Who's Running This Ecosystem?

Proceedings of the 13th Annual
South Platte Forum
October 23-24, 2002
Longmont, Colorado

Jennifer Brown, Editor

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Sponsored by:
Colorado Division of Wildlife
Colorado Water Resources Research Institute
Colorado State University Cooperative Extension
Denver Water
Northern Colorado Water Conservancy District
U.S. Bureau of Reclamation
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey

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Colorado Water Resources Research Institute
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Robert C. Ward, Director

PREFACE

In the beginning, there was a man named Chuck GrandPre, a Division of Wildlife employee who saw a division between the "water community" and the "environmental community." Chuck envisioned a Forum where these two groups, along with others, could sit down face-to-face, hear issues, and have meaningful dialogue about these issues that affect all South Platte Basin citizens.

Chuck brought together the Colorado Water Resources Research Institute, the Colorado Division of Wildlife, Denver Water, Northern Colorado Water Conservancy District, the US Environmental Protection Agency, the US Fish and Wildlife Service and the US Geological Survey to create the South Platte Forum in 1989. Originally, there was apprehension with so many federal and state agencies planning the conference. But, one of the true successes of this Forum is the way in which the sponsoring agencies have been able to work together for the good of all, setting aside personal agendas.

In the early years generic topics were chosen to avoid speakers or subjects that might offend. The goal was to get as many people possible together and begin to establish trust and build communication between the different interests. Today it has evolved to a Forum where even the most controversial topics can be explored and the most pertinent issues are chosen. Attendees have come to expect nothing less than the trust that has been built over the past twelve years.

The South Platte Forum has not only survived, but thrived. There is continued interest with increasing attendance. It has an ability to attract top-level speakers, including Governors, Legislators, State Department Heads, Federal Agency Directors, and Supreme Court and Water Court Justices. Colorado State University Cooperative Extension and the US Bureau of Reclamation have joined on as sponsors. And, the continued improvement in quality has been done while maintaining reasonable fees.

And now, here we are today, recognizing Chuck GrandPre. A man whose dedication and committed efforts created the South Platte Forum; a place where people can freely and openly discuss the many dimensions of the South Platte River Basin, including the interface of environmental and water management. His outstanding vision, leadership, and persistence allowed the Forum to become the success it is today.

- Gene Schleiger
Northern Colorado Water Conservancy District

The South Platte Forum was initiated in 1989 to provide an avenue for a timely, multi-disciplinary exchange of information and ideas important to resource management in the South Platte River Basin. Its stated mandates are:

- To enhance the effective management of natural resources in the South Platte River Basin by promoting coordination between state, federal and local resource managers and private enterprise, and

- To promote the interchange of ideas among disciplines to increase awareness and understanding of South Platte River Basin issues and public values

The expressed opinions and information are not necessarily endorsed by the South Platte Forum or any of its sponsoring agencies.

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SOUTH PLATTE BASIN WILDLIFE HABITAT OVERVIEW

Daniel F. Luecke[1]

The South Platte River Basin is a very complex river system. The basin includes two physiographic provinces - the Front Range Section of the Southern Rocky Mountain Province and the Colorado Piedmont Section of the Great Plains Province. Elevation change, geology, and climate variations lead to a rich diversity of vegetation and wildlife and, at the same time, the presence of a major metropolitan area and agricultural region have transformed many of its features and established a wide range of uses. Its source is near the Continental Divide a few miles northwest of Fairplay and, from here, it flows in a southeasterly direction for about 75 miles before turning to the northeast where it passes through the montane region of the Platte Canyon emerging 40 miles downstream where it enters the Colorado Piedmont. Only a few miles before leaving the canyon, it is joined by the North Fork, which has it headwaters new Kenosha Pass.

It continues as a plains stream for nearly 300 miles to its confluence with the North Platte River near North Platte, Nebraska. As it traverses the piedmont it passes through the Denver metropolitan area and through or near several smaller communities, and it bisects the agricultural region of the South Platte valley. Along the way it is joined by a number of perennial tributaries: Plum Creek, Bear Creek, Cherry Creek, Clear Creek, Boulder Creek, St. Vrain River, Big Thompson River, and Cache la Poudre River.

The South Platte has a drainage area of about 24,300 mi^2 and is located in parts of three State -- Colorado (79 percent of the basin), Nebraska (15 percent of the basin), and Wyoming (6 percent of the basin). Elevations in the basin range from 14,286 ft at Mt. Lincoln on the Continental Divide to 2,750 ft. at the confluence of the South Platte and North Platte Rivers.

The basin has a continental-type climate modified by topography, in which there are large temperature ranges and irregular seasonal and annual precipitation. Mean temperatures increase from west to east and on the plains from north to south. Areas along the Continental Divide average 30 in. or more of precipitation annually, which includes snowfall in excess of 300 in. In contrast, the annual precipitation on the plains east of Denver, Colorado, and in the South Park area in the southwest part of the basin, ranges from 7 to 15 in. Most of the precipitation on the plains occurs as rain, which typically falls between April and September, whereas most of the precipitation in the mountains occurs as snow, which typically falls between October and March.

The three-state area of the basin has about 3 million people, over 95 percent of whom live in Colorado along the Front Range, the most concentrated population density in the Rocky Mountain region. Populations outside the urban corridor are small and centered in small towns located along the principal streams. The economy in the mountainous headwaters is based on tourism and recreation, in the urbanized south-central region on manufacturing, service and trade industries, and government services, and downstream from Denver on agriculture and livestock production.

[1] 3870 Norwood Court, Boulder, CO 80304, (303) 443-0634

Forests, rangeland and agriculture are the dominant types of land use and land cover in the basin. Dry land agriculture that is actually cropped varies from year to year around an average of about 1.4 million acres and irrigated agriculture is about 800,000 acres. Urban land is a small but ever growing share and now exceeds 470,000 acres.

Water quality in the higher elevations of the basin and its tributaries is generally good, with the exception of segments or reaches that are contaminated by drainage and runoff from abandoned mining operations. Downstream of the Denver metropolitan area quality deteriorates. One of the most compromised segment is immediately upstream of the confluence of the Platte and Clear Creek. So-called Segment 15 is characterized by heavy commercial and industrial land uses. Along the segment itself there are active gravel mines, flooded gravel mines, pasture lands, and agricultural lands. Erosion control, which has extensively modified the upstream channel, has negatively affected the riparian zone, river hydrology, and assimilative capacity of the river. Dewatering flows from gravel-mining operations along the river contribute sediments and also affect the river hydrology. Dissolved oxygen problems tend to occur in large ponded areas, which are a result of in-stream gravel mining and small dams built for irrigation withdrawal and utility line protection. Low species diversity throughout segments indicates that poor water quality and habitat degradation are impairing the health of aquatic communities. Farther downstream surface and subsurface return flows from agriculture contribute fertilizers and pesticides.

In the future, residents of the South Platte face a number of important issues with varying degrees of immediacy: water supply for the Front Range; the drought of 2002; the major fires of the past five years; protection of the Platte Canyon found eligible for Wild and Scenic designation; contributing to the restoration of the endangered species habitat in Central Nebraska; and the protection and restoration of the river corridor through and downstream of Denver.

Notes:

THE US EPA – HELPING THE ENVIRONMENT

Robert E. Roberts[1]

Most people want to do the right thing - but many don't know what the right thing is. Most people want clean air, clean water and better treatment of land, but they may not see how what they are doing is impacting on the air, water and land. My job is not to look over everybody's shoulder as they go about their day-to-day business, hoping to catch them in an environmental violation. My job is to help people understand what is required, because I believe that when they understand what is required, almost everyone will work toward that result.

[1] Regional Administrator, US Environmental Protection Agency, Region 8 Office, 999 18th Street, Suite 300 Denver, CO 80202-2466

THE STATE OF WATER USE

Steve Sims[1]

I. Introduction
II. Overview of major issues facing South Platte water users
  A. Amended South Platte groundwater use rules
  B. Three State Agreement concerning endangered species on the Platte River
    1. The issues
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    1. A primer on the Compact
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    1. The parties
    2. The issues
    3. The trial schedule
IV. Conclusion: The future of water use in the South Platte
  A. Need for flexibility to achieve maximum utilization
  B. Role of technology to achieve maximum utilization
  C. The potential for decreasing water litigation

Notes:

[1] Assistant Attorney General, State Attorney General's Office, 1525 Sherman St., 5th Floor, Denver, CO 80203, (303) 866-5042

A DECADE ON THE SOUTH PLATTE – REFLECTIONS OF THE WATER COURT

Jonathan W. Hays[1]

The presentation will begin with a brief outline of the changes that have taken place, over time, in the issues presented to the water court before the enactment of the 1969 Water Right Determination and Administration Act.

The court will then outline the changes between 1969 and 1994, when I was appointed water judge. This portion of the presentation will focus on the changes in underground water rights, principally emerging restrictions on well and aquifer pumping.

Finally, I will summarize the significant cases that have come before me during my eight-year tenure as water judge: The South Park Conjunctive Use Project, the City of Golden kayak course and the City of Denver Bi-City effluent exchange application. The focus for this period will be pitfalls to underground storage, emerging in-stream recreational rights, and problems associated with the increasing reliance on effluent exchanges.

Notes:

[1] District Judge, Water Division 1, Weld County Courthouse, P.O. Box 2038, Greeley, CO 80632-0138, (970) 351-7300 Ext.4535

INTEGRATING HABITAT PROTECTION WITH AGRICULTURAL PRODUCTION

Allen Green[1]

Private landowners have the capability and interest to provide for multiple resource benefits on "working lands." There are numerous conservation measures that can be incorporated into most production operations that can benefit both wildlife habitat and agriculture production. While farmers and ranchers have for years worked to be good stewards of the land at their own expense, USDA conservation programs are now available to accelerate those efforts by providing additional levels of financial and technical assistance.

