Colorado Water

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

FEBRUARY 1998

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COLORADO WATER

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Colorado Water Resources Research Institute Phone: 970/491-6308
Colorado State University, Fort Collins, CO 80523. FAX: 970/491-2293
E-mail: cwis31@yuma/ACNS.ColoState.Edu
Internet: http://www.ColoState.EDU/Depts/CWRRI
Robert C. Ward, Director

EDITORIAL

AVOIDING THE 'TOWER OF BABEL' IN WATER DATA

Editorial by Robert C. Ward

. . .agencies are examining new ways to supply and share water data and information. A number of water management agencies are following the lead of the U.S. Geological Survey and putting their water data and information on the internet.

As the competition for Colorado's water resources grows ever stronger, the need to account for every drop of water, and every milligram of pollutant that enters the water, increases. Such accounting demands the acquisition of ever-larger amounts of water quantity and quality data. As the volume of water data grows, its storage in a readily accessible manner becomes a major problem. Avoiding duplication in water data collection and storage also is an issue as data representing constantly broadening dimensions of our water environment must be acquired by each agency.

The demand for ready access to water data and information is eliciting a variety of responses from water agencies -- from holding the data 'close to the vest' to placing it on the internet in easily accessible formats. The U.S. Geological Survey is placing its data on the internet and discovering many non-traditional users of the data (e.g., rafters and fishermen accessing flow data to determine if conditions are optimum for their recreational activity). Volunteer monitoring programs are growing around the country as the public wants to know more about the quality of the water in their local stream or river. Congress is also including public 'right-to-know' provisions in water legislation (e.g., the 'Consumer Confidence Reports' required in the 1996 reauthorization of the Safe Drinking Water Act). Implementation of the 1993 Government Performance and Results Act (GPRA) is also driving efforts to increase efficiency in data collection and improve water management performance information and evaluation.

To meet this growing demand for water information, agencies are examining new ways to supply and share water data and information. A number of water management agencies are following the lead of the U.S. Geological Survey and putting their water data and information on the internet.

The fear of many professionals is misuse of data by people who do not understand its original purpose and method of collection. Lack of standardization, or cross-referencing, in the way water data are collected, analyzed, stored and retrieved contributes to this fear. To begin to address these fears and lack of opportunities to share data at the national level, a National Water Quality Monitoring Council has been formed with representation from a broad cross-section of federal, state, and local governments as well as industry, academic and professional associations. I have the opportunity and responsibility of representing academia on the Council. A summary of the Council's second meeting is provided on the next page of this issue of ***Colorado Water.***

To reduce misuse of water data, there is an increasing recognition of the need to carefully document the contents of water data sets. The documentation that describes water data itself is often referred to as 'metadata'. One goal of metadata is to 'standardize' the way data is documented so that the data's original purpose, collection methods and, thus, limitations are understood by future users. Developing a common, easily understood metadata template that meets the needs of both those who provide water data and those who use the data requires considerable dialogue among all parties involved.

The concern . . . is lack of a common framework for putting water data on the internet and the potential for creating a 'Tower of Babel' situation where water data sets appear in as many formats as there are agencies/universities/ disciplines collecting data. If this happens, the true value of the internet as a tool for enhancing sharing of water data will be greatly diminished.

What are the ramifications to Colorado water managers of this effort to enhance water data sharing and public access? Maryland has formed a state-based water monitoring council to address state issues surrounding sharing data. Other states have tried similar coordination efforts and failed. Should Colorado form such a council to address the water data sharing concerns and limitations unique to Colorado's water management system? Is there a strong need and enough support for such an effort in Colorado today?

A ramification to Colorado's higher education system is the fact that faculty and graduate students, who often collect outstanding water data sets as part of their education and research duties, are not rewarded for making their raw data readily available over the internet. How can university faculty be encouraged/ rewarded to make their data available over the internet in a well documented manner?

The above remarks should not imply a lack of attention to this problem in Colorado. A quick visit to the home pages of many of Colorado's water management agencies reveals a rapidly moving trend in sharing data and information. The concern, however, is lack of a common framework for putting water data on the internet and the potential for creating a 'Tower of Babel' situation where water data sets appear in as many formats as there are agencies/universities/disciplines collecting data. If this happens, the true value of the internet as a tool for enhancing sharing of water data will be greatly diminished.

