydrologic institutional model to determine how well we did in replacing depletions to the usable state line flow. That is the tool we are using in the litigation with Kansas that the Master has endorsed. After the end of a year, when all the information is available, the model will be run to determine if the offsets made available by the various groundwater entities in fact did offset depletions to usable state line flow. If for some reason it did not, the shortage would be allocated among the wells on some basis of amount pumped, consumptive use, distance from the stream -- it is all spelled out in the rule. If there is a shortfall, we have to allocate the obligation to replace it, and Rule 3 deals with that.

Rule 4 gets into protection of the senior surface water rights in Colorado. Rule 4 has a very specific geographic area. It is the valley fill and surficial aquifer between Pueblo and the state

line as well as the alluvium of Fountain Creek and the alluvium of the Arkansas River between Pueblo and Pueblo dam. This additional area was not modeled in the studies by either Kansas or Colorado, so we expanded the area slightly. In this area all wells, regardless of whether they are irrigation, municipal, commercial or industrial, will not be allowed to pump after April 1, 1996 unless they operate pursuant to a plan approved by the state and division engineer that replaces out-of-priority depletions to senior vested water rights in Colorado. The focus is in Colorado, so if the Catlin Canal is calling, for instance, the plan would have to show that the wells above that can replace their depletions to the Catlin call - or the Fort Lyon call, or the Amity call. It is very important that we start dealing with how we protect our senior surface water rights in Colorado.

Rule 4 further establishes a presumptive depletion to simplify the process for determining depletions. Based upon the investigations and the litigation with Kansas, we have sufficient information to determine what depletions are related to certain types of irrigation applications. If it is a supplemental source of supply, if the well water is used on land that is also irrigated with surface water and the method of application is flood or furrow, the rule says the depletions are 30 percent of the amount pumped. If it is applied on land that receives no other surface water supply, a sole source and the method of application is flood or furrow, the rule indicates that the depletion is 50 percent of the amount pumped. And finally, if it is sprinkler irrigation, the amount of depletion is 75 percent. The rules set these presumptive depletions. They were negotiated over the last several months prior to the filing of the rules, and one of the key issues was to reach agreement on what those presumptive depletions should be.

Rule 5, then, covers the rest of the basin, the area outside what we call the valley fill and surficial aquifer and Fountain Creek alluvium. Everywhere else in the basin a well subject to these rules, pumping tributary groundwater, either must stop pumping on April 1, 1996 or operate pursuant to a plan approved by the state and division engineer whereby out-of-priority depletions to affected senior surface water rights are replaced.

Discussing briefly some of the other rules in the whole set of rules that were filed with the water court -- Rule 11 allows a phase-in in certain respects. Beginning in 1996, we will not phase in replacement of depletions to usable state line flow. All depletions to usable state line flow must be replaced in a plan approved by my office. We are going to bring about compact compliance beginning in 1996. With respect to replacement of depletions to senior surface water rights, we do phase that in over two years, because it is a larger amount of water to acquire and it will take longer to develop replacement resources. In 1996, 60 percent of the out-of-priority depletions must be replaced. In 1997, all out-of-priority depletions must be replaced.

Rule 12 deals with how we get pumping estimates. All of these rules are driven by how much you pump and applying certain depletions to them. In 1994 I promulgated rules

requiring that all well owners report the amount pumped on an annual basis but providing monthly values. They must be submitted by the end of January following the water year. Those rules allow that the well owner can install a totalizing flow meter or, if the conditions are appropriate, could utilize a power consumption or power conversion coefficient to estimate the volume pumped based upon a test performed by a certified tester. Rule 12 requires that this information be provided on a monthly basis. It will go to the division engineer who would then utilize certain computer programs that we are developing to estimate the depletions as near as possible to the end of the previous month so we can get a handle on depletions, when they occur, and require that replacement water be made available to either the affected senior surface water rights or to the state line.

Rule 14 requires that an annual operating plan be submitted prior to April 1, 1996 and March 1, 1997 and thereafter. That plan must be approved prior to any pumping in that irrigation season. The sooner the plan can be submitted the better. We are working closely with the water users for the 1996 year so that we can have as much input and review of their plan as possible prior to April 1.

What is the current status of the rules? You may be wondering where we are. As Jim Lochhead indicated, there were 18 different protests filed by the end of the protest period, the end of November. Some actually were in support. Individual well owners involved in protesting the rules who are opposed to them probably number less than 20 wells out of possibly 4,000 affected wells throughout the entire Arkansas River basin. That is encouraging to me. It indicates that most of the water users and well owners understand what we are up against and that this is not a matter in which we have a lot of discretion on how we bring about compact compliance. As David Robbins indicated, he doesn't understand the arguments behind some of the takings issues, and we will have to let those be litigated before the water court.

The Special Master is watching us closely. I want to emphasize that point as part of my conclusion. I testified at the end of October and in early November in Pasadena last year about what Colorado was doing to come into compact compliance. I submitted a report to the State of Kansas and to the Special Master which was used to tell him where we were at that time. He made it very clear that he will continue to monitor what we try to accomplish within the next few months.

I must testify in a hearing in March on where we are, how many protests we have had, the results of hearings by March,

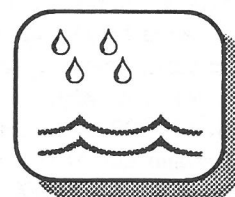
and what some of the augmentation entities are doing to bring about replacement of usable state line flows or augmentation of the river in Colorado. He further set a hearing in June giving Kansas the opportunity to then indicate their disagreements with where Colorado is going with respect to coming into compact compliance. I think he has made it clear that he will give Colorado every opportunity to take control of the situation and deal with it within Colorado. I think he recognizes that is the best way. We must, though, make sure that we are really and truly complying with the compact.

... most of the water users and well owners understand what we are up against and that this is not a matter in which we have a lot of discretion on how we bring about compact compliance... The Special Master is watching us closely.

The Special Master also made it very clear to me that if we fail, he will not hesitate to take control of the situation. As David indicated, we could end up with a Federal River Master in control of the river, and that is not desirable. We have three federal reservoirs in this basin -- Pueblo Reservoir, Trinidad Reservoir and John Martin Reservoir -- and they could be utilized by federal entities to bring

about compact compliance. I don't think we want that. In the alternative, he could issue an order to enjoin all post-compact pumping in Colorado, which is what Kansas sought in 1995, and he told them he would not do that. He wanted to see what Colorado was attempting to accomplish before he would enjoin or curtail pumping in Colorado.

My opinion is, Colorado is taking significant steps to deal with the issue. We are working on important legislation that would provide funding to acquire permanent augmentation water and provide resources to my office to enforce the new rules. We will need about nine additional staff in the field and in the Pueblo Office to properly enforce these rules. The key to success is proper enforcement, so that those who elect to ignore the rules can be brought before the water judge quickly so we can make it clear that we cannot allow people to ignore this important issue. I think the water users and the groundwater entities have made significant progress in developing cooperative plans to deal with the issue. Within a matter of months, Colorado should be in a position to fully replace depletions to usable state line flow in 1996, and will have made a significant step toward replacing depletions to senior vested water rights in Colorado.



HOW MUCH DO WE HAVE AND WHO OWNS IT?

**Steve Witte, Division Engineer
Colorado Division of Water Resources**

How much water do we have, and who owns it? I wish that these relatively simply questions had relatively simple answers. An exacting quantification of how much water there is within the Arkansas River Basin is complicated by missing or highly variable data; timing and location; shared use of a commonly owned resource which can lead to double accounting; priority; operational decisions; and I'm sure there are several other factors.

To illustrate that, anyone who has any experience dealing with water realizes that the water supply can be extremely variable from one year to the next -- witness last year compared to the year before that -- and it also can vary within the same season. Last year at this time we thought we were headed toward a pretty sorry year. Then, late in the Spring Mother Nature turned all that around and we had a very abundant year.

There is always more water available in downstream reaches. For example, there is always more water available in Canyon City than in Leadville, because at that location the Arkansas River has been swelled by a number of tributaries. Regarding double accounting, consider that the water that enhances someone's picnic experience up in the national forest may be the same water that provides for someone else's rafting recreational experience; it may provide someone in Pueblo with a shower; it may irrigate melons in Rocky Ford, and it may also contribute to usable state line flow. So how do you account for that water?

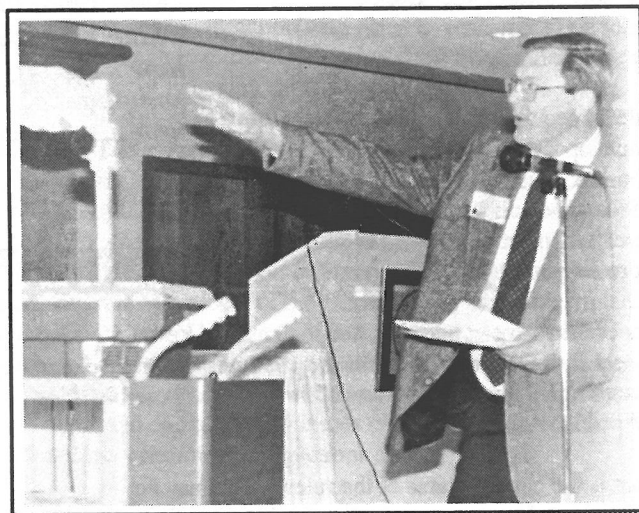
The amount of water that is in the river at any particular location and time, that is available for any particular use, may be subject to Colorado's allocation system which is based on priority of appropriation. Or, it may be the result of someone's operational decision, such as when the owner of a reservoir directs the release of water previously appropriated into the stream system for subsequent use.

Looking at some long-term average stream flows can begin to give one a sense of the net effect of some of these variables on water supply and smooth out the timing consideration by looking at a broader expanse of time.

Figure 1 illustrates how the water supply varies at different locations in relation to the contributing watersheds and the regions of most intensive use. What is shown here are average historical stream flows at various locations. Near Leadville, the number is 278,000 acre-feet (af). I assume this location (further downstream) represents the Portland gage above Pueblo reservoir, where the average annual stream flow is roughly 527,000 af. Contribution of the Fountain is 53,000 af; the Huerfano 28,000 af; the Apishapa 20,000 af; and the Purgatoire roughly 47,000 af. But by the time one gets down

to this location (near John Martin Reservoir), the supply has been reduced to 76,000 af and the outflow at the state line is about 142,000 af.