The USDA has several programs that facilitate the integration of wildlife habitat protection and agricultural production. Programs include EQIP, WHIP, and Conservation Technical Assistance.

EQIP (Environmental Incentives Program) – With the State Wildlife Issue, we have the opportunity to integrate wildlife habitat enhancements with production agriculture. For example, we can combine grazing management plans with riparian restoration to benefit wildlife. Fencing, improved watering facilities, and tree and shrub plantings are just a few of the practices that could be applied in a plan to benefit wildlife and maintain livestock production. We can also provide annual wildlife food plots and winter cover by leaving portions of crop fields unharvested.

WHIP (Wildlife Habitat Incentives Program)– Ponds provide multiple benefits to wildlife as well as livestock on farms and ranches throughout Colorado. Range seedings and riparian area restoration efforts are examples of how this program has benefited wildlife habitat and production agriculture. One of the goals in WHIP is to manage wildlife and agriculture conflicts. For example, elk damage to hay fields and stacks may be lessened by providing alternative suitable winter habitat through WHIP contracts.

Conservation Technical Assistance - Conservation plans can be written that focus on the needs of wildlife while addressing agricultural production. For example, leaving minimum amounts of cover during the nesting season can benefit species such as the Mountain Plover. Adjustment of the timing of haying operations to before or after the nesting period, or keeping range forage at acceptable heights are two ways to benefit wildlife.

Notes:

[1] State Conservationist, Natural Resources Conservation Service, 655 Parfait St., Room E-200C, Lakewood, CO 80215, (720) 544-2810

THE CONSERVATION RESERVE ENHANCEMENT PROGRAM - AN OPPORTUNITY FOR SOUTH PLATTE AGRICULTURE

Tim J. Davis[1]

The Conservation Reserve Enhancement Program (CREP) is a voluntary state/federal and private partnership delivered through the United States Department of Agriculture (USDA) that is intended to address environmental resource concerns in a specific geographic region. The program is similar to the popular Conservation Reserve Program (CRP), however CREP provides flexibility to address specific resource needs that otherwise could not be addressed. Several of the criteria required by CREP are met within the South Platte River Basin. Water quality, water conservation, wildlife habitat and other resource concerns have been identified in this basin as critical issues that need to be addressed. Traditional CRP provides annual dry-land rental payments, which is not economically feasible for producers on irrigated cropland in this area. CREP allows for negotiated rental rates, which may approach a more attractive annual payment to producers on irrigated cropland. CREP could offer these rental payments to producers that voluntarily retire selected acres. An important practice that may be used could apply water recharge during non-call periods on the river to those acres through a USDA practice referred to as "Shallow Water Areas for Wildlife." Additional acres currently not efficient to farm could also be voluntarily retired through this program. Producers could receive an annual rental payment for up to fifteen years and a one-time cost-share payment for installation of certain infrastructure necessary to implement the practices. Additional incentives may be provided to influence producers to enroll if necessary. Water rights must be protected to ensure that landowners enrolled in the program retain their water rights through the term of their agreement with the USDA. CREP requires a twenty percent non-federal match, which can come from state government agencies or private organizations. A portion of the non-federal match may be provided through in-kind services. States are limited to enrolling no more than 100,000 acres or receiving no more than two hundred million dollars of USDA funding through this program.

Notes:

[1] Private Lands Coordinator, Colorado Division of Wildlife, 6060 North Broadway, Denver, CO 80216, (303) 291-7274

HABITAT DEVELOPMENT IN THE LOWER SOUTH PLATTE BASIN

Greg Kernohan[1]

Ducks Unlimited conserves, restores, and manages wetlands and associated habitats for North America's waterfowl. These habitats also benefit other wildlife and people. In Colorado, DU has established a strong conservation program that includes restoration, creation, protection and management. Although in the past DU has developed wetlands in a "shotgun" pattern throughout numerous locations in the state, our recently developed strategic plan has recognized several important habitat areas for waterfowl, including the South Platte River Valley. This plan will help focus our efforts and assure we conserve wetlands in the most effective manner possible.

The South Platte River contributes significantly to life-cycle requirements of migrating waterbirds during fall and especially spring migration. But, due to impacts from agriculture and increasing populations along the Front Range, DU considers the South Platte River to be a highly threatened corridor in need of protection and restoration. Our programs are designed to protect properties for long periods of time. Restoration and creation projects are performed on both public and private lands and are secured with a 30-year conservation agreement or conservation easement held by DU in perpetuity. Protection projects include donated or purchased conservation easements held by DU to protect private lands from development in perpetuity. Wetland management is a relatively new discipline for DU, currently implemented on public lands, but the project will eventually grow into private land management.

Notes:

[1] Wetlands Manager, Ducks Unlimited, 2401 13th Ave, Greeley, CO 80631, (970) 506-1797

THE OBSERVED CLIMATE OF THE SOUTH PLATTE BASIN

Nolan J. Doesken[1]

The instrumental records of the climate of the South Platte Basin date back to the early 1870s. Information on mountain snow accumulation is sketchy until the late 1930s. High mountain data is very limited until recent decades. This is not enough time to assess significant long-term climate trends, particularly for highly variable quantities like precipitation. However, these data are adequate to determine seasonal weather patterns and typical ranges of climate variability.

Several key elements of the climate of the South Platte Basin will be presented. The predictable seasonal cycle of temperatures will be shown as a function of elevation within the basin. Typical wind, humidity, and sunshine patterns will also be described. Precipitation will be described in more detail showing spatial patterns and seasonal characteristics and how they vary with elevation within the basin. The frequency of extreme rainfall events will be briefly discussed. Finally, long term time series of temperature, precipitation and snow accumulation will be shown for selected sites in the basin that show the range of variations that can be expected. For example, at lower elevations annual precipitation can vary from half or less of the long-term average to nearly double the average. Such large variations effectively mask any long-term trends that may exist in the observed data. Temperatures are much more stable from year to year making it much easier to detect apparent changes. However, temperature, humidity and evaporation are all very sensitive to the exact location and exposure of weather instruments. Most Colorado weather stations have experienced changes in instrumentation, location and surroundings, which make it very difficult to assess regional climate trends.

Notes:

[1] Assistant State Climatologist, Colorado Climate Center, Dept. of Atmospheric Science, Colorado State University, Fort Collins, CO 80523, (970) 491-8545

UNDERSTANDING COLORADO CLIMATE CHANGES

Roger A. Pielke, Sr.[1]

The current Colorado drought provides evidence of our increased vulnerability of water resources to long-term periods of below average precipitation. Streamflow and reservoir storage, for example, are at all-time low levels despite rain and snow amounts which have been less for longer periods of time in the past. This disparity will be discussed. The inability of predicting these droughts is also documented.

In the long-term prediction of climate, the current event emphasizes the lack of any predictive skill. The loss of resiliency to drought is also a major concern. In my talk, the failure of longer-term GCM model predictions is documented; and an alternate approach based on vulnerability is proposed.

Notes:

[1] State Climatologist; President-Elect of the American Association of State Climatologists; Professor, Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523, (970) 491-8293, http://blue.atmos.colostate.edu

GLOBAL INFLUENCES ON COLORADO'S CLIMATE

Kevin E. Trenberth[1]

The atmosphere is global and Colorado's weather and climate is largely determined by influences from elsewhere. In fact, the atmosphere is a "global commons" and serves as a dumping ground for pollution from all nations. Air over one nation is half way around the world a week later, as shown by manned balloon flights. While rain is a remarkable cleanser of the atmosphere, some gases are not affected, long-lived and changing our climate. Global warming is happening. In Colorado, as in other mountain areas, this means more precipitation falls as rain instead of snow, snow melts sooner, and there is less snow pack as we go into the summer. Risk of summer drought increases. With it comes increased heat waves and wildfires. The summer of 2002 is perhaps a taste of what we can expect more of in the future. Water will become a valuable resource.

Notes:

[1] Climate Analysis Section, National Center for Atmospheric Research, PO Box 3000, Boulder, CO 80307, (303) 497-1318

IT'S OUR WATER, COLORADO

Cynthia Peterson[1]

The Colorado Water Protection Project (CWPP) has undertaken a statewide public education campaign to inform residents about the causes of, and solutions to, household-generated polluted runoff. The project's objectives are to increase public awareness 1) about what household-generated polluted runoff is, 2) that individuals can prevent some household-generated polluted runoff, and 3) about how polluted runoff enters local rivers, lakes and streams.

The project has used a number of different strategies to achieve these objectives, including: television, radio and bus sign advertising; television, radio and print news coverage; a Web site; print and compact disc publications; and local projects conducted by League volunteers.

A pre-survey of Colorado residents to determine baseline levels of awareness and appropriate communication methods was administered prior to commencing outreach efforts. Two follow-up surveys have been conducted to evaluate the success of project activities and to provide direction for subsequent endeavors.

Notes:

[1] Project Manager, Colorado Water Protection Program, League of Women Voters, 1410 Grant St., Ste. B204, Denver, CO 80203, (303) 861-5195

THE SOUTH PLATTE NAWQA – AN UPDATE OF CYCLE II ACTIVITIES

Suzanne S. Paschke, Ph.D.[1]

The National Water-Quality Assessment (NAWQA) Program of the U.S. Geological Survey is the primary source for long-term, nationwide information on the quality of streams, ground water, and aquatic ecosystems. The goal of NAWQA is to collect long-term, consistent, and comparable information to support sound management and policy decisions. The NAWQA program is designed to answer these questions: What is the condition of our Nation's streams and ground water? How are these conditions changing over time? How do natural features and human activities affect these conditions? The South Platte River Basin is one of more than 50 NAWQA study units across the nation. A first cycle of NAWQA investigation was completed in the South Platte River Basin from 1992 to 1995, and a second cycle of NAWQA study in the South Platte River Basin began in 2002 and will continue through 2005.