NATIONAL WATER QUALITY MONITORING COUNCIL UPDATE

The National Water Quality Monitoring Council (NWQMC)held its second meeting at U.S. Geological Survey headquarters in Reston, Virginia, January 27-29, 1998. The 33 council members represent a balance of federal, interstate, state, tribal, watershed, and municipal governments and the private sector, including industry, agriculture, environmental and volunteer monitoring organizations. The NWQMC's purpose is to stimulate voluntary improvements in monitoring needed to achieve comparable and scientifically defensible interpretations and evaluations of water quality conditions. This information, in turn, is used to support water quality management decision-making at all levels of government (e.g., establishing Total Maximum Daily Loads on streams, performing Source Water Assessments as part of the Safe Drinking Water Act, and providing water data over the internet).

During the meeting, data management and sharing among federal agencies and state agencies were examined. The internet increasingly is viewed as a means to bring about widespread sharing of water data. Putting water data on the internet also provides a need to improve the design of monitoring systems used to acquire data, particularly the methods used to sample water and analyze the physical, chemical and biological characteristics of water.

The NWQMC is organizing a National Water Quality Monitoring Conference for July 7-9, 1998, in Reno, Nevada, with the theme: "Monitoring: Critical Foundations to Protect Our Waters." The purpose of the conference is to encourage sharing of successful monitoring designs, protocols, methods and data management ideas using ongoing monitoring efforts as case studies. Over 90 presentations will be on the program. For information about the conference, contact Joanne Kurklin at (405) 810-4408 or via e-mail: **jkurklin@usgs.gov**.

When the many problems facing water management today are considered, the daunting task facing those who provide information on the quality of water can be appreciated, especially given the budget limitations facing monitoring managers. The NWQMC represents a new effort to improve the integration, effectiveness and efficiency of water quality monitoring in the U.S.

RESEARCH OPPORTUNITIES

WATER RESOURCES COMPETITIVE GRANTS PROGRAM, WESTERN REGION

CWRRI Deadline: March 16, 1998

Note: The State Water Institutes Program will operate for Fiscal Year 1998 as it did in FY1997— with a Regional Water Resources Competitive Grants Program. The issuance of RFAs under this program is the responsibility of a lead Water Resources Research Institute or Center in each of four geographic areas of the United States. The lead institute for the Western Region is the Wyoming Water Resources Center. Here is information as it was received from the Wyoming Water Resources Center.

This Request for Applications (RFA) is issued as part of the programs under the Water Resources Research Act (P.L. 104-147) administered by the U.S. Department of the Interior through the Water Resources Division of the U.S. Geological Survey.

ELIGIBILITY: Awards are available only to Water Research Institutes or Centers in the Western Region (AK, AZ, CA, CO, ID, NM, NV, OK, OR, TX, UT, WA, WY) established at a college or university pursuant to the provisions of Section 104 of the Water Resources Research Act and 30 CFR Part 401.

Investigators not a part of the aforementioned Institutes or Centers must submit their application through an Institute or Center at the University where said Institutes or Centers are located (in Colorado, the Colorado Water Resources Research Institute at Colorado State University). All applications must be submitted to the lead institute BY AN ELIGIBLE INSTITUTE OR CENTER in the Western Region. All proposals under this solicitation must involve substantive collaboration among at least two or more states in the Western Region. Applications involving only investigators from a single state will not be considered.

FUNDS: Approximately $800,000 is available for the Western Region. Proposed projects should be 1-3 years in duration and not request total federal funds exceeding $350,000 per project. EACH INSTITUTE'S APPLICANTS SHALL MATCH EACH FEDERAL DOLLAR PROVIDED TO SUPPORT EACH PROPOSED PROJECT WITH NOT LESS THAN TWO NON-FEDERAL DOLLARS.