Figure 1 also gives a sense of how the Arkansas compares in its historical yield to some of the other major river basins in the state. In the South Platte, for example, the high is on the order of 880,000 af, and that has reduced by the time it exits the state to 387,000 af, which is considerably more than the



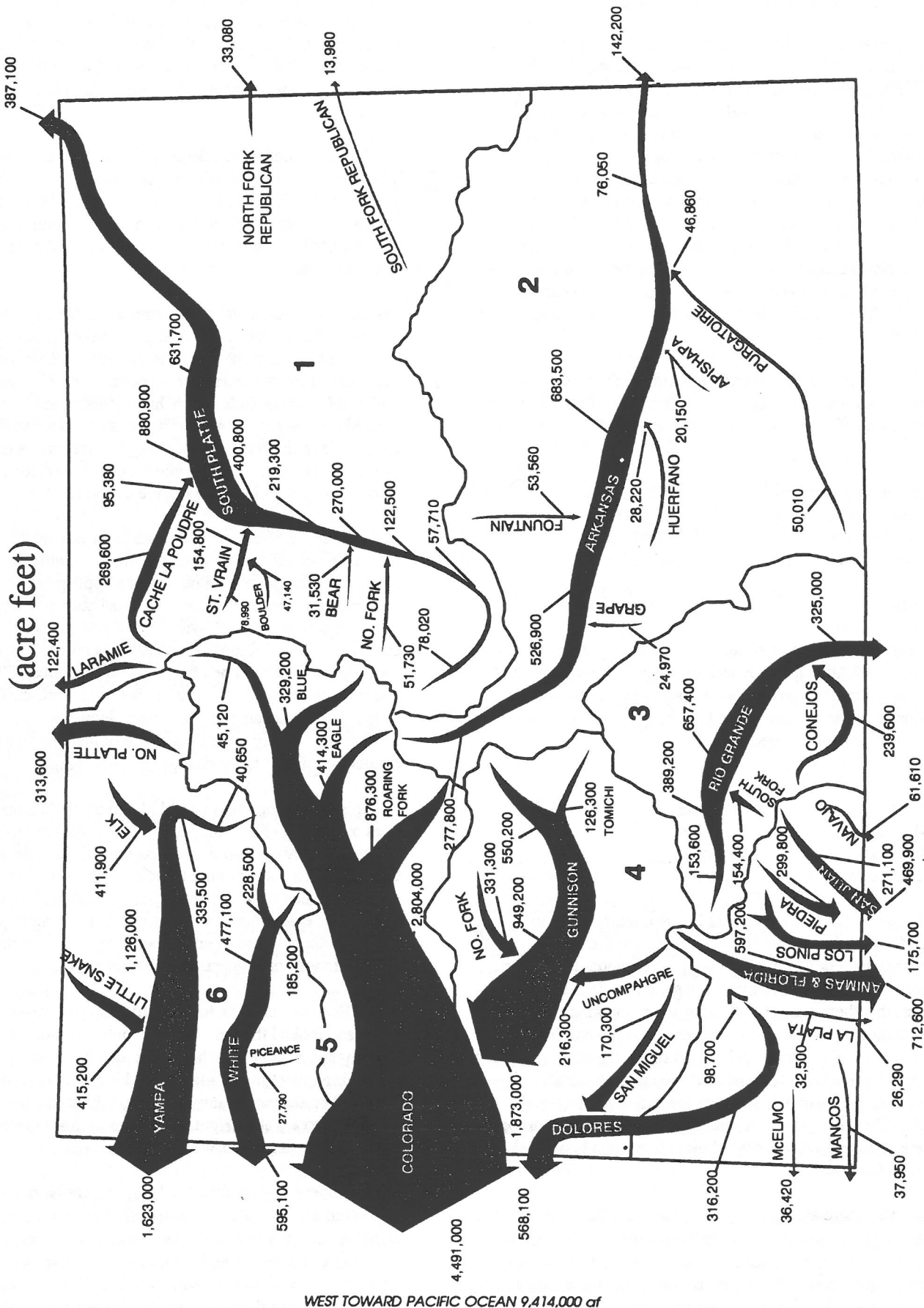
Steve Witte, Division 2 Water Engineer. Photo by Karen L. Stewart, Arkansas Valley Journal.

overflow from the Arkansas Basin. The Rio Grande outflow averages about 325,000 af. On the West Slope, you can see without looking at the numbers and just looking at the relative size of the arrows that this is where the real water is in this state.

It should be remembered that these are stream flow figures and will include both transmountain and native components. By summing the average annual stream flow measurements over a period of time for selected gaging stations, one can estimate the average total basin inflow. By doing that for the period 1980 through 1994, I came up with a number of about 875,000 af. Deducting from that the average total transmountain imports over the same period of time (125,000 af known because of independent measurements of water brought into the Arkansas River Basin), I arrived at an average total native inflow of about 750,000 af for the period. One published report that I am aware of has placed this undepleted average annual native supply at 875,000 af, and that is just the native component alone. So, as you can see there can be tremendous variations just by using different time periods, and I suspect

EAST TOWARD ATLANTIC OCEAN 1,337,000 af

FIGURE 1. COLORADO
HISTORIC AVERAGE ANNUAL STREAM FLOWS



Prepared by the Hydrographic Branch (1995)
Historic averages obtained from USGS Water-Data Report CO-93

TOTAL LEAVING COLORADO 10,751,000 af

OFFICE OF THE STATE ENGINEER
COLORADO DIVISION OF WATER RESOURCES

that this report also attempted to estimate the depletions upstream of some of these gaged locations.

During the '80 to '94 time period, transmountain imports constituted about 14 percent of the total water supply. The largest of these transmountain diversions was the Boostead Tunnel, which is the Fryingpan-Arkansas Project delivery structure and which averages about 55,000 af. According to the USGS, the total basin outflow average for the period 1951 to 1994 was approximately 142,000 af, so that agrees very well with Figure 1. However, it does not include the outflows from the state carried through the Frontier Ditch, which is a ditch that diverts in Colorado but provides water to users in Kansas. Nevertheless, even recognizing some of the short coming in this data, it is evident that a significant portion of the physically available water supply in Colorado is used in Colorado.

Next, I would like to briefly examine some information that we have pulled out of recent diversion records. The following are diversions of native water for 1992 and 1993 by use type:

Irrigation diversions	1.5 million af
Native municipal use	630,000 af
Industrial use	93,000 af
All other uses	142,000 af
Total	1.848 million af

If you adjust those figures by an assumed 150,00 af for pumping of tributary groundwater for irrigation purposes, that is the long-term average estimate of pumping. Then, the diversions as a percentage of the total native diversions for each of those categories become:

Irrigation	85 percent
Municipal	3 percent
Industrial	5 percent
All other uses	7 percent

I would like to point out that what I have cited pertains to recorded native diversions and then I adjusted for some unrecorded diversions for which we have reasonably reliable estimates of tributary pumping. One must bear in mind, however, that there are other uses for water for which we do not maintain any diversion records per se. An example is the Colorado Water Conservation Board's minimum stream flow rights, numbering over 120 and scattered throughout the Arkansas River Basin, which range from .5 cubic-feet-per-second (cfs) to over 20 cfs. Generally these are thought to be nonconsumptive uses, but nevertheless they are a beneficial use within Colorado.

Additionally, there are other types of uses for which we do not maintain diversion records. For example, many exempt-type wells (stock-water wells, domestic house wells, and the like) that are not reflected in those figures. Some of you are saying, "Hey, wait a minute. Didn't he just say that the total average

native basin supply was something like 750,000 acre-feet, and in those two years the total diversions were on the order of 1.85 million? Something just doesn't add up." Well that is exactly right. This is one of those cases where the sum of the parts is indeed greater than the whole. I think this is the basis for the old adage, "One man's return flow is another man's water right."

I'm still not sure I have adequately answered the question of who owns it. The idea of ownership fascinates me. Yesterday you heard David Robbins articulately outline how Colorado's ownership of water has to be viewed from within the context of Colorado's entitlement to use water under the Arkansas River compact.

I believe there are also some common misconceptions regarding the nature of ownership of water rights. The Colorado Constitution, Article XVI, section 5, provides that the water of every natural stream not heretofore appropriated within the State of Colorado is hereby dedicated to be the property of the public, and the same is dedicated to the use of the people of the state, subject to appropriation, as hereinafter provided. Section 6 of the same article goes on to say that priority of appropriation shall give the better right.

The process of determining a water right is established by statute through the water courts, and ownership of water rights is vested at that point in time with the appropriator. Furthermore, statute provides that in all conveyance of water rights, except where the ownership of stock in a ditch company or other companies constitutes ownership, that the same formalities shall be observed and complied with as in the conveyance of real estate. So, in theory at least, the title to ownership is traceable through time. However, often in practice this is very difficult because of inattention to the details evidencing those changes of ownership.

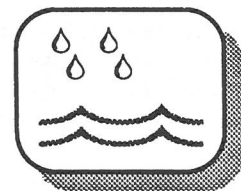
The misconception that I would like to try to address is, "What does ownership of a water right mean?" We tend to think of our rights of ownership in real property in absolute terms. But they really are not -- zoning laws, covenants, all have an effect on what we can do with property or real estate that we may own, to the extent that our preferred use may impinge on the rights of others to use or enjoy their property. Similarly, there are restrictions on ownerships of water rights.

David Robbins used the term usufructuary yesterday. I went home and looked that up. Webster defines usufructuary as the right to utilize and enjoy the profits and advantages of something belonging to another, so long as the property is not damaged or altered. In simpler terms, I think that the rules pertaining to a water right are similar to those that applied to the use of the family car when you were a kid.

What happened if you failed to bring the car home at the appointed time when Dad needed it? Your use was curtailed, right? That's priority - Dad had priority. What happened if you totaled the car through recklessness? Your use undoubtedly would have been curtailed. Why? Waste of a commonly or jointly held resource. Suppose you told the folks

that you were going to take the car six blocks to the Malt Shop, you left with a full tank of gas, and returned with it empty. Might there have been some inquiry into your expanded use? Might there have been some future restriction on your use of the resource? Well, Colorado Courts have long held these same kinds of waste and expanded use are implied in every water right.

I hope that I have helped refine some of your thinking regarding the nature of ownership of water rights. It is extremely important to have a right understanding to promote the maximum beneficial use of the waters that we have.



MAINTAINING WATER QUALITY

Brad Austin, Program Manager
Agricultural Chemical Program, Colorado Department of Health

As part of a state program authorized by Senate Bill 90-126, we have been collecting groundwater quality data around the state for the last four years. I work with the Colorado Department of Agriculture to collect this data, which we use to see if fertilizer, nitrates and pesticides are getting into the groundwater. We look at groundwater all over the state, and the Arkansas River was the third area that we have intensively sampled -- in 1994 with a follow up in 1995.

I collected 139 samples from 139 wells starting at the state line and working upstream almost to Pueblo. In previous studies we have used exclusively domestic wells, but here in the Arkansas there were not enough domestic wells to give the coverage I needed. As a result, the Arkansas study consists of a mixture of irrigation, domestic wells, and stock wells -- probably about 50 percent irrigation wells. Due to the high mineral content, most people do not drill wells into the shallow, alluvial aquifer for a domestic supply.

The alluvial aquifer is a shallow, sand gravel deposit along the river rarely more than just a few miles wide with some exceptions as it goes up tributaries. Depth of groundwater is anywhere from near the surface to a few tens of feet below. This is the aquifer on which we concentrated in the Arkansas study, as it is the aquifer that is most susceptible to contamination from the surface.

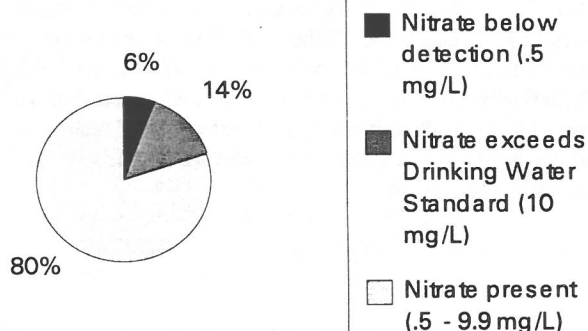
Our analysis of samples was quite extensive. We were trying to establish a baseline. No one had sampled the Arkansas groundwater quality this extensively in over 25 years, so we analyzed for everything we could possibly afford. The inorganic analyses were done at the CSU Soil and Water Laboratory in Fort Collins.

Total dissolved solids (TDS) is probably the largest and best-known problem with the groundwater in the Arkansas. Seventy-five percent of the samples had a TDS higher than 1500 mg/l. Five-hundred would be a recommended limit for drinking water, and even the minimum is close to that. Of all the minerals that combine to determine TDS, sulfate represents about one-half in the Arkansas samples. Sulfate is the dominant mineral component that makes what local people refer to as "hard" water. This is a function of the geology in the valley and also the water use.

One of the major inorganic chemicals that we look for,

because of its human health impact, is nitrate. In the pie chart, I have summarized the survey results for nitrate. You can see that only six percent of the wells had no nitrate detected. The detection level was .5 parts per million (ppm) or milligrams per liter (mg/l). In the bulk of the data, 80 percent falls in the range where we detected nitrate in the sample, but fortunately it was below the drinking water standard of 10. We use the drinking water standard as a benchmark because the alluvial aquifer is used as a drinking water supply throughout its entire

**Nitrate levels in ground water
 Lower Arkansas Valley 1994**



length, although several of the wells we sampled were irrigation and stock wells. Fourteen percent of the wells exceeded the drinking water standard of 10 mg/l, and with the exception of one, the majority of that exceedance is in the 10 to 20 range. We are over the standard with that 14 percent, but we are not way over -- up to about double it.