Cycle II NAWQA investigations in the South Platte River Basin include studies of the status and trends of surface-water quality, biota, and ground-water quality. Monthly surface-water quality sampling and annual biological community inventories are ongoing at four study sites. This trend sampling is designed to evaluate long-term changes in water quality and stream ecosystem conditions in urban, agricultural, mixed urban/agricultural, and undisturbed reference areas. A synoptic sampling of fish, bed sediment, and surface-water quality to evaluate mercury bioaccumulation and its availability in biota at eight sites was completed during the summer of 2002. A third surface-water study is evaluating the effects of urbanization on stream water-quality and ecosystems. Hydrologic, geomorphic, chemical, habitat, and biological characteristics of 30 stream sites are being evaluated to determine stream response along a gradient of urban land use. There are four ongoing ground-water studies as part of the South Platte NAWQA. During the summer of 2002, the project completed resampling of 30 monitoring wells in South Platte alluvial aquifer underlying irrigated agriculture (corn), and results will be compared to previous samples collected during the first cycle of NAWQA. During the fall of 2002, 60 ground-water monitoring wells will be installed for two studies: a second agricultural land-use study beneath areas of dry-land wheat farming, and an urban land-use study beneath areas of recent resident/commercial development. A fourth ground-water study is investigating hydrologic and geochemical controls on occurrence and transport of natural and anthropogenic contaminants in the Dawson aquifer.

Notes:

[1] U.S. Geological Survey, Denver Federal Center, P.O. Box 25046 MS 415, Lakewood, CO 80225, (303) 236-4882 X352

SOUTH PLATTE GROUND WATER AND AGRICULTURAL CHEMICALS -PROTECTING A VULNERABLE AQUIFER

Troy A. Bauder[1] and Reagan M. Waskom[2]

Agriculture and water are inseparable in Colorado. In fact, adequate supplies of clean water for drinking, irrigation, industry and recreation are critical for the lifestyle that all Coloradoans enjoy. This reality is accentuated in the South Platte basin with the majority of the State's population and a significant proportion of the State's irrigated acres. Additionally, Colorado's leading county for agricultural receipts, Weld, lies within the basin. The intensity of water use in the basin presents challenges for preventing ground water contamination.

The Agricultural Chemicals and Ground water Protection Program, a cooperative effort of the Colorado Department of Agriculture, Colorado State University Cooperative Extension, and the Colorado Department of Public Health and the Environment has been working on South Platte ground water issues for over a decade. This work includes a monitoring network, vulnerability studies, Best Management Practices (BMP) adoption assessment, and educational outreach programs focused on crop producers, commercial applicators, homeowners, and the green industry.

The ground water program has sampled the South Platte alluvial aquifer from Denver to the state line in 1992 and 2001 and samples Weld County annually since 1995. Domestic, monitoring, and irrigation wells are used in this effort. During this time period, over 650 samples taken from over 200 wells have been analyzed for inorganic constituents, nitrate-nitrogen, and a suite of pesticides. The sampling program has revealed that nitrate-nitrogen is the most prevalent contaminant with approximately 90% of wells sampled containing detectable levels (>0.5 mg NO_3-N L^{-1}) and 30% above the drinking water standard (10 mg NO_3-N L^{-1}). Pesticide analyses have detected 17 different compounds, but only Atrazine has been found above an established standard for drinking water. Triazine herbicides, particularly Atrazine and Prometone, are the most commonly detected compounds.

The South Platte Basin has been the focus of educational outreach programs by the Ground Water Program and several other organizations for close to a decade. The results of these activities can be measured by changes in farming practices or by improvements in the ground water itself. The Ground Water Program has assessed BMP adoption statewide with mailed surveys in 1997 and 2001. These results suggest growers in the South Platte utilize BMPs more frequently than the state average, but less frequently than irrigators in the High Plains or San Luis Valley. Pest management BMPs have the highest rate of adoption followed by nutrient management with irrigation BMPs with the lowest adoption.

[1] Extension Specialist, CSU Cooperative Extension, Dept. of Soil and Crop Sciences, Colorado State University Fort Collins, CO 80523-1170, (970) 491-4923
[2] Extension Specialist, CSU Cooperative Extension, Dept. of Soil and Crop Sciences, Colorado State University Fort Collins, CO 80523-1170, (970) 491-2947

Having several years of data from the Weld County portion of the South Platte alluvial aquifer, the Ground Water Program is using the results to determine whether changes in water quality are present over time. Trend analysis of irrigation wells in the Weld County data set reveal that nitrate across the data set is relatively stable, but with more individual wells increasing than decreasing. Likewise, triazine herbicide concentrations show a significant decrease across the aquifer, but with 14 of 33 wells showing significant downward trends and one well had an upward trend. These results suggest that there is potential to change ground water quality in this portion of the aquifer within 10 years.

Portions of the South Platte alluvial aquifer have significant water quality problems. However, with continued cooperation from the agricultural industry and incentives from the public sector, progress can be made towards improving the water for future generations.

Notes:

WATER QUALITY PROTECTION PROVIDED BY ONSITE WASTEWATER SYSTEMS

Robert L. Siegrist, Ph.D., P.E.[1]

Wastewater infrastructure includes a continuum of approaches that range from highly centralized systems serving densely populated urban areas to decentralized onsite systems serving sparsely populated rural areas. In Colorado and the U.S., onsite and decentralized systems serve about 25% of the population and are characterized by collection distances that are short or negligible, with tank-based pretreatment followed by natural systems for advanced treatment before discharge to the land with recharge to ground water. In the past, onsite systems have often been viewed as a temporary approach to wastewater management and acceptable for use only until a centralized approach could be implemented. Yet there are many situations within Colorado and the U.S. (and more so in developing countries) where centralized systems are neither cost-effective nor sustainable due to a variety of factors (e.g., low density development, rugged topography, limited water and energy supplies, lack of skilled labor). In these situations, decentralized systems can and should be considered as long-term solutions.

Decentralized approaches to wastewater infrastructure are based on the use of onsite wastewater systems (OWS). These have evolved greatly during the 20th century from early cesspool and seepage pit designs that were focused simply on waste disposal, to contemporary OWS designs that include unit operations to achieve advanced treatment as well as disposal and beneficial reuse. OWS can now be designed from a rapidly increasing array of options that include engineered tank and packed-bed reactors as well as natural system treatment operations that can be tailored for a given application to yield high treatment efficiencies over a long service life at low cost, and be protective of public health and environmental quality. In a typical modern system, combined raw sewage flows into an anaerobic bioreactor (i.e., the septic tank) wherein the principal treatment processes include solids separation and anaerobic digestion. Unit operations that provide higher levels of pretreatment (e.g., granular media filters, disinfection units) may be employed to reduce the levels of some pollutants in STE. Advanced wastewater treatment is typically achieved by discharging the effluent into a subsurface trench or bed from which infiltration and percolation occur through an underlying unsaturated soil zone. After percolation through 60 to 120 cm or more of soil, the renovated water can recharge the ground water under the site, and in some cases, eventually be transported into surface water near the site. In these onsite systems, the soil serves as an *in situ* porous media biofilter (PMB), which can provide treatment efficiencies comparable to tank-based advanced treatment plants. However, older onsite systems, and even newer systems, that were not properly designed, sited, constructed, operated, and maintained may present risks to public health and water quality.

To advance the science and engineering of treatment technologies and enhance the long-term viability of decentralized wastewater systems in Colorado, the U.S. and abroad, a program of research and educational activities was initiated at the Colorado School of Mines (CSM). This multidisciplinary program involves fundamental and applied research designed to quantify and model key hydraulic and purification processes in decentralized treatment systems. Recent and

[1] Professor and Division Director, Environmental Science & Engineering, Colorado School of Mines, Golden, CO 80401-1887, (303) 273-3490

ongoing research is focused on natural and engineered porous media biofilters at the single-site to watershed scales. Bench-scale studies are completed to understand fundamental processes while pilot-scale unit operations and test cells are used to study treatment processes under controlled conditions. For this research, apparatus and facilities exist in laboratories at CSM as well as at a new field site at Mines Park housing complex on the CSM campus. Field investigations occur at operating facilities elsewhere in Colorado and at sites across the U.S. Monitoring and assessment of hydraulic and purification processes involves sampling and analysis combined with *in situ* sensors and computer-assisted data acquisition and visualization. Multicomponent tracer and surrogate studies as well as DNA fingerprinting are employed to delineate pollutant source and flow and transport behavior. Analytical and numerical models are used to describe micro- (e.g., soil pore-scale) to macro-scale (e.g., watershed-scale) processes.

This presentation will highlight the process function and performance capabilities of common and emerging onsite wastewater systems and the circumstances under which they can protect the State's water quality as well as those conditions where water quality deterioration may be experienced.

Notes:

WHITEWATER PARKS AND WATER RIGHTS

Steve Bushong[1]

In the past, Colorado's economy was primarily based on mining and agriculture and those uses still command much of the State's water. That economic base is changing. Recreation is becoming an economic force in Colorado and it is a way of life for many who live here. The recreation industry needs water, however, just like any other type of beneficial use. Several recent cases involving water rights for kayak courses reflect this change in Colorado's economy and its use of water. Kayak courses are built with large stone structures that span the river and work by concentrating and controlling the flow of water to create whitewater features. At increased flows up to the design capacity, the whitewater features created by the structures get larger and more powerful and attract more boaters. In the first years after construction, the City of Golden's kayak course was rated one of the top ten courses in the nation and hosted Olympic trials and international boating events. The Golden course and the courses built by the towns of Vail and Breckenridge are conservatively estimated to have an economic value of more than $20 million each to their respective local economies. Golden, Breckenridge and Vail sought water rights to protect their investment in the courses and were awarded water rights by the Water Courts for up to a maximum of 400 cfs for Vail, 500 cfs for Breckenridge and 1,000 cfs for Golden. All three cases have been appealed to the Colorado Supreme Court.