Research proposals submitted under this RFA are generally intended to address water resources problems of regional or multi-state significance. Illustrative examples of research topics are:

Ecosystem Approaches to Managing Riparian Areas in the Western United States
Reassessing Salinity Management Policy
Improving Decisions for Managing Major River Systems in the Western United States
Impacts of Incremental Institutional Reforms for Drought Management of Western Water Resources
River Basin Level Nonpoint Source Pollution Control
Native American Water Rights Issues
Water Quality Impacts of Confined Animal Production Activities
Water Conservation and Artificial Recharge of Aquifers
Water Quality Problems Associated with Oil and Natural Gas Exploration and Development
Institutional Infrastructure Changes for Holistic Water Management
Impacts of Air Pollution on Recharge and Quality of Surface Water and Ground Water Supplies
Evaluating Conservation Programs
Flood Frequency Forecasting
Effects of Urbanization on Floods and Water Quality
Water Reuse
Hydroclimatic Variation

(see next page)

CWRRI APPLICATION DUE DATE: March 16, 1998.

SUBMIT TO: ROBERT C. WARD, DIRECTOR
COLORADO WATER RESOURCES RESEARCH INSTITUTE
410N UNIVERSITY SERVICES CENTER
COLORADO STATE UNIVERSITY, FORT COLLINS, CO 80523

Proposals will be processed by CWRRI for submission to the lead institute for the Western Region, the Wyoming Water Resources Center. The Wyoming Center will coordinate proposal evaluation by: (1) written peer reviews (at least 3 qualified scientists or managers in the area of the proposed research) and (2) a selection panel consisting of 5 or more Institute directors from the Western Region and at least one USGS employee as an ex officio member. The following criteria will be used: 20 points — relevance and importance, 50 points — scientific merit; 10 points — feasibility; 10 points — technology transfer; and 10 points — qualifications of the investigators and budget (is it reasonable and adequate).

AWARDS: All awards will have a preferred start date of September 1, 1998 and must start no later than September 30, 1998. **COMPLETE INSTRUCTIONS ARE AVAILABLE ON THE WORLDWIDE WEB AT http://www.wwrc.uwyo.edu/. OR CONTACT CWRRI OR YOUR CONTRACTS AND GRANTS OFFICE.**

AWWA RESEARCH FOUNDATION RELEASES REQUESTS FOR 1998 PROPOSALS

The AWWA Research Foundation Board of Trustees selected 44 projects for 1998 funding. Requests for proposals (RFPs) will be issued for 35 of these, including 7 perchlorate projects that will be funded using a $2 million congressional earmark. The board approved $6 million to sponsor solicited research projects, $40,000 for applications projects, $1.3 million for tailored collaborative research, and $205,000 for expert workshops.

Additionally, approximately $1.3 million was appropriated for projects to be selected through the Foundation's unsolicited project program. Unsolicited proposal funds are set aside for innovative research ideas that are not included in the solicited project list. Guidelines for preparing unsolicited research proposals are available from the Foundation. Unsolicited project proposals must be postmarked by April 1.

Requests for proposals (RFPs) for solicited projects will be available in early March. Proposals submitted in response to RFPs must be postmarked by May 4 for all perchlorate projects and projects with budgets up to $250,000 in AWWARF funds. Proposals seeking $250,000 or more in AWWARF funds must be postmarked by July 15.

All project proposals must include 25 percent of the total project budget as in-kind cash contribution. In-kind contributions can be in the form of labor or laboratory services, and may come from utilities, consulting firms, and universities.

Contract awards for all solicited projects will be determined by an AWWARF project advisory committee (PAC) appointed for each project. Proposal evaluations will be based on responsiveness to the RFP, scientific and technical merit, and qualifications of the researchers. Unsolicited proposals are evaluated by AWWARF's Unsolicited Proposal Review Committee (UPRC) using similar criteria. The UPRC sends its recommendations to the board for final selection in June.

Below is a list of RFPs for 1998 projects along with maximum AWWARF funding amounts. Interested parties can obtain RFPs from the AWWARF RFP Desk, 6666 W. Quincy Ave., Denver, CO 80235; or by calling 303/347-6117 or 303/347-6211. Be sure to indicate the RFP number. RFPs can also be requested and send through e-mail via Internet (**dhughston@awwarf.com** or **gpreston@awwarf.com**) and on AWWARF's homepage: **http://www.awwarf.com** in the ***What's New*** section.