The majority of the aquifer area, like the majority of the samples, falls in the range of above-detection level but below the drinking water standard. The nitrate contamination is widespread throughout the aquifer, but currently at low levels. The samples that have exceeded drinking water standards tend to be only in a few isolated spots.

Pesticides are a big part of our work and a major concern for us because of their toxicity. There are quite a lot of pesticides used in this valley because of the agriculture, and some are known to make their way into groundwater. The pesticides that we analyze for are listed below. The analysis is done at a

laboratory at the Colorado Department of Agriculture in Denver. When we talk about pesticide levels, we are talking about micrograms per liter, or parts per billion (ppb).

In the pesticide analysis for all 139 wells, I found only three pesticides, and two of those I found in only one well -- Metolachlor and 2,4-d. The only pesticide that I found to be widespread, in more than one well, was the herbicide Atrazine. This is not surprising, because Atrazine is a very persistent pesticide, highly mobile, and once it gets in the groundwater it tends to stay there.

Although I found it spread throughout a large area in 12 samples, I never found it above a trace level. Trace level means that a chemist positively can identify Atrazine in the sample, but there is not enough present that he can quantify it with a number. This means, for our survey, that the level of Atrazine did not go above .5 P.B. -- a very low levels. That is good news for the Arkansas River. The Environmental Protection Agency considers the maximum allowable level for Atrazine in drinking water to be 3 P.B., and in these samples it never exceeded .5. The wells with the Atrazine tended to concentrate in Bent and western Prowers County.

This data was collected from June to November, 1994, and in 1995 I went back to the Arkansas to do some confirmation sampling. I resampled all the wells that had nitrate levels greater than 10. I have compared the 1994 versus 1995 level. Statistically, the two surveys were the same, and that was good news for us because it confirmed that our field technique and laboratory methods were correct and we had done a good job the first time around.



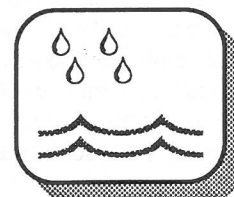
From left: Brad Austin with Don Magnuson, Cache la Poudre Irrigating and Marke Rude, Kansas Water Commission. Photo by Karen L. Stewart, Arkansas Valley Journal.

I also went back and resampled all of the wells where a pesticide was detected, and this time only Atrazine came up. The well with the Metolachlor and 2,4-d didn't show up the second time around, and since that was only a trace level, it is not surprising that it might have disappeared. The range of values went anywhere from .12 P.B. up to one well that had 4.2. That one really shot up and went over the MCL for Atrazine. We will track that one in the future.

In the coming year we will be working along the Front Range, particularly concentrating on some of the urban areas, to see if pesticide and fertilizer use in the urban environment is causing groundwater contamination.

ARKANSAS VALLEY AQUIFER - List of Analytes -- Pesticide Compounds

Name	Use	Name	Use
Alachlor	Herb	2,4-D	Herb
Atrazine	Herb	Dicamba	Herb
Benfluralin	Herb	MCP	Herb
Chlorpyrifos	Insect	MCPA	Herb
Chlorthalonil	Fung		
Cyanazine	Herb	Aldicarb	Insect
DDT	Insect	Aldicarb Sulfone	Insect
Endrin	Insect	Aldicarb Sulfoxide	Insect
Heptachlor	Insect	Baygon	Insect
Heptachlor Epoxide	Insect	Carbaryl	Insect
Lindane	Insect	Carbofuran	Insect
Methoxychlor	Insect	3-Hydroxycarbofuran	Insect
Metolachlor	Herb	Methiocarb	Insect
Metribuzin	Herb	Methomyl	Insect
Trifluralin	Herb	Oxamyl	Insect
Hexazinone	Herb		



OVERVIEW – THE FUTURE OF THE RIVER

*Ralph Adkins, President of the Board
Southeastern Colorado Water Conservancy District*

A River of Dreams and Realities -- I think that what you have heard the past two days makes it very clear that it is no longer a dream; it is the reality of what we face right now. The dreaming is over, the hard, dirty work is here, and time is of the essence.

valley as we work to solve our problems with the use of our water, both subsurface and surface. The plans that I will describe have resulted in the conservation and exchange of water among the states on the Lower Colorado River.

In 1993, Secretary Bruce Babbitt approved an arrangement between the Metropolitan Water District of California and the Central Arizona Water Conservation District. Many of you recall the bitter lawsuit between California and Arizona that wound up in the Supreme Court after many years of battling. Under the plan that they worked out, the Metropolitan District will pay Central Arizona to store its unused water in Arizona's underground aquifers. In return, Central Arizona will not divert its Colorado River entitlement in an amount approximately equal to what they have stored underground. Metropolitan will then divert Arizona's unused apportionment, at least until the time comes when Arizona will need that water.

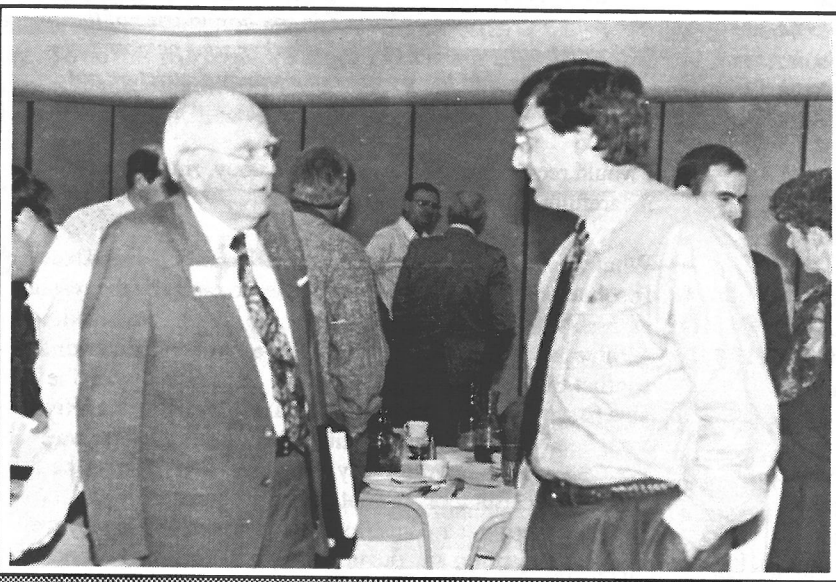
Interestingly, California has a statute that allows a user who conserves water to transfer that conserved water for use elsewhere. In 1989, Interior Secretary Mannie Lujan approved a plan whereby the Metropolitan District finances 16 conservation projects in the Imperial Irrigation District. In return, Metropolitan gets the use of 100,000 acre-feet (af) of conserved water for at least 35 years. Cities can afford to pay for such water where farmers cannot, so you can expect to

see cities doing more of this in the years ahead.

In Colorado, we have had at least two attempts in the Legislature with bills that have been introduced to do that very same thing. They both went down to defeat. Whether the changing complexion will result in a different approach we will have to wait to see.

Metropolitan Water District has a contract with the Palo Verde Irrigation District under which the farmers who enroll in the plan get a fixed payment for each acre placed in the plan and an extra payment per acre for every year that the plan is exercised. This plan is for 35 years and the farmers continue their irrigation except in the dry years. There has been some suggestion of that here in Colorado and in the valley, and I think it may be something that we will want to look at in the long pull. We may want to give some serious consideration to it in the years that lie ahead.

Water banking is not a new idea. The seven-party agreement of 1931 incorporated into every Secretarial contract with California water users provisions whereby the Metropolitan Water District, San Diego and Los Angeles could bank up to five million af of water saved by diversions reduced below



Ralph Adkins with Marke Rude, Kansas Water Commission. Photo by Karen L. Stewart, Arkansas Valley Journal.

Colorado has a history of conflict over water. When I was growing up in Las Animas, as a boy I can remember when two neighbors got into a fight over water and one of them hit the other in the head with a round-point shovel and killed him. Quite a few years later, there was an incident down on the Purgatoire when the water commissioner was out on the ditch bank with a farmer. Another fellow drove up, got out of his pickup with a gun, and started after the farmer. The water commissioner said at that point he went right over the riverbank without any hesitation. In the chase, the chassee was able to grab his gun and he shot the chasor.

Water has been a matter of many conflicts not just in Colorado but all over the West. I hope that we today have outgrown that. Many of the contests have been resolved by compacts. Colorado is a party to nine of them. We are probably the greatest compacted state in the Union with the Colorado River, the Upper Colorado River, the La Plata, the Animas-La Plata, the South Platte, the Rio Grande, the Republican, Costilla Creek, and of course, the Arkansas River.

As we look to the future, we might want to look at the past and see what happened there. Perhaps from what I shall share with you will come some ideas we may be able to use here in the

their entitlements. These contracts reserved to the United States the right to enter into the same kind of contracts in other states -- something to think about with our Reclamation projects here.

In 1933 the Metropolitan Water District and Nevada were at the Secretary's door with plans for banking and transfer of water. For various reasons those plans have been held in abeyance, and one of the reasons is that Arizona came completely unwound when they heard what California and Nevada were thinking about doing and asking for the Secretary's blessing to do. Keep in mind that the Lower Basin States, particularly California and Arizona, have fought for years over the division of their share of the Colorado River, and Arizona did not sign the Colorado River Compact of 1922 until 1944.

Closer to home, we have the Roan Creek project of the Chevron Shale Oil Company and Getty Oil Company located at Debeque, some 24 miles above Grand Junction on the Colorado River. This project has priority dates that are senior to the Fryingpan project. Those water rights were originally secured for the oil shale industry. With the pullback in activity on oil shale development, the companies are looking for ways to protect their decrees against abandonment. One way is the Roan Creek Project, which would lease the water to Nevada in an amount up to 200,000 af for 30-50 years, after which it could be pulled back for use in Colorado.

This raises all kinds of questions: the export statute that we have in Colorado, compact entitlements -- it opens a whole Pandora's box of questions. Backers of the proposal are in court now with a diligence application, and it remains to be seen how that will come out. They are receiving a lot of opposition including the Southeast District, which takes a dim view of that. Many say, "Why worry? It will never come to pass." But let me remind you that a number of years ago people said that John Elliot was crazy to think that he could pull off the Homestake Project. Ask Aurora and Colorado Springs where some of their water is coming from today.

As many of you are aware, Ruedi Reservoir on the Fryingpan River above Basalt was built as a replacement storage facility to hold water that would allow us to divert to Eastern Colorado when there was a Western Colorado call on the river. This structure was built to hold 100,000 af, with up to 28,000 af for East Slope diversion. The Bureau of Reclamation is now involved in the round two water sales selling the remaining uncommitted water in Ruedi. The Fish and Wildlife Service wants it all for fish, including the water that is committed to us. We are monitoring these actions very carefully to always be certain that our rights are preserved. Eternal vigilance is the price of safety, and nowhere is it more true than for our West Slope decrees.

There is also a 15-mile reach on the Colorado River between Palisade and Debeque where the Fish and Wildlife Service is demanding flows adequate to protect the endangered fish. Ten-thousand af of Ruedi storage has already been committed to the reach, with a second 10,000 af to be available on call. That is one more place where we must protect our rights in the

days ahead, and will explain in part why the Southeastern Water Conservancy District legal costs are as high as they are.

The coming proposed constitutional amendment, which we have mentioned, states:

...every director of a water conservancy district shall be elected in a nonpartisan election by a majority of the eligible electors who vote thereon. An eligible elector is one who is otherwise eligible to vote under the laws of this State and who has been a resident of the water conservancy district for not less than 30 days, or who, or whose spouse, owns taxable, real or personal property situated in the boundaries of the water conservancy district whether said person resides within the water conservancy district or not.

I would recommend that you all get a copy, and when you read it carefully you will realize its impact.

What we now face in the Arkansas River in Colorado is the absolute need to work closely together to abide by the results of the Colorado/Kansas lawsuit and the coming rules and regulations that exist as a result. We cannot afford the kind of conflict that we have had in the past. I can recall when the idea first surfaced of having a park along the Arkansas River from Leadville to Pueblo. Quite a few of us said, "No way." We were not about to lose any of our Fry-Ark water to the fish and boaters. But look at what sitting around a table and honestly sharing our concerns has accomplished. Today we are living together, and the upper river has a strong economy built on rafting and boating as well as fishing.