The principal requirements to obtain a water right in Colorado are diversion or control of water for a beneficial use. These requirements were found to be satisfied for flows up to the maximum design capacity of the Golden, Vail and Breckenridge kayak courses. Similar to hydropower plants, the Courts found that more economic value is generated by the kayak courses at the higher flows. Kayak courses have the benefit of creating a large economic return without consuming or polluting the water and without de-watering the stream. In the Golden, Vail and Breckenridge cases, the Water Courts found that all the water used in the kayak courses would be used and re-used many times downstream by other water users. On over-appropriated streams, such non-consumptive uses are one of the few new water rights that remain available for appropriation. Numerous municipalities and water districts are now seeking similar water rights. In response to the applications being filed, the Legislature adopted a new law that allows the Colorado Water Conservation Board to make recommendations to the Water Court regarding future kayak course water rights. The Golden, Breckenridge and Vail cases, and related issues, will be discussed.

Notes:

[1] Attorney, Porzak Browning & Bushong, LLP, 929 Pearl St., Ste. 300, Boulder, CO 80302

BENEFICIAL USE LEGISLATION

Ken Gordon[1]

I. Introduction

II. Senate Bill 156
   a. In-stream Flow
   b. Brief summary of bill
   c. Course of bill through Legislature
      i. Supporters of bill

III. Drought
   a. Effects on Colorado

VI. Possible Legislation in 2003

Notes:

[1] Colorado State Senator, Colorado State Legislature, 200 E Colfax, Room 331, Denver, CO 80203, (303) 866-4543

PROTECTING OUR FUTURE

Robert Sakata[1]

"In order to foster the health, welfare, and safety of the inhabitants of the state of Colorado and to facilitate the enjoyment and use of the scenic and natural resources of the state, it is declared to be the policy of this state to prevent injury to beneficial uses made of state waters, to maximize the beneficial uses of water, and to develop water to which Colorado and its citizens are entitled and, within this context, to achieve the maximum practical degree of water quality in the waters of the state consistent with the welfare of the state." Colorado Water Quality Control Act 25-8-102

How do we attempt to achieve the lofty goals set forth in the Colorado Water Quality Control Act? I will briefly describe the different ways to be involved in "running your ecosystem" from a water quality standpoint. From the formal rulemaking proceedings held by the Water Quality Control Commission in the setting of classified uses and standards to the informal workgroups and councils formed to explore ways to develop networks of those individuals interested in different aspects of the water quality arena.

What does the Water Quality Control Commission do? How do we go about protecting water quality? As a Commissioner, what do I look for when setting water quality standards? I would also like to personalize the process and share what information I have found valuable to me in serving on the Commission the past five years.

I'll also take a quick look at challenges and opportunities that face Colorado; Colorado Water Quality Control Act section 25-8-204 (quantity/quality), net environmental benefits in arid west conditions, TMDL development, and etc.

Water Quality Resource List **Oct. 2002**

Water Quality Control Commission, 4300 Cherry Creek Drive South, Denver, Colorado 80246-1530, (303) 692-3469, FAX (303) 691-7702,
http://www.cdphe.state.co.us/op/wqcc/wqcchom.asp
Administrator: Paul Frohardt, (303) 692-3468

Colorado Water Quality Forum, Lisa Carlson, (303) 820-5662, http://www.cwqf.org

Section 309 Study Advisory Group (HB02-1344), Paul Frohardt, (303) 692-3468

Colorado Water Quality Monitoring Council, Holly Huyck, Email: hhuyck@csd.net,
Web site: http://cwqmc.colostate.edu

Section 319 Non-point Source Program, Laurie Fisher, (303) 692-3570

[1] Chair, Water Quality Control Commission, 4300 Cherry Creek Dr. South, Denver, CO 80246-1530, (303) 692-3469

Water Quality Control Division, South Platte Watershed, Dick Parchini, (303) 692-3516

South Platte regular rulemaking hearing schedule:
Issues scoping hearing……. Oct 15, 2002
Issues formulation hearing….. November 2003
Rulemaking hearing…… July 2004

Basic Standards review schedule:
Issues scoping hearing……. Oct 2003
Issues formulation hearing….. November 2004
Rulemaking hearing……..... July 2005

Documents of interest;
1. 2002 Status of Water Quality in Colorado "305(b) report"
2. Public Participation Handbook
3. Water Quality Management and Drinking Water Protection Handbook
4. Colorado 2002 303(d) List

Notes:

SOUTH PLATTE DECISION SUPPORT SYSTEM AND RECREATIONAL IN-CHANNEL DIVERSIONS

Eric W. Wilkinson[1]

The South Platte River Basin is a complex, highly managed, over-appropriated stream system. As demands continue to grow for the finite amount of water that is available to meet an expanding spectrum of beneficial uses, we all face the challenge of how to meet those demands within the confines of the available resources. Water users continue to hone their skills in finding ways to "stretch" the available water supplies.

Over the past several years, the Colorado Water Conservation Board (CWCB) and the Colorado Division of Water Resources have developed decision support systems (DSS), first in the Colorado River Basin and then in the Rio Grande River Basin, to provide the "tools" to water users, water administrators, communities, water purveyors, conservation groups, regulatory agencies, and the public as a whole to better manage basin water resources. These computer-based systems provide robust databases that are coupled with computer accounting and simulation tools. These systems provide for the efficient collection and compilation of data on a real-time basis, and include tools that use compiled data to: aid in the real-time administration of stream systems; allow analyses of both current and proposed stream system operations; and provide means of planning for water resources needs into the future.

The Colorado River DSS has been operational for a number of years and the Rio Grande DSS is nearing completion. A scoping study for the development and completion of the South Platte DSS has been completed and the initial phases of data compilation for this system have already begun. Because of the complexity of the South Platte Basin, including the complex water administration system and the extensive interaction of surface and groundwater (both tributary and non-tributary), the development of the South Platte DSS presents some new and unique questions and challenges that must be addressed if the system is to be successful. Design and implementation of the system is planned to take more than five years. Water user involvement in the definition, design, configuration, and implementation of this system is essential. Ongoing maintenance of the system and the associated databases is essential if the system, once implemented, is to remain useful and credible.

Recreational In-Channel Diversion (RICD) water rights, as defined by the Colorado State Legislature in 2001 in SB-216, are representative of society's expanding demands for the beneficial uses of water in Colorado. Several entities within Colorado have filed for RICD water rights. The CWCB is responsible for reviewing these applications and providing recommendations to the water courts concerning specific characteristics or components of these water rights applications. RICD water rights can have an effect on the future administration of a stream system. Those effects, although not always initially evident, may be significant. As part of the CWCB's statutory charge, those future effects must be considered in the CWCB analyses of the water rights.

Following the development and adoption of rules and regulations guiding the review of these applications, the CWCB conducted its first public hearing on the City of Pueblo RICD application in July and its second public hearing on the Upper Gunnison Water Conservancy District RICD application in September. The CWCB, and the rest of the water community, are faced with new and unique challenges and issues with each of these applications.

[1] General Manager, Northern Colorado Water Conservancy District, PO Box 679, Loveland, CO 80539, (970) 667-2437

CONSERVATION AND DROUGHT PLANNING

Brad Lundahl[1]

Drought is likely the most complex but the least understood of all natural disasters. While more common in the arid parts of the West, no state or region is immune to the effects of drought. Colorado is currently facing what could be the worst drought in the state's history. Throughout the year, governments, businesses, and individuals have been working to address the constantly changing conditions associated with this drought. This will be a discussion from the state's perspective of what measures were taken to prepare, respond, and mitigate the effects of this drought.

Notes:

[1] Chief of Conservation and Drought Planning, Colorado Water Conservation Board, Office of Water Conservation, 1313 Sherman St., Ste. 721, Denver, CO 80203, (303) 866-3339

CUMULATIVE IMPACTS OF AGGREGATE MINING ALONG THE SOUTH PLATTE RIVER IN COLORADO: A STUDY USING GIS APPLICATIONS

Rena Brand[1]

Over time, aggregate mining has changed the hydro-geomorphologic and environmental conditions on and near the South Platte River in Colorado, the cumulative impacts of which, depending on perspective, have had both positive and negative repercussions. The US Congress enacted laws that became the Clean Water Act of 1977 to "restore and maintain the chemical, physical and biological integrity of the Nations Waters." Section 404 of the Clean Water Act regulates the placement of fill material into waters of the United States, and established a permit program to ensure such impacts comply with environmental requirements. Since some marketable aggregate deposits in Colorado are located in or near the South Platte River and adjacent wetlands, mining of the aggregates has often required a Section 404 Permit. A study is proposed that evaluates the cumulative impacts of Section 404 permitting of aggregate mining along the South Platte River in Colorado from Denver to Greeley using GIS and remote sensing techniques. Factors such as change in open water, wetlands, vegetation, and wildlife habitat along the river corridor will be quantified and compared using land-use classification comparisons from the 1930's, 1950's, 1970's and 1990's. The data will be presented so that decision-makers can be informed of the effects (positive or negative) of gravel mining along the river corridor.

[1] University of Colorado at Denver, Masters of Engineering GIS Program, (303) 979-4120

A METHOD FOR ESTIMATING ANNUAL COUNTY-LEVEL IRRIGATION WATER REQUIREMENTS IN COLORADO: A PROGRESS REPORT – JULY 2002

Dr. David Carlson[1], James Leeper[2] and Mark Pond[2]

This report describes a cost-effective method for estimating the total annual irrigation water requirement for each county and crop type in Colorado for most years since 1975. *Irrigation Water Requirement (IWR)* is the amount of irrigation water—exclusive of precipitation and soil moisture—required to meet the consumptive water requirement of the crop.