Protect the Drinking Water Consumer From Microbial Risk

- Advancing *Cryptosporidium parvum* Detection Methodologies (RFP 2502). $350,000
- Development of a Decision Process for Prioritization of Emerging Pathogen Research (RFP 2503). $150,000.
- Synergistic Inactivation of Cryptosporidium in Natural Waters (RFP 2504). $250,000
- Serosurveys to Determine the Attributable Risk of Viral Infection From Groundwater Sources (RFP 2505). $200,000

Protect the Drinking Water Consumer From Adverse Health Effects Due to Chemicals

- Disposal of Waste Resulting from Arsenic Removal Processes (RFP 2506). $200,000.
- National Assessment of MTBE Occurrence in Drinking Water and Associated Taste-and-Odor Issues (RFP 2507). $350,000.
- Reaction of Polyelectrolytes With Other Water Treatment Chemicals and Subsequent Effects on Water Quality and Operational Efficiencies (RFP 2509). $250,000
- National Assessment of Perchlorate Contamination Occurrence (RFP 2508). $150,000

The Following Perchlorate Projects Will Be Funded Through a Congressional Earmark

- Application of Bioreactor Systems to Low-Concentration Perchlorate-Contaminated Water (RFP 2530). $550,000
- Treatability of Perchlorate-Containing Water by Reverse Osmosis and Nanofiltration (RFP 2531). $250,000
- Treatability of Perchlorate in Groundwater Using Ion Exchange Technology (RFP 2532). $250,000
- Survey the Performance of the California Department of Health Services (Ion Chromatography) Analytical Protocol (RFP 2533). $75,000
- Short-Term Perchlorate Laboratory Issues (RFP 2534). $100,000
- Removal of Perchlorate and Bromate in Conventional Ozone/Granular Activated Carbon Systems (RFP 2535). $150,000
- Investigation of Methods for Perchlorate Destruction in Aqueous Waste Streams (RFP 2536). $200,000

Improve Utility Management to Obtain Optimum Water Quality and System Reliability

- Feasibility Study to Develop an Artificial Intelligence System for Optimization of Water Treatment Plant Operations (RFP 2510). $200,000.
- Filter Maintenance and Operations Guidance Manual (RFP 2511). $300,000
- Guidance Manual for Coagulant Change-Over (RFP 2512). $150,000
- Guidance Manual for Disposal of Chlorinated Water (RFP 2513). $100,000
- Improve Membrane Operation by Control of Particle Fouling (RFP 2514). $250,000
- Learning From Other Industry Deregulation Experiences: Identify Trends and Opportunities for Water Utilities (RFP 2515). $120,000
- Practical Applications of On-Line Monitoring (RFP 2516). $100,000
- Workforce Planning and Development (RFP 2517). $200,000
- Quantifying Public Health Risk Reduction Benefits (RFP 2518). $225,000

Improve Utility Infrastructure for the Reliable Delivery of High-Quality Water to the Customer's Tap

- Decision Support System for Distribution System Piping Replacement and Rehabilitation (RFP 2519). $200,000
- Development of a Capital Planning Strategy Manual (RFP 2520). $250,000
- Feasibility of Fast Response Testing for Coliform Bacteria in the Distribution System (RFP 2521). $75,000
- Guidance Manual for Monitoring Distribution System Water Quality (RFP 2522). $350,000
- Influence of Distribution System Infrastructure on Bacterial Regrowth (RFP 2523). $320,000
- New Techniques for Precisely Locating Buried Infrastructure (RFP 2524). $300,000

Provide Science and Technology to Improve Public and Customer Relations

- Customer Satisfaction: Best Practices for a Continually Improving Customer Responsive Organization (RFP 2525). $250,000
- Public Involvement Strategies: Phase II - Making It Work (RFP 2526). $250,000

Ensure Access To and Wise Use Of Water Resources and Protection of the Environment

- Design of Early Warning and Predictive Source Water Monitoring Systems (RFP 2528). $300,000
- Impacts of Major Point and Non-Point Sources on Raw Water Treatability (RFP 2528). $300,000
- Comparing Basins, Galleries, and Shallow Wells for the Recharge of a Deep Aquifer (RFP 2529). (Tailored collaboration project). $170,000

TAILORED COLLABORATION PROGRAM AWARDS

Guidelines for the Tailored Collaboration Program are available on the web at www.awwarf.com, or for further information, call Elizabeth Kawczynski, Collaborative Research Manager, at 303/347-6106.