Rest assured that Kansas, having won, will give no quarter in the days ahead as final decisions are made in the lawsuit. Witness the fact that Kansas asked the court for injunctions to stop all pumping until the case is settled. We must work together to bring about the best use of our water with the least injury to our towns and farmers who will be hurt. Some farmers will have to curtail their acreages and some will be forced out of business before this is over. That is a hard fact of life that we may have to face.

In an attempt to make the best of the situation, the Colorado Well Protective Development Association, the Arkansas Groundwater Users Association, and the Lower Arkansas Water Management Association have been formed and are working to solve the problems. CWPDA and AGUA have signed a merger agreement to form one entity above John Martin. They will work with the Southeast District to allocate the District's return flow water and find other water that can be used to make up the consumptive portion of the pumped water.

For a while, at least, it is expected that Pueblo and Colorado Springs will be able to provide some of the make-up water from their surpluses. Over time, as the cities grow, this water gradually will be withdrawn and other means of meeting the need will have to be found. There is some time in this area in

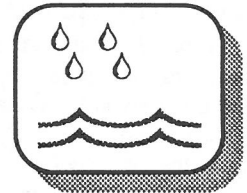
which to make the necessary replacements, and it is here that the valley must work together in the closest fashion to meet the needs of our water users.

The same is true of Lawma, located below John Martin Reservoir. It is moving aggressively toward the goal of meeting the usable state line flow requirements, and I think doing a fine job in that direction.

We have come a long way, and I think the Arkansas River Coordinating Committee was a tremendous move in the right direction to bring us together here in the valley to look at the common problems that we face. It will continue to be of help in the days ahead. We can, working together, solve our problems with the least possible hurt to the economy of the valley. To do this will require a much more comprehensive level of administering water rights in the valley. Every well and every headgate will have to be known to the

water officials, and it is at that point that I think we have our greatest concern. The key to this whole plan to meet our usable state line flow requirements will be the administration of the rules and regulations. We must have the cooperation of every pumper in the valley as well as the surface people if we are going to accomplish this. It is good to know that the power companies have indicated a willingness to make the pump records available, which will greatly assist in the administration process.

Time is of the essence, and I urge that all of us move as rapidly as possible to solve these problems so we give no opportunity for Kansas or Judge Littleworth to even think about placing a federal river master on the Arkansas River. We must continue to guide our own destiny.



WATER RESEARCH



MANAGEMENT OPTIONS FOR IRRIGATION DISTRICTS AND MUTUAL IRRIGATION COMPANIES

The overall goal of the research is to identify strategies that will maintain the economic and managerial viability of irrigation districts and mutual irrigation companies, while at the same time addressing new environmental concerns.

An interdisciplinary research group at Colorado State University has received funding to study past and present institutional constraints and management innovations in approximately 100 irrigation enterprises (IEs) throughout the West. The project will include specifically *irrigation districts and mutual irrigation companies* (ditch companies) providing water to service areas in the range of 10,000 to 100,000 acres.

The researchers will track the "life histories" of these 100 organizations from 1900 to the present (an historical trends analysis) on a number of key indicators. The sample of IEs selected will carefully represent legal traditions, water conditions, cropping patterns and changing county demographics throughout the region.

Irrigation enterprises of this nature still constitute the primary water management sector in the West, in terms of the amount of water managed. Their economic viability and ability to address changes in agriculture, natural resource management and urbanization are central to maintaining an adequate agricultural water supply. This viability and ability to address change is also central to new environmental objectives. Existing state agency databases, IE annual reports and minutes of meetings, census data, and both federal

and state archival materials will be used. These primary databases will be supplemented by individual and focus group interviews of present and past IE board members and officers. The project goals are to:

- address the issues of preserving and maintaining prime irrigated lands in the West;
- reduce conflict over land and water policy in the rural/urban community interface;
- identify institutional constraints that impact IE performance; and
- help IEs identify (and explore financing for) new and innovative management practices.

An interdisciplinary team of research scientists at Colorado State University will conduct the three-year project. John Wilkins-Wells, Department of Sociology, and Raymond L. Anderson, Department of Agricultural and Resource Economics, are the principal investigators.

Funding is provided by the U.S. Bureau of Reclamation's Research and Technology Development function.

NITROGEN IN PRECIPITATION THREATENS ECOSYSTEMS

Alpine watersheds in the Front Range of Colorado exhibit the symptoms of advanced stages of nitrogen saturation, and watersheds in other parts of the state appear to be in the early stages, researchers say. Don Campbell and Carol Kendall of the U.S. Geological Survey, Jill Baron of the National Biological Survey and Research Ecologist at Colorado State University, and Mark Williams of the University of Colorado reported on jointly conducted research in December.

Snow and rain in parts of the Rocky Mountains contain dissolved nitrate and ammonia in amounts that might affect pristine high-altitude ecosystems. Undisturbed watersheds in most areas are able to retain all of this nitrogen in biological processes, but in some alpine watersheds along the Continental Divide the capacity for uptake of nitrogen is being exceeded. This leads to a condition called "nitrogen saturation" in which nitrate is released into surface waters. The release increases the potential for acidification and eutrophication of lakes and streams.

Sources of nitrogen in snow and rain include emissions from automobiles and power plants, agriculture and natural sources. Atmospheric pollutants may be transported long distances from their source before being deposited in precipitation. Concentrations of nitrate and ammonia in snow and rain are high in northern Colorado relative to other parts of the Rocky Mountains, but not as high as in other areas of the country that exhibit nitrogen saturation, such as the northeastern US.

The monitoring and research were sponsored by the U.S. Geological Survey, the National Park Service, the National Biological Service, the Environmental Protection Agency, the USDA Forest Service, the National Science Foundation, and the State of Colorado. Because of reduced federal funding, monitoring has been discontinued in some sensitive areas. According to a USGS representative, "Progress is being made in understanding nitrogen cycling processes along the Front Range, but without the monitoring in other areas, we will not know if the problem is growing more widespread."

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

- Economic Research and Analysis of Funding for the Fish & Wildlife Conservation Act, William P. Spencer, Agricultural and Resource Economics. Sponsor: National Biological Survey.
- *Hydrological Forecasting System Evaluation, Lynn Johnson, Atmospheric Science. Sponsor: NOAA.
- Ecological Modeling in Support of County Decision Making (GIS), N. Thompson Hobbs, Natural Resource Ecology Lab. Sponsor: Colorado Division of Wildlife.
- Environmental Science and Technology Center (ESTC) - Development and Analysis, Freeman Smith, Earth Resources. Sponsor: National Biological Survey.
- Multinuclear Magnetic Resonance study of the Interactions of Pollutants with Major Soil..., Gary E. Maciel, Chemistry. Sponsor: Department of Energy.
- *Hydraulic Model Study of Rock Creek and Creste Dam Sediment Management, Albert Molinas, Civil Engineering. Sponsor: Pacific Gas & Electric Co.
- *Gas Phase Transport of Volatile Organic Compounds in the Vadose Zone, David McWhorter, Chemical and Bioresource Engr. Sponsor: University of Waterloo.
- *Research Workshop on the Hydrometeorology, Impacts and Management of Extreme Floods, Jose D. Salas, Civil Engr. Sponsor: National Science Foundation.
- *Distribution and Dynamics of Radionuclides in Ecosystems of the Savannah River Site, Floyd W. Whicker, Radiological Health Sciences. Sponsor: University of Georgia.
- Arkansas River Basin Research Study, John D. Stednick, Earth Resources. Sponsor: Colorado Division of Wildlife.
- Population Modeling, Gary C. White, Fishery and Wildlife Biology. Sponsor: Colorado Division of Wildlife.
- *Flaming Gorge Studies: Technical Integration and Synthesis, Robert T. Muth, Fishery & Wildlife Biology. Sponsor: Bureau of Reclamation (USBR).
- *Larval Fish Laboratory Involvement in Implementing Recovery Actions..., Robert T. Muth, Fishery & Wildlife Biology. Sponsor: USBR.
- *Effects of Winter and Spring Flows on Colorado Squawfish, Daniel W. Beyers, Fishery & Wildlife Biology. Sponsor: USBR.
- *Interdisciplinary Approaches to Identification & Mitigation of NPS Water Quality Impacts, John D. Stednick, Earth Resource. Sponsor: University of Wyoming.
- *Support for the Town of Vail Waste Characterization Study, Harry W. Edwards, Mechanical Engineering. Sponsor: Town of Vail.

***Stress Factors in Whirling Disease**, Eric P. Bergersen, Cooperative Fish & Wildlife Research. Sponsor: Colorado Division of Wildlife.

The University of Colorado, Boulder, CO 80309

Water Quality Model of Cascade Reservoir, Steven Chapra, Civil Engineering. Sponsor: Superconducting Core Tech. Inc.
South Platte Water Rights Management System – Maintenance Phase II, Jacquelyn Sullivan, CADSWES. Sponsor: State of Colorado.

The Yampa Basin as a Model for Watershed Problem Solving, David Getches, School of Law. Sponsor: CWRRI.

Urban Water Conservation – Current Status and New Process-Oriented Approach, James Heaney, Civil Engineering. Sponsor: CWRRI.

Biogeochemical and Hydrologic Controls on Solutes and Flowpaths in Alpine Watersheds, Mark Williams, Institute of Arctic and Alpine Research. Sponsor: National Science Foundation.

Generation of Level 3 SSMR and SSM/I Brightness Temperatures for the Period 1978-1998 and Development of a Snow Cover Extent and Depth Algorithm for Global Change Research, Richard Armstrong, Cooperative Institute for Research in Environmental Sciences. Sponsor: National Aeronautics and Space Administration (NASA).

***Determination and Applications of Satellite-Derived Atmospheric Water Characteristics in Oceanic Regions**, Judith Curry, Atmospheric and Oceanic Sciences. Sponsor: NASA.

***Continue Design and Development of the Power and Reservoir System Model (PRSYM)**, Edith Zagana, Civil Engineering (CADSWES). Sponsor: Electric Power Research Institute.

***Conceptual Planning for Integrated Analyses (Integral) of Water Resource Systems and Power Operations**, Edith Zagana. Sponsor: Tennessee Valley Authority.

***Potential Effects of Global Climate Change on Western River Basins Study**, Edith Zagana, Civil Engineering (CADSWES). Sponsor: USBR.

*Supplement to existing award.



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 stream flow, reservoir storage, and precipitation for the summer period (May-October). During the summer period stream flow 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 on July 1, 1995 and reflect conditions during the month of August.

<u>Basin</u>	<u>Jan. 1, 1996 SWSI Value</u>	<u>Change From Previous Mo.</u>	<u>Change From Previous Yr.</u>
South Platte	+2.9	0.0	+3.5
Arkansas	-0.5	-1.3	+0.2
Rio Grande	-3.5	+0.2	-5.5
Gunnison	-2.3	+0.54	-4.0
Colorado	+1.7	-0.6	+2.5
Yampa/White	-0.7	-2.4	+0.2
San Juan/Dolores	-2.7	+0.5	-4.3

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

UNIVERSITY WATER NEWS



SPOT INSPECTION OF FLUMES SHOWS AGING AND MAINTENANCE NEEDS

The Parshall flume is one of the most accurate and dependable open channel flow measurement instruments when properly installed and maintained. A recent spot assessment and inspection of flumes in the field, however, has indicated that inadequate maintenance can result in underestimating the amount of water the flumes convey. Data and observations collected during the assessment of 66 Parshall flume field sites across Colorado indicate that the flow measurement and monitoring network is aging and in need of maintenance and/or upgrading.

The Parshall flume was developed at Colorado State University nearly 70 years ago, and hundreds are placed throughout the state to ensure that water is allocated appropriately for agricultural use. Generally, they are constructed of concrete, metal or fiberglass materials for durability, and because of the material weight, long-term consolidation of the foundation soils may result in settlement of the flume. Other adverse influences include weather cycles of wet/dry-freeze/thaw-heat/cool, and vibrations from agricultural equipment. These adverse effects can result in inaccurate flow measurement information for users.