The essence of this method is to combine county-level estimates of irrigated acreage, published annually by USDA for most crops, with county-level seasonal unit IWR values for these crops (e.g., 1.5 acre-feet per acre for corn, etc.). County-level seasonal unit IWR values are weighted averages of seasonal unit IWR values calculated at climate stations within the county. Such unit IWR values are available from Colorado's Decision Support Systems (CDSS) for all crops at one or more climate stations in every county in Colorado. The CDSS is maintained jointly by the Colorado Water Conservation Board and the State Division of Water Resources.

To test the efficacy of this method, called the *ag statistics method*, estimates of total irrigated acreage and total IWR for all 18 Western Slope counties in water divisions 4-7 for the year 1993 were developed using the ag statistics method and compared with estimates generated by the CDSS. Due to time constraints, county-level unit IWR values were developed through data from a single representative climate station in each county rather than a weighted average of such information from several climate stations within each county. Thus, testing of the ag statistics method is still provisional. The year 1993 was selected because the CDSS contains detailed estimates of irrigated acreage at the ditch level from satellite imagery through divisions 4-7.

COMPARING METHODS IN 18 WESTERN SLOPE COUNTIES IN DIVISIONS 4-7 (1993)					
Total Irrigated Acreage			Total Irrigation Water Requirement (IWR)		
GIS-based Method	Ag Statistics Method	Difference	GIS-based Method	Ag Statistics Method	Difference
766,892 acres	723,012 acres	- 5.7 %	1,050,749 acre-feet	961,369 acre-feet	- 8.5 %

Estimates of the economic value of irrigation water are included, as well as recommendations for future analysis.

Partial funding for this report was provided by the Colorado Water Conservation Board.

[1] Resource Analyst, Colorado Dept. of Agriculture, Resource Analysis Section, 700 Kipling St., Ste. 4000, Lakewood, CO 80215-8000, (303) 239-4112
[2] Research Assistant, Colorado Dept. of Agriculture, Resource Analysis Section, 700 Kipling St., Ste. 4000, Lakewood, CO 80215-8000, (303) 239-4112

THE COMMUNITY COLLABORATIVE RAIN AND HAIL STUDY COMES TO DENVER

Nolan J. Doesken[1]

Since the Fort Collins Flood of 1997, the Colorado Climate Center has been utilizing volunteers of all ages to help track and map storms in the South Platte Basin. This year, with the help of the Urban Drainage and Flood Control District, Denver Water, the Colorado Scientific Society and the Colorado State University Jefferson County Cooperative Extension, the Community Collaborative Rain and Hail Study (CoCo RaHS) targeted the Denver area. More than 150 new volunteers were recruited and trained to join more than 500 other volunteers already gathering rain, hail and snow data in northern Colorado. All data are available on line via the CoCo RaHS web page at http://www.cocorahs.com.

Despite the drought, there were surprisingly many storms during 2002 with several producing rains in excess of 1.50 inches in 24 hours. Examples of some of these storms will be shown along with hail pads showing the number and size of hail stones. There were many fewer hail storms than a typical year, but stones nearly three inches in diameter were observed near Parker.

Preliminary results suggest that accurate mapping of local storm patterns across the Denver area and the South Platte Valley will require approximately one reporting station per square mile. Despite the large number of volunteers already participating in the project, hundreds more are needed to achieve this ideal coverage. Plans are to continue this project and add more volunteers in future years. Individuals of any age or education that would like to help with the study, are encouraged to join.

[1] Assistant State Climatologist, Colorado Climate Center, Colorado State University, Dept. of Atmospheric Science, Fort Collins, CO 80523, (970) 491-8545

THE IMPORTANCE AND FUNCTIONING OF WATER MARKETS IN THE SOUTH PLATTE BASIN OF COLORADO

Charles Howe[1] and Chris Goemans

In the western U.S., the development of new water supplies has become costly in both economic and environmental terms while roughly 85% of total consumptive use still takes place in irrigated agriculture. Much of this water is used in production of feed and forage crops which support a large livestock industry, but methods of application are often inefficient, creating "win-win" opportunities for the transfer of water from agriculture to growing M&I and environmental uses.

Changes of water ownership in Colorado take place through informal market-like arrangements under the supervision of the Division Water Court. In the South Platte Basin there are two principal water markets: that for traditional water rights and that for shares (allotments) in the Northern Colorado Water Conservancy District (the District supplies about 30% of the basin water supply). All transfers are to new uses in the Basin because of the dynamic regional economy. Since each traditional water right is unique while NCWCD shares are homogenious, one can expect these two markets to function differently and perhaps to have different impacts on the region's economy.

To compare the functioning of these two water markets, all permanent water right transfers in the South Platte Basin (Water Division 1) for the period 1979 through 1995 were identified in the records of the Water Court and classified by size (acre-feet) and nature of transaction: ag-to-ag, ag-to-M&I, and other. Transfers of NCWCD shares over the same period were similarly classified. The volumes of trades over time (acre-feet), the aggregate nature of the trades and the path of prices for NCWCD shares are shown in the accompanying figures (prices for traditional rights are available only when purchased by a municipality).

It is clear the NCWCD share market results in frequent small trades - primarily from ag to urban but with some ag-to-ag. The market for traditional water rights is more irregular over time, results in transfers averaging ten times the size of those in NCWCD and is nearly all ag-to-urban. NCWCD prices have soared in recent years with rapid economic growth, increasing environmental demands and climate change concerns. NCWCD prices are often used as a guide for other transactions, although NCWCD prices are generally above those of roughly equivalent traditional rights because of high water quality, lower transaction costs and good "plumbing" for delivery.

The direct and indirect negative impacts of transferring water out of ag stem from the drying up of ag acreage, resulting in average regional income loss and regional tax loss of $22 and $9 respectively. We estimate the "present value" of these losses over five years to be about $83 per acre-foot. The present value of benefits per acre-foot to the purchasing towns is suggested by the purchase prices which recently averaged about $2000 for water rights and nearly $10,000 for NCWCD shares, indicating very large net economic gains from the transfers that have occurred.

[1] University of Colorado, Charles.Howe@Colorado.edu

COLORADO'S STREAM AND LAKE PROTECTION PROGRAM -PRESERVING THE WATER-DEPENDENT NATURAL ENVIRONMENT

Anne Janicki[1]

New water right appropriations and water right acquisitions are tools that state agencies, water users and federal land managers can use in Colorado to ensure protection of instream flows and natural lakes within Colorado's existing water right framework.

In 1973, the Colorado legislature recognized the need to "correlate the activities of mankind with some reasonable preservation of the natural environment" and vested the Colorado Water Conservation Board with the exclusive authority to appropriate or acquire water for instream flows. The Board accomplishes this mission in two ways: 1) through new appropriations for instream flow or natural lake water rights, and 2) by the acquisition of senior water rights from willing donors or lessors.

Each year, the Board requests recommendations from state and federal agencies for streams and lakes to be considered for new appropriations. The Board works with these agencies or other interested parties to plan and coordinate data collection, develop flow recommendations and appropriate the water rights. Once decreed by the water court, these new water rights are monitored and protected by the Water Conservation Board staff. To date, the Board has filed for water rights on over 1,400 stream segments, covering over 8,000 miles of stream, and 475 natural lakes.

The Board may also acquire senior priority water rights through a variety of contractual and legal mechanisms to preserve the natural environment. This year, the state Legislature passed SB 02-156 which removes the "minimum" standard for water right acquisitions, and broadens the Board's authority for acquisitions to preserve or improve the natural environment. The Board will be initiating rulemaking this fall to implement the provisions of SB 02-156.

The Board is prohibited from acquiring water by eminent domain, therefore, water right acquisitions are typically initiated by water users and water right owners. To date, all of the Board's acquisitions have been through donations or leases of water rights. Each transaction is governed by an Acquisition Agreement, which outlines the responsibilities and obligations of each party. Typical agreements include terms related to monitoring and enforcement of the rights, reversions for drought and emergency conditions, and responsibilities in any water court proceedings. The acquisition of senior rights allows the Board to protect the natural environment on streams where water may not be available for a new junior priority water right. In addition, the Board may rely on the acquired senior rights to supplement existing junior instream flow water rights. By working with conservation groups, private parties, government agencies, and municipalities, the Board has acquired over 390 c.f.s and 3,652 acre-feet of senior rights on streams and lakes throughout the state.

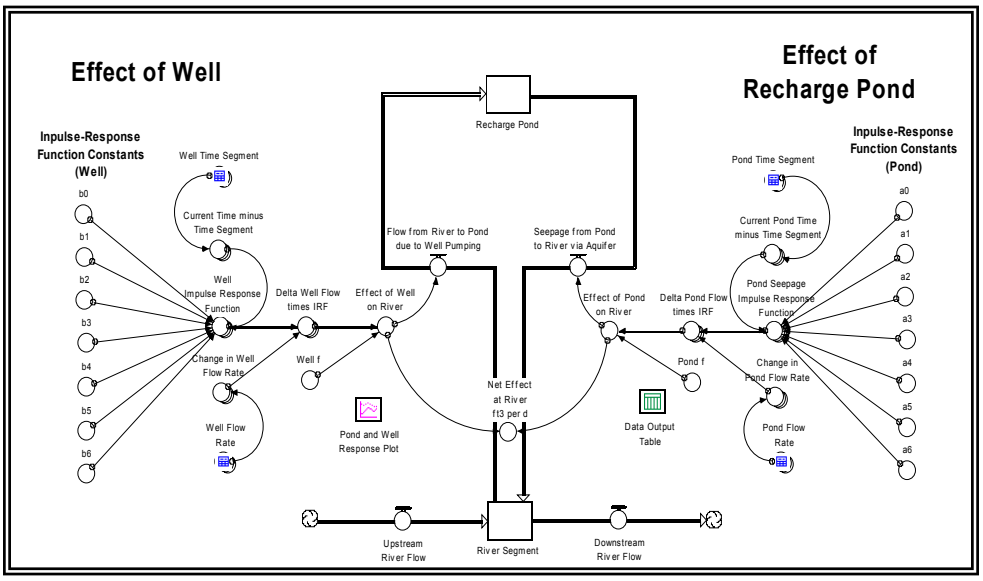
[1] Colorado Water Conservation Board, 1313 Sherman Street, Room 721, Denver, CO 80203, (303) 866-3977

DYNAMIC SYSTEMS MODEL AT ARTIFICIAL RECHARGE SITES: A TOOL FOR EVERYONE

Walter L. Niccoli[1], Fred Marinelli[1], and Paul Haby[1]

At artificial recharge sites along the South Platte River and other alluvial flood plain locations throughout Colorado, ground water users and managers are required to provide return flows to the river to eliminate negative effects on downstream users. Managers often rely on technical professionals to assist with development and operations of these return-flow systems. The technical professionals may create analytical or numerical solutions (ground water models) of the ground water regime to assist in this task. While these methods can be highly robust, the manager is typically left with a report and having to rely on the technical professional to address any changes brought on by management decisions and the environment. A Dynamic Systems Model (DSM) is a tool that captures the essence of the professional's work in a framework that allows the manager (who may not be well versed in the trade of ground water hydrology) to evaluate various operational scenarios with a high level of technical detail.