RESEARCH

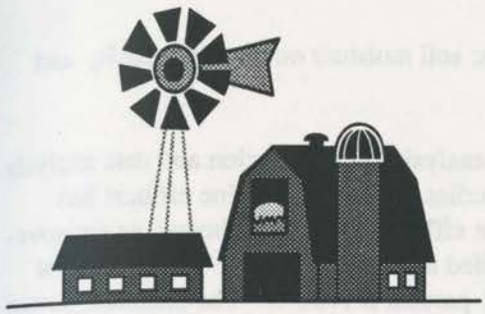
SEDIMENT ISSUES IN COLORADO

A Task Force led by Dr. Ellen Wohl, Department of Earth Resources, Colorado State University, has been organized by CWRRI to prepare a report on river sediment issues in Colorado. The report will be designed to serve as a reference for Colorado citizens who wish to better understand and manage water resources in the state. Written in nontechnical language, the publication will include maps, tables and graphs, a bibliography of relevant references, and black and white photographs. Its focus will be to provide the following information:

- A general review of river sediment issues in Colorado, especially excess, absence or contamination of sediment as a result of either natural or human factors.
- An overview of the three general physiographic provinces of Colorado (eastern plains, central mountains, and western plateaus and canyons) with respect to rivers (channel types, flow regimes, sediment sources and transport).
- A summary of how sediment impacts water management as well as how water management affects sediment movement, with brief case studies from around the state.
- A list of options for managing sediment and planning for sustainable water storage and use.
- Recommendations for future research studies and for improving sediment management.

Task Force members are:

Jay Skinner, Colorado Division of Wildlife
Dick Stenzel, Division I Engineer, Colorado Division of Water Resources
Bob McConnell, Water Quality Control Division, Colorado Department of Public Health and Environment



EVALUATION OF SWINE EFFLUENT FIELD APPLICATION

by Mahdi Al-Kaisi
Regional Water Quality/Management Specialist
CSU Cooperative Extension

Optimizing the use of animal manure as a source of nutrients for crop production can minimize the contamination of water resources. Manure is used either as a fertilizer amendment on agricultural land or disposed of on the ground. This study deals with the use of swine effluent as a plant nutrient source and its management as a fertilizer. This study does not address the issue of odor or any pathogenic aspects of swine effluent. The major emphasis of this study is the development of best management practices (BMPs) in using swine effluent under irrigated conditions and site-specific conditions (i.e., loamy sand soil, continuous corn crop, and sprinkler -irrigated field). The long-term impact of over-application can be significant, especially under irrigated conditions.

Applying manure (liquid or solid) to meet the crop nutrient requirement is complicated by the dynamics of organic matter decomposition in soils. This is especially critical for crops such as corn, where the nitrogen (N) requirement during vegetative stages is very high. On the other hand, excessive rates of manure can result in a higher N content than the crop needs. Excess N in soil can convert to nitrate, which is subject to leaching when the soil water content exceeds the soil water-holding capacity.

Developing BMPs for handling manure is crucial to addressing one of the public's environmental concerns. This study will begin to establish a database that is not available at the present time to help evaluate swine effluent applications on irrigated soils. Also, this kind of information will enhance decision-makers' ability to determine the best use of such materials and their impact on water quality.

The objectives of the Yuma County Swine Effluent Project are to:

- **Evaluate swine effluent impact on water quality and irrigated crop production under different application rates;**
- **Evaluate the NO3-N leaching under irrigated conditions;**
- **Determine the amount and rate of N mineralized and released from swine effluent under irrigated conditions;**
- **Evaluate the economic value of using swine effluent as a plant nutrient source; and**
- **Develop best management practices for using swine effluent as a fertilizer.**