The field assessment found that the discharge measured by the majority of the Parshall flumes underestimates the true amount

of water conveyed through the ditch and/or lateral system. Thus, many water users receive more water than their appropriate allocation.

The assessment resulted in the following recommendations:

- A comprehensive study of flumes should be performed throughout the state.
- Water districts, irrigation districts and reservoir owners need a data base that describes the status of the water measurement system.
- A state water congress should be held to inform and/or alert water users of the system status.
- Alternatives should be devised for maintaining and/or upgrading the system.
- Cooperative Extension should implement an educational program to inform water users how they can adjust, maintain, replace, and/or repair Parshall flumes.

The field inspection of sample Parshall flumes across Colorado was undertaken by Professor Steven R. Abt and students of CSU's Civil Engineering Department with assistance from specialists of CSU's Cooperative Extension. It was funded by the Agricultural Experiment Station.

Summary of Measurement Errors

<u>Condition</u>	<u>% Observed</u>
Discharge Overestimated	42
Discharge Underestimated	58
Total Error Less Than 3%	39
Total Error Less Than 5%	59

*For information about the report, **Condition Assessment of Parshall Flumes in Colorado**, by Steven R. Abt, Bryan C. Ruth, Travis L. Brisendine, Cara M. Mitchell and Chad M. Lipscomb, contact Professor Abt at Phone 970/491-8203, FAX 970/491-8671, or e-mail abt@lance.colostate.edu.*

WET SPOTS ON THE WEB

Find Water-Related Information Quickly and Easily ***by Julie Eyre***

Since the last "Wet Spots" article, more water resources information has continued to become available. Some has been brought to our attention by the readers of *Colorado Water*, and some has been discovered by surfing the web. In any case, we have found several more pages that we think will be of interest to water professionals.

Government Information Available:

The U.S. Government Printing Office has made available

government documents through the world wide web, and dial-in access. The Congressional Record, Federal Register, and congressional bills are all available to search free of charge. Also available on the home page is information available through Federal Depository Libraries, and the ability to connect to the Consumer Information Catalog, which allows the public to order publications produced by numerous Federal Agencies. All of this information can be found at the following url:
http://www.access.gpo.gov/su_docs;

through telnet:

telnet to swais.access.gpo.gov; then login as guest;

or through dial-in:

call 202-512-1661; type swais and login as guest.

Water Conservation Districts:

The Southwest Water Conservation District has gone on line. Available on the home page is information about the history of the Southwest Water Conservation District, an excellent list of water terms and definitions, and water information for the Four Corners area. The url is located at:

<http://web.frontier.net/SCAN/wip/wiphome.html>.

Graduate Degree in Water Resources Science:

For those interested in a graduate degree in Water Resources Science, the University of Minnesota has created a home page with program requirements, application requirements, faculty, and curriculum. The url is located at:

<http://www.soils.agri.umn.edu/academics/gradstudies/wrs>

Colorado Water Resources Research Institute:

CWRRI has developed an on-site wastewater treatment homepage to give homeowners some ideas when central sewer is

not an option. Some of the articles contain information particular to Colorado, while others contain more general information. A list of links was also compiled that relate to on-site wastewater treatment. The url is located at:

<http://www.colostate.edu/Depts/CWRRI/onsite/home.html>.

Water Web:

This home page provides a large amount of water information quickly. It is designed to provide water users around the world with information regarding all water technology. The url is located at:

<http://www.waterweb.com/>.

International Association of Hydrological Sciences:

The International Association of Hydrological Sciences (IAHS) is the international nongovernmental organization which deals with hydrology and water resources. The IAHS has created a home page that contains information on IAHS statutes and bye-laws, newsletters, and lists of publications and conferences. The home page is still under construction, but stop by and check it out. The url is located at:

<http://www.wlu.ca/~wwwiahs/index.html>

COLORADO WATER KNOWLEDGE HOMEPAGE

by Julie Eyre

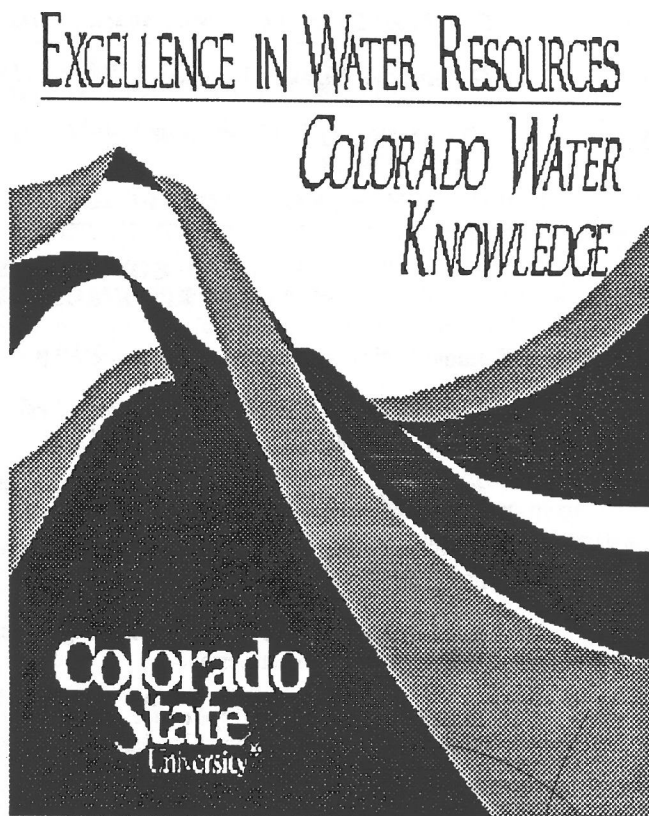
The joint efforts of twelve Colorado Commission on Higher Education (CCHE) undergraduate scholars and several departments at CSU have made the dream of creating a home page that provides basic water information in Colorado to the public a reality. The departments that have participated include the Department of Civil Engineering, the Department of Earth Resources, and the Department of Chemical and Bioresource Engineering. Topics covered on the home page include five sections: An Overview; Sources, Uses, Management, and Conservation; Aquatic Life, Wetlands, Water quality, and Environmental law; Water Administration; and Frequently Asked Questions.

The overview contains information on a variety of basic water concepts. A section is devoted to a summary of Colorado water history from prehistoric times to the present. A description of how geologic features influence the movement of water and distribution can also be found under the overview. Another section is devoted to Colorado's climate, including long-term temperature and precipitation patterns from six stations throughout the state.

The sources, uses, management and conservation section contains interesting maps and data, including a map of the river basin boundaries in Colorado. Links have been made available to water conservation sites. Water use, listed in categories and by the amount of water each category uses each year, can also be found in this section.

The aquatic life, wetlands, water quality and environmental law section has links to environmental sites and definitions of water-

(Colorado Water Knowledge as seen on the Worldwide Web)



related terms. Pictures and descriptions of aquatic organisms can be found. A description of wetlands in Colorado and links to EPA pages are available. Links to environmental law-related sites are also provided under this section.

The water administration section provides information to those interested in water law. There is a summary of Colorado water rights laws and information on how to obtain a water right. A map of the transmountain water diversions from the Colorado river basin to the Arkansas, South Platte, and Rio Grande river basins is provided, along with a description of the projects. Descriptions of water compacts Colorado has made with neighboring states is also provided.

The frequently asked questions section has three different areas of focus along with links to other pages with frequently asked water questions. The areas include water rights, water quality, and septic systems.

Also provided on the web page is a water fact of the week, and a place to send questions and comments. The information listed above is a brief summary of all the options available. Please take some time to check out this page. A lot of effort has gone into compiling all of the information. The Colorado Water Knowledge page can be found at:

<http://www.cnr.colostate.edu/CWK/index.html>

SEMINAR SERIES

COLORADO STATE UNIVERSITY SOIL AND CROP SCIENCES DEPARTMENT

Faculty/Graduate Student Seminar, Spring Semester, 1996, Thursday at 3:10-4:00 p.m., C146 Plant Sciences Building. Coffee and cookies at 2:45 p.m. in C146 Plant Sciences Building. Coordinator: Jim Quick, 970/491-6483.

- Mar. 1 *Ten Years Experience with Dryland Farming Systems* -- Gary Peterson/Dwayne Westfall
- Mar. 21 *Soil Organic Matter Changes in Intensively Cropped Systems* -- Rudy Bowman
- Mar. 28 *Busch Barley Breeding Program* -- Mike Bjarko
- Apr. 4 *Pedology and Biogeochemistry on the Island of Hawaii* -- Gene Kelly
- Apr. 11 *Solubility Controls of Fine-Textured Basaltic Lunar Simulants* -- James Oglesby
- Apr. 18 *Soil P Test Calibrations Using Spacial Variability of Landscapes* -- Rodrigo Ortega
- Apr. 25 *Genetic and Physical Mapping in Barley* -- Deana Namuth
- May 2 *Management of Irrigation Water and Nitrogen Fertilizer to Minimize Nitrate Leaching to the Groundwater* -- Chris Iremonger

COLORADO STATE UNIVERSITY NATURAL RESOURCE AND AGRICULTURAL ECONOMICS

Lunch time Seminar Series, Wednesdays, 12:10 to 1:10 p.m. 110 Animal Science Building.

- Feb. 28 *The Theory and Practice of Pollution Credit Trading in Water Quality Management* -- Jennie Hughes, CSU; Dana Hoag, CSU
- Mar. 27 *Historic Built Resources as an Example of the Double Public Good* -- Karin Sable, CSU
- Apr. 3 *How Important is the Contribution of Mineral Production on National Forest to the U.S.?* -- Deborah Shields, U.S. Forest Service
- Apr. 10 *Spatial Optimization of Habitat Management for Endangered Species: Ferrets and Owls* -- John Hof, U.S. Forest Service
- Apr. 17 *Benefit Transfer: An Application Using WTP for Rural Water Supply Improvements* -- Steve Piper, U.S. Bureau of Reclamation
- Apr. 24 *Relevance of Altruism in Benefit-Cost Analysis* -- Nick Flores, University of Colorado

**COLORADO STATE UNIVERSITY
ENVIRONMENTAL ENGINEERING SEMINAR SERIES, SPRING 1996
Department of Civil Engineering**

All seminars will be held on **Mondays** from **Noon to 1:00 p.m.** in the **Student Senate Chambers Room** in the **Lory Student Center**. All are welcome and feel free to bring your lunch.

- Feb. 26 ***Environmental Aspects of Xin-Jiang Water Master Plan***
Armando Balloffet, P.E., President, Balloffet & Associates, Fort Collins, Colorado
- Mar. 4 ***Contamination at the Denver Federal Center – Regulations and Responsibilities***
Paul Sealy, Environmental Scientist, Lewis Berger & Associates, Boulder, Colorado
- Mar. 18 ***In-situ Bioremediation Techniques***
Bill Mahaffey, Manager Bioremediation Systems, Walsh Environmental Scientists and Engineers, Boulder, CO
- Mar. 25 ***South Platte River Channel Rehabilitation for Water Quality Improvement***
Ted Johnson, Senior Environmental Engineer, Camp, Dresser & McKee, Inc., and
Bob Neil, Project Director, Metro Wastewater Reclamation District, Denver, CO
- Apr. 1 ***Principal Municipal Wastewater Concerns in Slovakia***
Mike Condran, P.E., Dames & Moore, Denver, CO
- Apr. 8 ***Project Management and You, the Engineer***
John Clark, P.E., Senior Project Engineer, RBD Inc., Fort Collins, CO
- Apr. 15 ***Colloid Charge Titration: A Promising Tool for Coagulation Control***
Roger Jordan, Professor at University of Colorado, Clear Corp., Boulder, CO
- Apr. 22 ***Future Environmental Trends***
Ralph Chapuis, P.G., Director of Engineering, Research Management Consultants, Inc., Golden, CO
- Apr. 29 ***Aspects of Wastewater Treatment Plant Upgrading***
John McGee, RBD Inc., Fort Collins, CO

**NATURAL RESOURCES LAW CENTER, UNIVERSITY OF COLORADO
Hot Topics in Natural Resources**

Tuesday, March 12 – AIR QUALITY AND TRANSPORTATION ON COLORADO'S FRONT RANGE: TAKING RESPONSIBILITY FOR DIFFICULT CHOICES – Communities along Colorado's Front Range are faced with difficult choices concerning air quality and transportation. Can we control the "brown cloud" and increasing congestion on our roads and freeways? What decisions and sacrifices must be made, and who will take responsibility for them? **Wade Buchanan**, Chairman of the Regional Air Quality Council (RAQC), will moderate a panel addressing these issues including **David Pumpu**, Deputy Executive Director of the Denver Regional Council of Governments (DRCOG), **Christine Shaver**, Environmental Defense Fund attorney, and **Ken Hotard**, Senior Vice-President of the Boulder Area Board of Realtors.