A DSM is composed of features that store and transfer water. The model's structure is similar to a flow chart as displayed in Figure 1. Once developed, a manager can manipulate this tool to evaluate various operational scenarios and their effects on return flows to the river, allowing selection of the most cost efficient and technically feasible alternative.



In this example, Telesto has developed a DSM of an artificial recharge scheme at a general location along the South Platte River. The site features several recharge ponds and several pumping wells. Ground water modeling professionals developed a sophisticated ground water model of the system that was incorporated into the DSM through the use of impulse-response functions for each well and recharge pond. This DSM: 1) maintains the accuracy of the ground water model, 2) is fast and easy to use, 3) is intuitive, 4) can be used on a day-to-day basis by non-modelers, and 5) can be readily modified or expanded. With a slight modification, the DSM can also be used to evaluate the changes in ground water chemistry due to operational modifications, test the effects of fertilizer and chemical applications on the ground water system, and estimate chemical loading to the river.

[1] Telesto Solutions, Inc., 2636 Midpoint Dr., Ste. B, Fort Collins, CO 80525

AGGREGATE MINING ALONG THE SOUTH PLATTE RIVER: ISSUES, CONCERNS, AND OPPORTUNITIES

Glenn J. Rodriguez[1]

Many individuals may not be aware of the full extent of aggregate mining within the South Platte River corridor. These activities have significant individual and cumulative impacts on the diverse ecological values of the South Platte system. There is a critical need for a more comprehensive approach to address the need for aggregate materials as well as protection of the environmental values of the South Platte corridor.

According to Colorado's Division of Minerals and Geology, there are 62 active aggregate mines in Colorado located in the township and range adjacent to the South Platte River. The permitted area is 7000 acres. The U.S. Geological Survey has noted the downstream limit of mining along the South Platte River has extended approximately nine miles further north from 1974 to 1997. They have also described the location of recoverable aggregate along the River corridor. The ability of a private company to economically mine and deliver aggregate depends on many factors such as: the availability of a willing land seller/leaser, the quality of the extractable resource, the depth of the gravel, the amount of overburden, and transportation costs.
The South Platte corridor has developed many diverse plant communities and land types. The South Platte Basin biologically diverse riparian ecosystem has been described as "every bit as unique and valuable as the Florida Everglades or San Francisco Bay" [U.S. Water News, Vol 14, N0.8, August, 1997]. Many of remnant oxbows contain extensive wetlands and contribute to the overall function of the River corridor. Many wildlife species depend on the conditions present in wetlands and riparian areas to survive where travel corridors, breeding areas, and food sources are present.

Segment 15 of the South Platte River is listed as water quality impaired due to nitrates and metals. The towns of Fort Lupton, Brighton, and Wattenberg have had to limit their use of the alluvial ground water for drinking water purposes due to the levels of nitrate in the water. Generally, the subsurface flow of ground water is to the river. Aggregate mining with lined pits or pits with impervious slurry walls, modify the flow of ground water in unseen ways. Ground water can be directed to open notches between pits, diverted around areas, mound up as open water or be in shadowed areas. Dewatering trenches next to wetlands and riparian areas can direct water away from these areas.

There are three to four large aggregate extraction companies and numerous small companies operating along the South Platte corridor. Each company identifies areas to mine based upon their own resources and interests. Many of these are adjacent to each other along the river. Historically each project deals with projects individually as they relate to wetland mitigation, impact avoidance, water depletions, water storage, and aquatic resource compensatory

[1] US EPA, Region 8, Wetlands and Watersheds

mitigation. There has been little regard as to how the different individual projects cumulatively impact the South Platte River.

At one location along the river, there are three different aggregate company's properties next to each other. All three are locating pits, slurry walls, and mitigation areas independently. One is considering constructing a wetland mitigation bank, which may be next to the other company's pits and slurry walls. The hydrology to and from the mitigation bank could likely be affected by the adjoining aggregate company development plans. At the other adjacent site, past permitting actions were based on preserving and enhancing a creek corridor. However, the upgradient aggregate company now plans on relocating the creek and mining through the creek.

These issues raise the concerns of the permitting and resource agencies and others in the community. Construction, reclamation, and management of the pits can be conducted in a manner more favorable to the environment. The need for aggregate will continue; however with planning, these could be opportunities for restoring and preserving the ecological integrity of the South Platte River.

HABITAT POTENTIAL ASSESSMENT TOOL (HPAT): PLANNING TOOLS TO SUPPORT DEVELOPMENT OF RECHARGE PONDS AND WETLAND HABITAT IN THE LOWER SOUTH PLATTE OF COLORADO

Catherine J. Shrier[1]

The Habitat Potential Assessment Tool (HPAT), currently under development, will be used to assess the feasibility of integrating habitat enhancement components into managed groundwater recharge facilities. In accordance with state water law and with Colorado's participation in a multi-state endangered species recovery effort, many recharge facilities are being developed in the Lower South Platte River. Pilot projects have been created at new recharge facilities at the Tamarack Ranch State Wildlife Area in which fish and waterfowl habitat components for Colorado native species of concern have been integrated into recharge facility design and operations. The author is developing a knowledge-based system that the State Division of Wildlife and private landowners can use to determine whether and which components can be added to new recharge facilities. This work is being sponsored by the South Platte Lower River Group (SPLRG), through funding and technical support from the Colorado Division of Wildlife (CDOW), Lower South Platte Water Conservancy District (LSPWCD), and the Colorado Water Resources Research Institute (CWRRI).

Prototype tools have been created to identify the feasibility of developing a recharge facility at a user-selected site; to identify potential sites with suitable stream depletion factors, surface soils, and proximity to water sources; and to identify areas to target for wetland development, based upon proximity to water sources and to other habitat areas, riparian vegetation, and surface soil types. These tools have been developed as modular additions to the South Platte Mapping and Analysis Program (SPMAP), a GIS-based system of map themes and analytical tools utilized by several water user organizations in the lower South Platte River. The new habitat modules have been developed in conjunction with the Colorado Division of Wildlife Integrated Management Process prototype development and with the formulation of the Strategic Plan for the South Platte Valley Wetland Focus Area Committee (SPWFAC). Organizations within SPWFAC that can provide funding and technical support to landowners developing recharge ponds include the US Fish and Wildlife Service's Partners for Fish and Wildlife program; the Natural Resources Conservation Service's Wetlands Reserve Program (WRP) and Wildlife Habitat Improvement Program (WHIP); and Ducks Unlimited, which is developing projects in the region with funding from a North American Wetlands Conservation Act (NAWCA) grant. These wetland partner organizations are providing guidance on the development of analytical tools needed for evaluation and planning of wetland habitat in the region. Water user organizations are providing guidance on the development of analytical tools needed for evaluation and planning of recharge facilities in the region. This poster will display prototype tools that have been developed for assessment of potential recharge facilities and wetland habitats.

[1] Integrated Decision Support Group, Colorado State University, Fort Collins, CO 80523

THE DROUGHT OF 2002 IN THE SOUTH PLATTE BASIN

Jonathan Thomas[1], Nolan Doesken[2], and Roger Pielke, Sr.[3]

Temperature, precipitation, snowpack, and streamflow data from selected sites in the South Platte Basin will be presented for the 2002 water year. Comparisons with previous years will be shown. Low winter snowpack and warm and dry weather in previous years set the stage for a rapidly developing severe drought in 2002. Below average snowfall at high elevations in the basin characterized the winter months. Spring storms, which are an important aspect of the hydroclimate of the basin, were nearly nonexistent, and record breaking warm temperatures in April resulted in a premature melt of the limited snowpack. One major storm did bring widespread precipitation to the basin in late May but it was too little and too late. The summer of 2002 was the third consecutive extremely hot summer for the basin with only occasional scattered thunderstorms. The result was abnormally high evaporation rates along with low streamflows, which by July and August reached record low levels. Colorado has experienced more severe multi-year droughts, but for 2002 alone, the year is on track to be the driest in Colorado history encompassing the entire state in addition to the South Platte Basin.

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[3] State Climatologist, President-Elect of the American Association of State Climatologists, Professor, Dept. of Atmospheric Science, Colorado State University, Fort Collins, CO 80523, (970) 491-8293, http://blue.atmos.colostate.edu

SPEAKER AND MODERATOR BIOGRAPHIES

Troy Bauder
Troy is the state Extension Water Quality Specialist in the Department of Soil and Crop Sciences at CSU. Troy received his B.S. degree in Agronomy and his M.S. in Soil Science from Colorado State University. He is responsible for conducting statewide educational and applied research programs on water quality, especially related to protection of ground water quality from impairment to agricultural chemicals as authorized under the Agricultural Chemicals and Groundwater Protection Act (SB90-126). His research and outreach activities include nitrogen management using high nitrate irrigation water, aquifer vulnerability to contamination, and factors affecting adoption of BMPs by Colorado producers. Prior to attending CSU, Troy received "hands-on" training in water as a farm hand, landscaper, and well repair technician. He is actively engaged in the family farm near Sterling, Colorado.