Tuesday, April 23 – THE PROBLEM OF FEDERAL-PRIVATE SPLIT MINERAL ESTATES: WHO HAS CONTROL? Many federally owned lands overlie privately owned oil and gas and mineral rights. Increasingly, the competition between agency multiple use directives and private interest in resource development has resulted in legal battles between the federal government, which seeks to regulate use of the federally owned surface estate for resource extraction, and the private owners of the mineral estates. **Andrew Mergen**, the Center's 1996 El Paso Natural Gas Law Fellow, will look at problems and potential solutions associated with these split mineral estates.

12:00 noon, Holland & Hart, 555 17th St. 32nd Floor, Denver

Box lunches provided

One Hour of continuing Legal Education (applied for)

Prepayment required. \$15 if received 3 working days before program; \$18 thereafter. Includes lunch. Additional \$5 for CLE credit, if desired. Limited scholarships. Register by phone or FAX with credit card or send check payable to the Univ. of Colorado to Natural Resources Law Center, Campus Box 401, Boulder, CO 80309-0401. Phone: 492-1288; FAX: 492-1297, Kathy Taylor.

WATER NEWS DIGEST

WATER QUALITY

Water Pollution Remains Widespread

Nearly 40 percent of lakes, rivers and streams in the United States are too dirty for fishing and swimming despite major federal efforts to combat water pollution, according to a recently released Environmental Protection Agency report. The report's figures are consistent with a similar analysis of pollution in major water bodies issued in 1992. Agricultural runoff containing pesticide residues or other pollutants poses the biggest threat to some water bodies, contributing about 60 percent of the pollution found in rivers and half of the pollution in lakes, the study said. Excessive levels of silt, found in 34 percent of polluted rivers, are a major problem. Storm sewers and municipal waste treatment plants also are major pollution sources, the study added. And of the 1,500 fish consumption advisories issued across the country in 1994, nearly three quarters warned of high levels of mercury.

Washington Post, 12/15/95

Safety of Water Supply Questioned

In a study based on data reported by more than 100 water utilities across the country, the Natural Resources Defense Council said arsenic, radon, or byproducts of chlorination, each considered highly toxic, contaminate the drinking and bathing water of at least 100 million Americans. The findings were challenged by the American Water Works Association. AWWA said the data do not show that the levels at which people have been drinking for years cause harm. In Colorado, citizens were given good news. An examination of EPA reports from 1993 and 1994, by Clean Water Action and the Colorado Public Interest Research Group (CoPIRG), found that Colorado citizens are drinking water well within the standards for arsenic, radon and trihalomethane (a byproduct of chlorination). The groups point to results elsewhere in the nation, however, as justifying the reauthorization of the Safe Drinking Water Act.

Los Angeles Times 10/27/95, Denver Post 10/30/95

Wetlands and Cattails Clean Park Wastewater

When renovations are complete, Island Acres State Park will have a new wastewater treatment system called a sealed or constructed wetlands system. Waste from the park's septic system goes first into a holding tank where solids and fluids separate. The solids eventually will be pumped out and disposed of while fluids go into an aerator chamber where water and bacteria are broken down by bubbling action. The remaining clear fluids are diverted into the sealed wetlands, which are in ponds first lined with heavy plastic and then covered with soil. Cattails then are planted in the soil. The fluids, called treated effluent, are pumped into the wetlands and either evaporate or transpire through the plants. The self-contained system does not discharge any effluent into the water table, thus protecting the environment and saving the cost of state discharge permits.

Grand Junction Daily Sentinel 11/9/95

Summitville Cleanup Costs Keep Growing

The cost of cleanup at the Summitville Gold Mine is now at \$105 million and still climbing, according to the lead agency for cleanup of the site, the Colorado Department of Public Health and Environment. The department said the cleanup is running at \$25,000 per day. The Environmental Protection Agency took over cleanup of the mine site in Dec. 1991 after Galactic Resources Ltd. of Vancouver, Canada declared bankruptcy and abandoned operation of the mine. Neither the company nor its owner has paid a cent toward the cleanup. It is expected to take from 5 to 10 years to complete water treatment at Summitville.

Denver Post 11/3/95, Pueblo Chieftain, 1/6/96

Preliminary Report Shows Potential Problem at Hog Farm

Members of the Water Quality Control Commission want more information about the amount of nitrates in the soil before the state requires National Hog Farms east of Kersey to change its operation. Waste from the 185,000-hog farm is sprayed on about 2,800 acres of farmland by center-pivot sprinklers and nitrogen is supposed to evaporate or be absorbed by crops. A water quality control engineer for the WQCD says there is strong evidence that nitrogen from hog waste has soaked into the ground far enough that plants cannot absorb it. Those nitrates will make their way to groundwater and pollute it, he said. Hog Farm officials promised to give a written response to the state's preliminary report by the end of January.

Greeley Tribune 11/22/95, 1/9/96

Reservoir Caulk Contaminated

Drinking-water reservoirs in northwest Fort Collins contain PCB-contaminated caulk which has been flaking off into the water, say city officials. So far, neither drinking water nor groundwater shows any signs of contamination, but PCB levels in soil outside the reservoirs' drainage sites are ten times higher than the Environmental Protection Agency allows. The city plans to remove the old caulk and replace it with a new, safer sealant, as well as dig up all the contaminated soil. The project will begin in Jan. and last about three months.

Fort Collins Coloradoan 11/17/95

Modest Efforts Are Reclaiming Upper Animas Basin

The Animas River Stakeholders are taking small steps forward to reclaim the Upper Animas Basin, site of abandoned mines that actively drain into the Animas or its tributary creeks. The organization was formed when the Colorado Water Quality Control Commission asked the Colorado Center for Environmental Management in early 1994 to organize the basin's factions into a stakeholders group. In Placer Gulch the Mining Remedial Recovery Co. has moved Sunbank Mine's dump and put in half a dozen settling ponds, bulkheads and limestone to reduce the acidity of surface water flowing downbasin. The Sunbank Project so far has cost \$400,000, of which \$300,000 was

MRRC's money. Other funds came from the EPA. MRRC came into being and owns the property under reclamation because of a steel company's bankruptcy proceedings. At the Silverwing Mine, active from 1875 to 1965, a small project is underway with private funds (\$7,500) to improve water quality. Sunnyside Gold Corp. has spent about \$10.5 million on reclamation, begun even before the mine closed in 1991.

Fort Collins Coloradoan 10/21/95

RECREATION/WILDERNESS

GO-Colorado Picks Six Legacy Project Proposals

On January 9 the board for the Great Outdoors Colorado Trust Fund announced it had picked six "concept papers" from across the state to apply for special Legacy Project funds. The Legacy Projects must address regional and statewide needs by providing outdoor recreation, open space, wildlife protection and local government. The proposals were:

- A Denver project to build parks and trails and improve wildlife habitat along 10.5 miles of the South Platte River.
- The Colorado River "greenway" in Mesa County, with new trails, open space, wildlife habitat and other improvements along 29 miles of streams in the Grand Junction area.
- The Historic Arkansas Riverwalk project in Pueblo, to restore and enhance the 1921 Arkansas River channel with park, recreation and aquatic habitat improvements.
- The Yampa River project in northwestern Colorado, to develop recreation opportunities along the river from Yampa and Steamboat Springs to Dinosaur National Monument.
- The Great Plains Reservoirs project in southeastern Colorado, to buy water rights, protect wildlife and improve recreation for a future state park.
- The I-25 Conservation Corridor, with open space, trails, wildlife habitat and recreation areas on 25,000 acres between Denver and Colorado Springs.

GO Colorado established the Legacy program in October to distribute money from lottery revenues that were far greater than predicted, and will announce selected projects in May.

Colorado Springs Gazette Telegraph, 1/11/96

1996 is "Year of the South Platte River"

On New Year's Day, Denver Mayor Wellington Webb proclaimed 1996 the "Year of the South Platte River." Webb pledged that during 1996 the city will accomplish ground breakings for expansion or development of four public parks along the Central Platte River corridor. The city, Great Outdoors Colorado and other partners will have invested more than \$5 million in parks and river channel improvements called the Riverfront Park system.

Denver Post, 1/10/96

Pueblo Voters Approve HARP

In November, Pueblo voters OK'd a \$12.85 million bond issue for the Historic Arkansas Riverwalk Project. Fewer than 1,000 votes marked the narrow victory of the proposal to reopen the original channel of the Arkansas River and build a San Antonio-style park and commercial district there.

Pueblo Chieftain 12/31/95

Deep Creek Now Eligible for Wild & Scenic Designation

A joint review by the U.S. Forest Service and Bureau of Land Management has determined that Deep Creek is eligible for designation as a national wild and scenic river. The creek runs 15 miles from Deep Lake on the Flat Tops to its confluence with the Colorado River just north of Dotsero. Eligibility is the first of the two-part study process that may lead to wild and scenic designation. A second, more detailed study will be done later to decide whether the designation, which must be approved by Congress, is suitable. Call 945-2521 or 945-2341 (Glenwood Springs) to obtain a copy of the eligibility report.

Grand Junction Daily Sentinel 11/7/95

WATER DEVELOPMENT

Funding Approved for Animas-La Plata

Initial funding of \$10 million for the Animas-La Plata project was approved in the 1996 federal water and energy appropriations bill signed by President Clinton in Nov. The project will store water from the two rivers in Ridges Basin Reservoir for use by Indian tribes, farmers and ranchers in Colorado and New Mexico. Sam Maynes, attorney for the Southern Ute Indians, said that although delivery systems are not scheduled to be built until the second phase of the project, the tribes are willing to take their chances as long as their water is stored in the reservoir. Originally, the Indian tribes had insisted on getting their water in the project's first phase.

Pueblo Chieftain, 11/19/95, *Grand Junction Daily Sentinel*, 1/2/96

Final Chapter Not Written on Homestake II

On Dec. 4 Aurora and Colorado Springs lost their court battle to force Eagle County let them develop Homestake II, which would divert more than six billion gallons a year from the Holy Cross Wilderness Area near Vail. This is not the final chapter for the project, however. Under proposed legislation sponsored by Colorado Senate President Tom Norton, Eagle County no longer would have the authority to halt Homestake II. Norton's bill would limit use of special-use permits to regulate public and private projects. In 1974, concerned about growth, the Colorado Legislature passed several measures including one that gave local governments the power to require special-use permits when a project raised issues of "statewide concern." Eagle County used the law to deny Aurora and Colorado Springs a permit to proceed with Homestake II. State Rep. Andy McElhany, R-Colorado Springs, will co-sponsor Norton's bill. Proponents of the bill say it would still allow counties to review projects and request

changes that are "reasonable." Opponents contend it would take the teeth out of the law by taking away the ability to veto projects.

Denver Post 12/5/95, 12/12/95; *Colorado Springs Gazette Telegraph*, 1/16/96 (<http://www.usa.net/gtwork/today/loc009.html>)

Rocky Mountain National Park Wins Battle Over Dam

Officials of Rocky Mountain National Park have won a battle to keep a new dam from being built in the park. Northern Colorado Properties Inc. has deeded over 822 acre-feet of water in Mirror Lake to the park. The company had wanted a dam to hold the water to supply new development.