Steve Bushong
Mr. Bushong is a partner at the law firm of Porzak Browning & Bushong LLP where he primarily practices in the area of water rights, water quality and environmental litigation. After graduating from the University of Colorado Law School in 1992, Mr. Bushong clerked for the Honorable Wade Brorby on the Tenth Circuit Court of Appeals and was then a lawyer at the law firm of Holme Roberts & Owen. Prior to law school, Mr. Bushong was an aquatic scientist at the Johns Hopkins University and earned his Masters of Science degree in Limnology in 1985 and his Bachelor of Science degree in 1981, both from Iowa State University. Mr. Bushong has published numerous articles in scientific and legal journals.

Tim J. Davis
Tim was raised in a small farming community in northwestern Ohio. He migrated to Fort Collins, Colorado, in 1974 where he attended Colorado State University and received his Bachelor of Science degree in Wildlife Biology in 1978. Tim began his career with the Colorado Department of Natural Resources as a parks officer with the Colorado Division of Parks and Outdoor Recreation in 1978. He transferred to the Colorado Division of Wildlife in 1980, working on pheasant habitat projects on private land in northeastern Colorado. He spent 16 years as a terrestrial wildlife biologist in the northeast part of the state and the last several years as the Private Lands Coordinator for the Division. In his current position, Tim serves as the editor of the Landowner Newsletter, administers the Landowner of the Year Program, the Cooperative Habitat Improvement Program, and serves as the Division liaison to the Farm Service Agency (FSA) and the Natural Resources Conservation Service (NRCS). Tim is particularly interested and involved in voluntary Farm Bill programs that can address wildlife habitat needs on private land. He has recently been exploring ways to address wildlife and water related issues on the South Platte River through the USDA Farm Bill Programs.

Nolan Doesken
Nolan has been with the Colorado Climate Center in the Department of Atmospheric Science at Colorado State University since 1977. He came to Colorado from the Midwest. He received a B.S. from the University of Michigan in 1974 and an M.S. from the University of Illinois in 1976. His life-long interest has been climatology, and his work in Colorado has involved monitoring current and long term patterns and variations in precipitation, temperature, snowfall and other climate elements. One part of his work is maintaining the historic Colorado State University campus weather station with uninterrupted data going back 114 years. More recently, Nolan helped establish CoCo RaHS (Community Collaborative Rain and Hail Study) to involve the citizens of Colorado in an investigation of localized precipitation patterns.

Ken Gordon
Senator Gordon (D-35) serves as Chair for the Judiciary committee. He is a member of the Agriculture and Natural Resources and Legal Services committees. He is also the interim vice chair for the Study of Criminal Sentencing Statutes. Ken was elected to the State Senate in 2000, elected to the State House of Representatives in 1992 and from 1998 to 2000 was the House Minority Leader.

Ken is a lawyer in private practice in Denver and an adjunct professor of political science at the University of Colorado in Denver teaching American Political Thought and Constitutional Law. He was the founder and executive director of the Rocky Mountain Forum and served as Denver County Public Defender.

Allen Green
Allen was named State Conservationist of the Natural Resources Conservation Service in Colorado by Chief Pearlie Reed, effective July 1, 2001. As State Conservationist, he has leadership for all NRCS operations in the state including approximately 300 employees, 63 field offices, and assisting 77 Soil Conservation Districts throughout the state. The NRCS works directly with private landowners to help them implement conservation measures, and with a broad array of state and local groups to sustain and enhance environmental quality.

He attended the University of Florida and earned a degree in Forest Resources and Conservation, with a specialty in Range Ecosystem Management.

Mr. Green began his career with the Soil Conservation Service (now NRCS) in Florida, as a field Range Conservationist. He worked in numerous locations in Florida as a Range Conservationist and as District Conservationist. Accepting the position of Area Conservationist, he moved to Dayton, Ohio in 1985, and oversaw 19 counties in southwestern Ohio. In 1989 he was selected as Assistant State Conservationist for Missouri NRCS, responsible for Programs and Operation functions, including all Farm Bill conservation programs such as Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), Wildlife Reserve Program (WRP), Conservation Reserve Program (CRP), and Forestry Incentives Program (FIP). He also was responsible for operation functions of Missouri NRCS including Strategic and Business Planning, Accountability, and the Workload Analysis.

Jonathan W. Hays
Jonathan is currently a District Judge and Water Judge for Water Division No. 1. He has a B.A. from the University of Colorado and a J.D. from the University of Colorado School of Law. He has served as the Deputy State Public Defender, Adams and Weld Counties; the Deputy District Attorney, Weld County; County Judge, Weld County; District Judge. Judge Hays has been active in the following organizations: Weld County Community Corrections Board, past chair; A Woman's Place, past member; Partners, Inc., past member; Island Grove Regional Treatment Center, past vice-chair; A Kid's Place, past member; American Trial Lawyer's Assn. and Colo. Trial Lawyer's Assn., judicial member. Judge Hays and his wife Roberta (Bert) have two daughters, Alexandra and Samantha.

Bill Jerke
Bill is a native of Weld County and graduated from Valley High School. He earned his B.A. in political science from the University of Northern Colorado. He still farms the family farm, Christmas Tree Acres, near LaSalle.

Bill served as a member of the Colorado State House of Representatives from 1989 through 1996. He is currently a Weld County Commissioner, a position he was elected to in 2000. Bill has a wife and three children.

Greg Kernohan
Greg is currently a Wetland Biologist with Ducks Unlimited Inc. Greg hails from northern Ontario, Canada, where he spent most of his life exploring the great outdoors. After performing seasonal work for the Ontario Ministry of Natural Resources, he entered and graduated from Sir Sandford Fleming College with a degree in Environmental Science. He later attended Queen's University to complete a degree in Biology. Greg has spent close to 10 years specializing in wetland restoration and waterfowl research for a number of different organizations including Ducks Unlimited Canada, Institute for Wetland and Waterfowl Research, Ducks Unlimited, Inc., Ontario Ministry of Environment, United States Geological Survey, California Waterfowl, and private consultants.

Greg joined the Colorado DU team in August 2000, to assist with the Managed Wetlands Project, a new cooperative agreement between Ducks Unlimited and the Colorado Division of Wildlife. The Managed Wetlands Project is a unique opportunity to apply wetland management science to deliver intensely managed wetland habitat for migrating birds on State Wildlife Areas throughout the South Platte River corridor. Although the Managed Wetlands Project was extended for another 2 years, Greg has recently become heavily involved with wetland restoration and protection projects for DU in northeastern Colorado.

Brad Lundahl
Brad is the Conservation and Drought Planning section chief for the Colorado Water Conservation Board (CWCB) and the current chairman of Colorado's Water Availability Task Force. Additionally, Brad is the project co-manager of the Colorado Drought and Water Supply Assessment -- the first major statewide project to determine if Colorado has sufficient water to meet existing and future needs. Prior to his current position, Brad was the Assistant Director of Legislative Affairs for the Colorado Department of Natural Resources. He has also worked for the Arizona State Land Department and the Arizona House of Representatives. Brad earned a B.S. in Political Science from Utah State University.

Raymond Mowery
Raymond was born and raised on an irrigated farm on the front-range of Colorado. He earned his BS degree at CSU with a major in botany and a minor in wildlife management. He received a teaching certificate from Metro State College. Raymond owned and operated a dairy farm prior to hiring on with the Natural Resources Conservation Service (NRCS). Raymond and his wife currently live on a farm north of Greeley, Colorado, which has 80 acres of Conservation Reserve Program (CRP) and 30 acres of tree and shrub plantings in cooperation with the Division of Wildlife and the USDA, CRP and Wildlife Habitat Incentives Program (WHIP).

Suzanne Paschke
Suzanne is a ground-water specialist for the Colorado District of the U.S. Geological Survey Water Resources Division and for the South Platte NAWQA study unit. Dr. Paschke holds a B.S. in Geology from the University of Wyoming (1983), an M.E. in Geological Engineering from the Colorado School of Mines (1992), and a Ph.D. in Geological Engineering from the Colorado School of Mines (1998).

Cynthia Peterson
Cynthia is the project manager for the Colorado Water Protection Project, a public education campaign of the League of Women Voters of Colorado Education Fund. She has an Undergraduate Degree in Biology and a Masters Degree in Environmental Policy and Management. She is Vice-Chair of the Colorado Air Quality Control Commission, Chair of the Colorado Pollution Prevention Advisory Board, and serves on the board of the Pollution Prevention Partnership.