Fort Collins Coloradoan, 12/16/96

Colorado Springs Studies Water Supply Options

About six years ago, Colorado Springs launched a \$500 million, 50-year water study, looking at systems of storage, exchanges and pumping from Twin Lakes in Leadville to reservoirs near Pikes Peak to Lake Meredith in Crowley County. Elephant Rock Dam, three miles north of the mountain town of Buena Vista, was one of the possibilities to provide Colorado Springs water for its growing population. Considering everything from cost to environmental impact to ease of operation, Elephant Rock finished last. The city also is looking at water reclamation — treating wastewater so thoroughly it can be used for drinking and washing. This would be the most expensive of the city's options, at a cost of about \$350 million. Another option is imposing tougher water conservation rules.

Pueblo Chieftain 11/20/95, *Colorado Springs Gazette Telegraph* 1/1/96, *Fort Collins Coloradoan* 1/2/96 (http://www.usa.net/gtwork/archive/Monday,_January_1,_1996.Arc/loc010.html)

Glendale Goes From Wells to Denver Water

On January 10 the City of Glendale officially hooked into Denver's water supply after using wells for the past 44 years. City voters overwhelmingly approved the \$9 million water deal in Nov. 1993. Glendale will pay back the \$9 million over the next 20 years with revenues from sales tax and water bills. The city will pay Denver \$500,000 a year for the water but will continue to bill its residents and maintain its water system. Glendale's water had high but technically safe levels of iron and magnesium which affected its taste and smell and also caused high maintenance costs because of corrosion.

Denver Post 1/11/96

FEDERAL WATER RIGHTS

Cities, Irrigation Company Propose Land Swap

The cities of Fort Collins and Greeley and the Water Supply and Storage Co. have offered to trade 1,108 acres of land in exchange for nine reservoirs, all on national forest land. The entities now own water rights in the nine reservoirs but must gain Forest Service permits to operate the reservoirs. The bulk of the land offered is on the Rockwell Ranch in the Poudre Canyon about 40

miles northwest of Fort Collins. It borders the Comanche Peak Wilderness and Cache la Poudre Wilderness. The reservoirs proposed for the swap include Joe Wright, Barnes Meadow, Chambers Lake, Comanche, Hourglass, Long Draw, Milton Seaman, Peterson Lake and Twin Lakes. Rep. Wayne Allard will introduce the legislation, which must pass Congress. The Forest Service has not decided whether it will support the bill. Trout Unlimited may oppose the legislative initiative.

Fort Collins Coloradoan, 12/8/95, 12/23/95

AG TO URBAN TRANSFERS

Weld County's prime agricultural land is being converted to urban development faster than any county in the nation, according to the Weld County planning director. However, property owners now will have to wait longer to split their land for development. The process to split parcels of land is called a recorded exemption, a land-use tool that allows owners to carve up their land for purposes other than the designated zoning. Previously, landowners could seek to split their land once every five years, but now it will go to ten years. Property owners still will be free to apply for zone changes on their land, but the process is more expensive and time-consuming, and there is no guarantee that commissioners would approve a zone change.

Greeley Tribune 11/27/95

ENDANGERED SPECIES

Romer/Babbitt Sign Endangered Species Agreement

On November 29 Interior Secretary Bruce Babbitt and Colorado Gov. Roy Romer signed an agreement that will give the state a larger role in decisions on endangered species. The objective is to prevent more additions to the Endangered Species Act (ESA) through collaboration between state and federal officials, greater flexibility under the law, and encouraging landowners' voluntary cooperation.

Fort Collins Coloradoan (Associated Press) 11/30/95

USBR to Test Low-Flow Impacts in San Juan

The Bureau of Reclamation's plan to cut San Juan River flow temporarily below Navajo Reservoir, to determine how it affects the Colorado squawfish and razorback sucker, is being questioned by anglers and irrigators. USBR regulates water flow through the dam, which is east of Farmington. The agency would reduce flows to 250 cubic feet per second (cfs), compared with the current 800 cfs, to test the impact on fish and plant life and human activities along the river. Critics say the low flow will harm trout waters below the dam, renowned for prime trout fishing. Another concern is that the low water flow will expose algae to the air and too much sunlight, causing it to die along with bugs, worms and leaches in the algae. The two-week test was to begin Jan. 10 (planned prior to the government shutdown) as a test to see if USBR can run a similar four-month test in 1997.

Denver Post (Associated Press) 12/6/95

CDOW Continues Struggle Against Whirling Disease

The Colorado Division of Wildlife is mounting a two-pronged attack to combat whirling disease (WD) by revamping fish hatcheries and expanding field research. A stocking policy recently adopted by CDOW says no WD-exposed trout will be stocked in WD-free waters or in waters where native trout exist. Eight of the state's 16 hatcheries have tested positive for whirling disease, although at least one subsequently tested negative. Anglers will see a reduction in numbers of fish produced. Some researchers claim operating the hatcheries at 100 percent capacity tends to overstress fish, leaving them more vulnerable to disease. The division also will take \$600,000 out of the hatchery capital improvement fund to rework existing disease-free hatcheries and will seek an additional legislative appropriation of \$3 million for other hatchery improvements.

Grand Junction Daily Sentinel 11/5/96

WESTERN WATER POLICY

Under the Western Water Policy Review Act of 1992, Congress directed the President to undertake a comprehensive review of federal activities in the 19 western states that affect the allocation and use of water resources, and to submit a report of findings and recommendations to the Senate Energy and Natural Resources Committee, the Senate Appropriations Committee, the House Resources Committee, the House Appropriations Committee, and the House Transportation and Infrastructure Committee. The legislation authorizing the commission noted that at least 14 federal agencies have water-related responsibilities, resulting in "unclear goals and an inefficient handling of the Nation's water policy." It noted that conflicts between competing goals and objectives among federal, state and local agencies and private water users is particularly apparent in the Western States.

The commission will review water resources problems in the 19 Western States including the existing and proposed federal programs, the need for additional water augmentation, the existing institutional arrangements, the legal regime, and the activities, authorities, and responsibilities of federal agencies with direct water resources management responsibility. It will examine these topics over a two-year period of research, field investigations, public discussions, and commission deliberations. The commission will focus on selected river basins in the Western United States. It will hold a series of regional public hearings and prepare a report of its findings.

The commission was chartered by the Secretary of the Interior on Sept. 15, 1995, and Congress extended its existence to Oct. 2, 1997. The commission has tentatively scheduled its first meeting in Portland on Feb. 16-17 at Lewis and Clark College. Senator Mark Hatfield, the Commission's mentor, has been invited to attend and swear in the appointed members.

Commission members are: Denise Fort, University of New Mexico, Chair; Bruce Babbitt, Secretary of Interior (represented by Joseph L. Sax, Counselor to the Secretary); Togo D. West, Secretary of the Army; Huali Chai, Attorney, San Jose, CA; John Davidson, Univ. of South Dakota; Janet Neuman, Northwestern School of Law, Lewis & Clark College, Portland, OR; Jack Robertson, Deputy Director, Bonneville Power Administration,

Portland OR; John Echohawk, Native American Rights Fund Boulder, CO; Patrick O'Toole, rancher and former state legislator, Savery, WY; Kenneth L. Salazar, Attorney, Denver, CO; Sen. Frank Murkowski, Chairman, Committee on Energy and Natural Resources; Sen. Larry Craig, Chairman, Subcommittee on Forests and Public Land Management; Sen. Mark O. Hatfield, Chairman, Committee on Appropriations; Sen. J. Bennett Johnston, Ranking Minority Member, Committee on Energy and Natural Resources; Sen. Bill Bradley, Ranking Minority Member, Subcommittee on Forests and Public Land Management; and Sen. Robert C. Byrd, Ranking Minority Member, Committee on Appropriations.

The commission is located at the Denver Federal Center.

COLORADO RIVER BASIN

After a nearly disastrous experience three years ago when initial deliveries of Colorado River water from the Central Arizona Project (CAP) corroded city mains and residential plumbing, Tucson voters have passed an initiative that essentially bans flow of CAP water through the municipal supply system for five years. The initiative, called the Water Consumer Protection Act, requires the city to find other uses for its share of CAP water, such as trading it to mines and farms, using the supply for groundwater recharge, or for watering parks and golf courses. While proponents of the initiative argued that it made no sense for Tucson to use substandard surface water while nearby mines and farms were using enough high-quality groundwater to serve a city of 500,000, others contend that the new directive could force the city to shut down some of its wells and might result in water shortages next summer. A representative of the Arizona Water Quality Association noted that the problem not only existed with the poor quality of CAP water, which has total dissolved solids (TDS) ranging to 690 parts per million, but with a decision by Tucson not to chlorinate the water. Instead, the city switched to ozonation with a residual of chloramine.

U.S. Water News, Jan. 1995

PEOPLE

Richard "Dick" Stenzel is the new Division Engineer for Water Division 1, responsible for administering the waters of the South Platte River Basin. Hal Simpson, State Engineer, made the announcement. Dick was an Assistant Division Engineer in Greeley for several years before he became Assistant State Engineer in 1991. He replaces Alan Berryman who took a position with the Northern Colorado Water Conservancy District.

Eluid Martinez was confirmed as Commissioner of the Bureau of Reclamation by the Senate on Dec. 22 with unanimous consent. Martinez served in the New Mexico State Engineer's Office for 23 years, most recently as the State Engineer.

Gilbert White received the 1995 Volvo Environment Prize at a ceremony in Gothenburg, Sweden, on Oct. 5. Volvo cited White for his work on "the problems of managing natural resources — especially water — for human use." White is former director of the Natural Hazards Research and Applications Information Center at the University of Colorado.

MEETINGS

PLANNERS, ENGINEERS AND WATERWAYS February 29, 1996 -- 8:00 a.m. to 5:00 p.m. Executive Tower Inn, 1405 Curtis, Denver, Colorado

Featured Speakers:

William Coors, Adolph Coors Company, FOSTERING TEAMWORK AND PARTNERSHIPS
Hon. Wellington Webb, Mayor of Denver (invited), REVITALIZATION OF THE PLATTE RIVER

Case Studies:

ROCKY FLATS--COLLABORATION FOR LONG-TERM RESTORATION
GORE CREEK WATERSHED MANAGEMENT
"CONTEXTURAL DESIGN" THE FUTURE OF WATER RESOURCES
BEAUTY AND FLOOD CONTROL ARE NOT ENOUGH
THE COMMUNITY AS PART OF THE DESIGN TEAM--BIBLE PARK - A CASE STUDY
A SLIDE TOUR OF PROJECTS

For information contact: Chuck McKnight 303/986-1444 or Bill Wenk 303/628-0003.

FIELD SCIENTISTS AND THE SHAPING OF THE AMERICAN WEST

Presented by The Center of the American West
Glenn Miller Ballroom, University of Colorado, Boulder
March 15-16, 1996

The conference will explore over two centuries of discovery through the perspectives of scientists, historians, and diarists. Their stories will provide the backdrop for an exciting and thought-provoking conference into what field scientists perceived the American West once was, what it is today, and what it may hold in the years to come. Principal speakers include: Wes Jackson of the Land Institute, a leading expert on agricultural land-use reform; Robert Bakker, a world-renowned expert on dinosaurs and author of *Dinosaur Heresies* and *Raptor Red*; Ted Strong, Executive Director of the Columbia River Inter-Tribal Fish Commission and expert on changing fish populations in the West; Patricia Limerick, a leading Western historian and author of *Legacies of Conquest*; and Charles Wilkinson, Western author of *Crossing the Next Meridian* and *The Eagle Bird*. For registration materials or more information contact the Center of the American West, University of Colorado, Campus Box 234, Boulder CO 80309-0234; Phone 303/492-4879; FAX 303/492-1868; E-mail centerwest@colorado.edu.

HYDROLOGY DAYS 1996

April 15-19, 1996

Colorado State University, Fort Collins, Colorado

Dedicated to Emeriti Professors Everett V. Richardson, Hsieh Wen Shen and Daryl B. Simons
Special Session: Hydraulics and Ecology, General Session: Hydrologic Engineering
Featured Speaker: Professor M. Levent Kavvas, Editor of the Journal of Hydrologic Engineering
Presentations by students in oral or poster form

For information contact:

H. J. Morel-Seytoux, 57 Selby Lane, Atherton, CA 94027
Phone: 415/365-4080 FAX 415/365-4080 email: Morelsey@leland.stanford.edu
or
Janet Montera, Civil Engineering, Colorado State University, Fort Collins, CO 80523
Phone: 970/491-7425 FAX 970/491-7727

WHAT WE HAVE LEARNED FROM THE BIG THOMPSON FLOOD -- 20 YEARS LATER

Fort Collins, Colorado July 10-13, 1996

The Big Thompson flash flood on July 31 1976, killed at least 139 people and destroyed over 400 homes, trailers, and businesses. This meeting will focus on the degree to which our vulnerability to flash floods has increased or decreased in the region, the nation, and throughout the world. The conference will examine the effects of rapid urbanization and other land use changes in the American West: the contributions of national associations concerned with flood management, improvements in emergency management and weather forecasting; advancements in flood warning and other technologies; and changes in national programs and priorities. The meeting will include a one-day field trip to the sites of the Big Thompson flood and the Lawn Lake dam break of 1982. For details, contact *Eve Gruntfest, Big Thompson symposium, University of Colorado-Colorado Springs, P.O. Box 7150, Colorado Springs, CO 80933-7150; (719) 593-3531; fax (719) 593-3019; e-mail: ecg@spring.uccs.edu.* Sponsors: Federal Emergency Management Agency and others.

A "LIVING" PERMIT: WHAT DO YOU HAVE ONCE THE INK DRIES?

Friday, March 15, 1996

Co-sponsored by the Natural Resources Law Center, University of Colorado School of Law
and the Natural Resources and Environment Section, Boulder County Bar Association

Regulatory agencies often perceive land use and environmental statutes -- and the permits which implement them -- as flexible tools. Many of the regulated community suggest that additional obligations imposed by agencies were never contemplated when the permits were originally issued. The agencies maintain that changed conditions or policies, as well as statutes, regulation and case law, authorize their actions. This symposium will explore the basis for these perceptions from multiple perspectives, examining property rights, the public interest, and the retroactive application of laws.

	<u>By March 8</u>	<u>After March 8</u>
Registration	\$100	\$110
BCBA Member	95	105
Government, acad, pub interest	65	75
Parking permit	4	5

Make check payable to University of Colorado and send to: Natural Resources Law Center, Campus Box 401, Boulder, CO 80309. Or pay by VISA/MasterCard. Phone Kathy Taylor, (303) 492-1288; FAX 492-1297

ANNUAL SUMMER CONFERENCE -- NATURAL RESOURCES LAW CENTER BIODIVERSITY PROTECTION AND THE ENDANGERED SPECIES ACT

June 10-12, 1996

The Center's annual conference, June 10-12, will examine the legal framework for protection of biological diversity, the rationale for biodiversity protection and proposals to strengthen, weaken or otherwise modify the manner in which biodiversity is protected under federal and state laws. Particular attention will be given to the Endangered Species Act, its application in regional and local contexts, and the consequences for the species at issue and the local economies. The conference will also address state, tribal, local and private efforts to preserve biodiversity. Brochures will be mailed in the early spring. For more information, contact Kathy Taylor, (303) 492-1288.

SHORT COURSES

INTERNATIONAL GROUND WATER MODELING CENTER **Colorado School of Mines, Boulder, Colorado** **1996 Short Course Schedule**

For information contact: Office of Special Programs & Continuing Education (SPACE), Colorado School of Mines, Golden, CO 80401. Phone: 303./273-3314.

<u>Date</u>	<u>Title. Instructors. Software</u>	<u>Location</u>
Mar. 11-13	The HELP Modeling Workshop for Landfill Design. Instructors: Paul Schroeder, U.S. Army Corps of Engineers; and Lee Peyton, Univ. of Missouri. Software: HELP, Version 3.	CSM
Apr. 1-2	Introduction to Health Risk Assessment for the Environmental Professional. Instructor: Debra Imel Nelson, Univ. Of Oklahoma. Software: EXCEL.	CSM
Apr. 3-4	Soil and Groundwater Modeling for Risk Assessment and Soil Clean-up Level Evaluation. Instructors: Michael Barden, Wisconsin Dept. Of Natural Resources, and Stephen J. Scott, Environmental Graphics, Inc. Software: AT123D and SESOIL.	CSM
May 13-17	Principles and Applications of Chemical Reaction Modeling in Ground Water. Instructors: Neil Plummer, David Parkhurst and Pierre Glynn, USGS. Software: PHREEQC, PHREEQM, NETPATH, PHRQPITZ.	CSM
May 27-29	Principles and Applications of Aquifer Testing. Instructors: Forest Arnold (IGWMC); Edward Gutentag and Joe Downey, USGS. Software: Aquix4S.	CSM
June 3-5	Subsurface 3D Data Management, Analysis, & Computer Visualization for Site Assessment/Remediation. Instructors: Dennis A. Moon, SESCO; Stephen A. Krajewski, Industrial Ergonomics, Inc.; Hisham Gaber, Intergraph Corporation; and Stephen J. Scott, Environmental Graphics, Inc.	Milwaukee, WI
June 3-7	Practical Modeling of Three-Dimensional Contaminant Transport and Remedial Action Designs using MODFLOW and MDT. Instructors: Chunmiao Zheng, Univ. of Alabama; and Christopher Neville, S.S. Papadopolus, Inc.). Software: MODFLOW, MDT.	CSM
June 17-21	Parameter Identification for MODFLOW. Instructors: Mary Hill, Richard Cooley and Richard Yager, USGS. Software: MODFLOWP, PEST.	CSM
June 24-26	An Introduction to Ground Water Modeling with Computers for Site Characterization, Exposure Assessment and Site Remediation. Instructors: Paul van der Heijde and Forest Arnold, IGWMC; and Kenneth Kolm, Colorado School of Mines. Software: THWELLS, SOLUTE, CHEMFLOW, ASM.	CSM


Integrated Support Technology for Groundwater Modeling

Colorado State University, Fort Collins, CO, Feb. 26-27, 1996. The course provides an overview of the importance of Hydrogeological Decision Analysis Support Systems for groundwater modeling. The system is based upon a unified integrated system consisting of Geographic Information Systems (GIS), Geostatistical Analysis, Scientific Visualization and Stochastic Groundwater Modeling Modules. The result of such analysis serves the decision makers in solving complex problems in subsurface hydrogeology. Course instructors: Dr. Abdel Abdel-Rahman, Dr. James W. Warner and Dr. Carlos E. Tamayo (Colorado State University). Sponsor: Dept of Civil Engineering, Groundwater/Environmental Hydrogeology Program, Colorado State University, Engineering Research Center, B103. Phone 970/491-8381; FAX 970/491-8554; e-mail twright@vines.colostate.edu.

Design of Water Quality Monitoring Systems

Colorado State University, Fort Collins, CO, June 3-7, 1996. This short course was developed using the collective research and design experience of the instructors over the past 21 years. The course will begin with a review of basic statistics and cover its use in the analysis of water quality data. It will cover detailed procedures for designing a water quality monitoring system including: information expectations, design criteria, network design, operating plans and procedures, and reporting formats and schedules. A free social and recreational program is planned for family members and guests accompanying short course attendees including trips to historic Larimer Square and Estes Park. For information contact:

Water Quality Short Course
Office of Conference Services, Colorado State University
Fort Collins, CO 80523
Phone: 970/491-7501 FAX: 970/491-3568

 Future Short Courses at Colorado State University
(Contact Office of Conference Services)

Hazardous Materials/Waste Management Training
June 11-13, 1996.

Activated Sludge Process Control Short Course
June 24-28, 1996.

CALENDAR

- Feb. 21-23 12TH HIGH ALTITUDE REVEGETATION WORKSHOP, Fort Collins, CO. Contact: Gary L. Thor, HAR Committee Secretary, Department of Soil and Crop Sciences, Colorado State University, Fort Collins, CO, 80523. FAX: 970/491-0564.
- Feb. 21-24 SEVENTH AMERICAN FOREST CONGRESS, Washington DC. Contact: Office of the Seventh American Forest Congress, Phone 203/432-5117.
- Feb. 23 1996 GOVERNOR'S AGRICULTURAL OUTLOOK FORUM, Denver, CO. Contact: Colorado Department of Agriculture, Phone 303/239-4100.
- Feb. 25-28 WATER REUSE 96, San Diego, CA. Contact: Susan Blount, American Water Works Assoc., Phone 303/794-7711, FAX 303/794-8915.
- Feb. 27-28 PLATTE RIVER BASIN ECOSYSTEM SYMPOSIUM, Kearney, NE. Contact: Mike Eckert, Platte Watershed Program Coordinator, Phone 402/472-0891, FAX 402/472-6338.
- Mar. 7-8 WESTERN WATER LAW, Third Annual Conference, Denver, CO. Contact: CLD International, Phone 303/377-6600.
- Mar. 15 WATERSHED PLANNING AND MANAGEMENT, Denver, CO. Contact: Steve Forvilly, Phone 303/286-3325.
- Mar. 15-16 FIELD SCIENTISTS AND THE SHAPING OF THE AMERICAN WEST, The Center of the American West, University of Colorado, Boulder, CO. Contact The Center of the American West, Phone 303/492-4879; FAX 303/492-1868; E-mail centerwest@colorado.edu.
- Mar. 19-20 AGRICULTURE AND THE ENVIRONMENT: DEFINING THE COMMON GROUND, Denver, CO. Contact: Colorado Alliance for Environmental Education, Phone 303/297-0187; FAX 303/297-0188.
- MAR. 20-22 WATER POLICY ROUNDTABLE, Washington, D.C. Contact: Holly Stoerker, Interstate Council on Water Policy, Phone 612/223-5828; or Craig Bell, Western States Water Council, Phone 801/561-5300.
- Apr. 15-19 HYDROLOGY DAYS 1996, Fort Collins, CO. Contact: H.J. Morel-Seytoux, Phone 415/365-4080, FAX 415/365-4080, e-mail Morelsey@leland.stanford.edu or Janet Montera, Phone 970/491-7425, FAX 970/491-7727.

- June 11-14 **COMPUTERS IN AGRICULTURE**, 6th International Conference, Cancun, Mexico. Contact: Susan Buntjer, American Society of Agricultural Engineers. Phone 616/428-6327, FAX 616/429-3852, email: buntjer@asae.org.
- June 16-19 **URBAN WET WEATHER POLLUTION FROM THE STREAM'S PERSPECTIVE**, Quebec City, Quebec, Canada. Water Environment Federation. Call 1-800/666-0206, Select Option #4 to put your name on mailing list.
- July 14-17 **WATERSHED RESTORATION AND MANAGEMENT**, Annual AWRA Symposium, Syracuse, NY. Contact: American Water Resources Association, Phone 703/904-1225; FAX 703/904-1228; E-Mail: awrahq@aol.com.
- July 21-24 **INDUSTRIAL WASTEWATER TREATMENT: MUNICIPAL AND INDUSTRIAL PERSPECTIVES**, Indianapolis, IN. Water Environment Federation. Call 1-800/666-0206, Select Option #4 to put your name on mailing list.
- Aug. 17-22 **10TH ANNUAL RESIDUALS MANAGEMENT BIOSOLIDS SPECIALTY CONFERENCE**, Denver, CO. Water Environment Federation. Call 1-800/666-0206, Select Option #4 to put your name on mailing list.
- Sept. 22-25 **RIVERTECH '96**, 1st International Conference on New/Emerging Concepts for Rivers, Chicago, IL. Contact: Rivertech '96, IWRA, University of Illinois, FAX 217/333-9561, E-mail: nbarrett@uiuc.edu.
- Sept. 22-26 **32ND ANNUAL AWRA CONFERENCE AND SYMPOSIUM**, Fort Lauderdale, FL. Contact: American Water Resources Association, Phone 703/904-1225, FAX 703/904-1228, E-Mail: awrahq@aol.com.

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Feb. 29-Mar. 1 – Visual MODFLOW
Denver, Colorado – Contact National Groundwater Association, 1-800/551-7379

April 1996 – 4th STORET Modernization Conference
Denver, Colorado – Additional Information 1-800/424-9067

Colorado Water Resources Research Institute
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