Roger A. Pielke, Sr.
During the first part of his career, he studied terrain-induced mesoscale systems, including the development of a three-dimensional mesoscale model of the sea breeze, for which he received the 1974 NOAA Distinguished Authorship Award. Dr. Pielke has worked for NOAA's Experimental Meteorology Lab, The University of Virginia and Colorado State University. He is currently a Professor of Atmospheric Science at CSU. He has served as Chairman and Member of the AMS Committee on Weather Forecasting and Analysis, and was Chief Editor for the *Monthly Weather Review.* In 1977, he received the AMS Leroy Meisinger Award for ``fundamental contributions to mesoscale meteorology through numerical modeling of the sea breeze and interaction among the mountains, oceans, boundary layer, and the free atmosphere.'. Dr. Pielke received the 1984 Abell New Faculty Research and Graduate Program Award, and also received the 1987/1988 Abell Research Faculty Award. He was declared "Researcher of 1993" by the Colorado State University Research Foundation. In 1999, he was appointed Colorado State Climatologist. He has authored and co-authored numerous books, including *Mesoscale Meteorological Modeling, The Hurricane, Human Impacts on Weather and Climate, Hurricanes: Their Nature and Impacts on Society,* and *Storms.*

He was elected a Fellow of the AMS in 1982. From 1993-1996, he served as Editor-in-Chief of the US National Science Report (1991-1994) for the American Geophysical Union. From January 1996 to December 2000, he served as Co-Chief Editor of the *Journal of Atmospheric Science*. In 1999, he received NOAA's ERL Outstanding Scientific Paper (with Conrad Ziegler and John Lee) for a modeling study of the convective dryline. His paper with Lawton, R.O., U.S. Nair, R.A. Pielke Sr., and R.M. Welch (2001: Climatic impact of tropical lowland deforestation on nearby montane cloud forests, *Science*, 294, 584-587) has been listed in Science News, Vol. 160, as being one of the most important science papers of 2001 in the area of Earth Science/Environment and Ecology. He was designated a Pennsylvania State Centennial Fellow in 1996, and named the Pennsylvania State College of Earth and Mineral Sciences Alumni of the year for 1999 (with Bill Cotton). He was awarded the Engineering Dean's Council Award in April 2000. He has published over 200 papers in peer-reviewed journals, 40 chapters in books, and co-edited 4 books.

Robert E. Roberts
Mr. Roberts is the Region 8 Administrator for the United States Environmental Protection Agency (EPA), with responsibility for EPA activities in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming. He was sworn in on April 15, 2002.

From 1995 to 2002, he was executive director of the Environmental Council of States (ECOS), the national, non-partisan, non-profit association of state and territorial environmental commissioners. Roberts co-chaired the founding meeting of ECOS in December 1993, and 16 months later was hired as the first full-time executive director. He led the organization from its paper existence to a position as the preeminent advocacy group for state environmental agencies, with Washington DC offices, annual meetings, and a professional journal and staff. ECOS provides a national clearinghouse of information for state environmental agency heads, is the leading advocate for increased roles for state environmental agencies, and an important research agency for state environmental protection issues.

He served as secretary of the South Dakota Department of Environment and Natural Resources from 1990 to 1995, a cabinet-level position appointed by the governor and confirmed by the state senate. In that position, he led successful campaigns for the first-ever permanent funding source for water projects and for the most comprehensive environmental protection act in South Dakota history.

(Robert Roberts continued)
Roberts' last assignment in a 23-year Air Force career was as commander of the 812th Combat Support Group at Ellsworth AFB, South Dakota, the largest operational base in the Strategic Air Command. In that position, which corresponded roughly to that of mayor of a small town, he conceived of, obtained approval and funding for, and completed the first section of the largest privately funded military housing complex in the Department of the Air Force, along with other major construction projects, including a middle school, which was produced with innovative financing. He retired in 1990 in the grade of colonel. From September 1970 to September 1971, he was Executive Officer, Air Force Advisory Team #3, Bien Hoa Air Base, Republic of Vietnam.

Roberts is an honors graduate in history from the University of Alabama, has a Masters in Public Administration from Auburn University, is a Distinguished Graduate of the Air Command and Staff College, and has completed executive training at the Governors' Center at Duke University. In 1999, *Governing* magazine named him a "Public Employee of the Year," one of ten such designations nation-wide, and the only association executive ever so designated. In 1992, the Council of State Governments named him a Henry Toll Fellow. In 2000 and 2001, he served as a member of the National Environmental Policy Commission, appointed by the Congressional Black Caucus, and participated in listening sessions across the United States regarding environmental justice.

He is married to the former Patricia Troup of Scranton, Pennsylvania. They have four children: Elizabeth Roberts Finney, an editor for a publishing company in Indianapolis; Lieutenant John Troup Roberts, United States Navy, North American Defense Command Headquarters, Colorado Springs, Colorado; Sarah Katherine Roberts, an administrative assistant for the National Association of Securities Dealers in Washington, DC; and Mary Margaret Roberts, a student at James Madison University in Virginia.

Robert T. Sakata

Robert, a Colorado native, resides in Brighton, Colorado. In partnership with his parents who started farming in Brighton in 1946, Robert is now vice president of the family vegetable farm. Appointed by Governor Owens in 2000, he is serving his second term on the State of Colorado Water Quality Control Commission. He serves as the Commission's liaison to the Water Quality Forum, the Colorado Nonpoint Source Council, and the Colorado Department of Agriculture. He has been a member of the SB90-126 Agricultural Chemicals and Ground Water Protection advisory committee since it's inception. He is currently Chair of the Commission. Robert also serves as Chairperson on the Adams County Open Space Advisory Board.

Jan Schenck

Jan is a business development manager for Denver Solutions Group, a Premier IBM Partner. He sells hardware, software and services. He has 33 years in the information technology industry with experience managing, developing and creating solutions for clients. Jan served as Mayor of Golden for 6 years and was on the Golden City Council for 14 years. For the past two years, he has been the Chairman for the Denver Regional Council of Governments and has been on their Board for 12 years.

Dr. Robert Siegrist
Dr. Siegrist earned his B.S. and M.S. in Civil Engineering (*High Honors*, 1972; 1975) and his Ph.D. in Environmental Engineering (1986) at the University of Wisconsin. He has held research and teaching appointments with the Colorado School of Mines, Oak Ridge National Laboratory, the University of Wisconsin, and the Agricultural University of Norway. Dr. Siegrist is currently Professor and Director of the Environmental Science & Engineering Division at the Colorado School of Mines. At CSM, Dr. Siegrist teaches and conducts research regarding water and wastewater systems as well as risk assessment and remediation of contaminated land. Dr. Siegrist has published over 150 papers. He is a registered professional engineer, a member of several national societies, and serves as a technical advisor to government agencies and private industries in the U.S. and abroad.

Steve Sims
Steve is an Assistant Attorney General in the Federal and Interstate Water Unit of the Colorado Attorney General's Office. Steve has been with the Attorney General's Office since 1989 and practiced in Colorado since 1979. Currently, he is the lead counsel on the Amended South Platte Groundwater Rules litigation. He is also currently co-lead counsel in the U.S. Supreme Court original jurisdiction litigation between Kansas, Nebraska and Colorado concerning the Republican River. Steve was formerly the First Assistant Attorney General for the instate Water Unit and in that role was the lead counsel in the Golden kayak course litigation, the Union Park litigation, the Park County Sportsman's Ranch litigation, co-counsel in the Arkansas Rules litigation and has tried over 30 other water law cases. He has briefed and argued many Colorado Supreme Court appeals including Empire Lodge v. Moyers, Union Park I and II, Upper Gunnison River Water Conservancy District (Taylor Park second fill case), Thornton v. Bijou, Santa Fe Trails Ranch, Midway Ranches and Turkey Canon Ranch. Steve has a B.A. from the University of Colorado (1975) and a J.D. from the University of Puget Sound (1979).

Kevin E. Trenberth
Dr. Trenberth is Head of the Climate Analysis Section at the National Center for Atmospheric Research. From New Zealand, he obtained his Sc. D. in meteorology in 1972 from Massachusetts Institute of Technology. He has been prominent in the Intergovernmental Panel on Climate Change (IPCC) Scientific Assessment activities and was a lead author of the 2001 Scientific Assessment. He serves on the International Scientific Steering Group for the Climate Variability and Predictability (CLIVAR) program and the Joint Scientific Committee of the World Climate Research Programme. Trenberth has served on a number of committees, panels and a board of the National Academy of Sciences and currently serves on the Committee on Global Change Research (Board on Sustainable Development). He is a fellow of the American Meteorological Society (AMS) and American Association for Advancement of Science, and an honorary fellow of the Royal Society of New Zealand. In 2000 he received the Jule G. Charney award from the AMS. His main interests are in climate variability, El Nino, global climate change (including global warming), and the hydrological cycle, with an emphasis on analyzing observational data to understand what happens in the real world.

Marc Waage, P.E.
Marc is the Manager of Raw Water Supply for Denver Water, where he has worked as a water resource engineer for 16 years. He works in the areas of planning, operations, and water rights. He supervises the water collection system and raw water sales. Marc particularly enjoys the challenge of operating Denver's system to benefit as many interests as possible. Marc also worked briefly for the Bureau's of Reclamation and Indian Affairs.

Robert Ward
Robert has been member the faculty at Colorado State University for 32 years. Besides serving as a Professor of Civil Engineering, he is Director of the Colorado Water Resources Research Institute and the CSU Water Center. He also served as Associate Dean for Undergraduate Studies for the College of Engineering, interim department head and Vice Chancellor for Academic Affairs for the Colorado State University System. His teaching and research activities focus on the means to acquire comparable and consistent data and information from water quality monitoring efforts, particularly as such information will be used to support fair and equitable management decision-making. He currently serves on the National Water Quality Monitoring Council and the Organizing Committee for Monitoring Tailor-made IV, a European-wide conference on water quality monitoring to be held in September 2003. He is a member of the Fort Collins Water Board.

Eric W. Wilkinson
Eric was appointed General Manager of the Northern Colorado Water Conservancy District on January 14, 1994. Mr. Wilkinson has worked for the District since 1987, prior to his present position as a water resources engineer with various responsibilities. From 1984 to 1987, Mr. Wilkinson worked for the City of Greeley Water Department as a Water Resources Engineer. From 1973 to 1984, he was employed by the Colorado Division of Water Resources, Office of the State Engineer, in the Dam Safety Branch. In 1972, Mr. Wilkinson served as the Deputy Water Commissioner for the Cache la Poudre River.

Mr. Wilkinson was born and raised in the Fort Collins, Colorado, area where he currently resides. He attended Colorado State University and graduated in 1973 with a Bachelor of Science Degree in Civil Engineering. In March 2000, Mr. Wilkinson was appointed as the South Plate Basin representative on the Colorado Water Conservation Board. He is married and has three children.