A field study, which began in 1995, is being conducted on an irrigated farm in Yuma County, Colorado. Four rates of swine effluent from a two-stage lagoon, along with four similar rates of commercial N fertilizer, have been applied on a loamy sand, sprinkler-irrigated corn field. The swine effluent and commercial N rates are a control, with the agronomic rate based on soil testing recommendations for the top two feet, and the other two rates are 50 lb/a N below and above the agronomic rate. Swine effluent was applied through a sprinkler system (center pivot) from a two-stage lagoon with less than 0.4 percent solid materials. Swine effluent has been applied at four applications, at 4-leaf, 8-leaf, 12-leaf, and tasseling growth stages. The experiment is arranged in a complete randomized block design in four replications, including a control where no effluent or commercial N was applied. The following measurements have been taken: initial soil chemical and physical analyses for depths of 1 to 20 feet; swine effluent composition analysis; NO3-N and NH4-N content from soil samples taken periodically for depths of 1 to 10 and 1 to 20 feet to

determine NO3-N movement through the soil profile; grain and dry matter yields; soil moisture on a weekly basis; and plant analysis for N content.

The findings of the study are not finalized yet, due to the continuation of sample analysis, data collection and data analysis until spring of 1999. However, preliminary findings from 1995 and 1996 field studies indicate that swine effluent has significant plant nutrition value. Yield results from both commercial N and swine effluent treatments showed an improvement in corn response under effluent as compared to commercial N fertilizer applied at the same N rate. Swine effluent analysis showed that 95 percent of the N is in the form of NH4-N, and less than 1 percent is NO3-N. The chemical nature of NH4-N (positively charged) allows it to adhere to the soil particles (negatively charged) as compared to NO3-N (negatively charged), which is more susceptible to leaching. However, other factors and processes can affect the stability of NH4-N and convert it to NO3-N. Therefore, proper water and nitrogen management is essential to reducing any N leaching. There was NO3-N leaching below 5-6 ft soil depth of 4-5 ppm from both sources (swine effluent and commercial N fertilizer) at the highest rates of application (over 250 lb N/a), as compared to the control treatment. Also, there was an increase in soil phosphorous content in the top 12 inches with effluent application. The results show that split application of effluent during the growing season was very effective in managing swine effluent under irrigated conditions on loamy sand soil. N and P plant uptake were higher under swine effluent treatments than with commercial N fertilizer.

The method of applying swine effluent used in this study is designed to examine several swine effluent application rates below and above the suggested agronomic rate. The split application of swine effluent four times during the growing season did not cause any crop damage.

BMPs in handling and managing animal manure, or any other source of N, are critical to minimize water resource contamination. The practices implemented in this study were effective in managing swine effluent under irrigated conditions. Following are the recommended practices that we adopted in treating effluent as a fertilizer:

Nutrient Management

- Effluent analysis before application to the field to determine the nutrient value for the crops.
- Soil sampling and analysis of N and other nutrients required for crop production.
- Setting a realistic yield goal that will enable us to apply the required amounts to achieve the yield goal, taking into consideration soil-N, N from organic matter, and N from irrigation water. This practice will minimize N over-application.
- Final soil analysis after harvest to determine the N status at t he end of the season. Analysis results from the top two feet can be used for next season's nitrogen recommendation.

Effluent Application

- Method of applying effluent is another critical factor. We applied effluent during the growing season in several applications to avoid over-application and N loss due to leaching from rainfall or irrigation. Effluent was applied through the sprinkler system at different growth stages up to tasseling. However, there are other methods that can be used to apply liquid manure, such as injecting or knifing under the soil surface.
- Timing of application is another consideration. To minimize leaching potential when there is no growing crop, effluent was applied in early spring and during the growing season.

Water Management

- Calibration of the system needs to be done prior to applying effluent, whether applied through sprinkler or injecting. This practice was achieved by using the same nozzle size and conducting a field "Can Test" to determine how much effluent the field was receiving at the time of application.

- Irrigation was scheduled according to crop water use (ET) data or soil moisture monitoring. Irrigation scheduling is very critical to minimize any potential leaching. We used weather information from a local weather station in Yuma County to estimate daily crop water use, and we also monitored soil moisture once a week.

Training

Training is a key factor in proper animal waste management. This was accomplished through workshops, field tours, and on-site training for local producers and individuals who deal with animal manure management. The training should emphasize the proper management of liquid or solid manure from point of production, storage, and field application.

The above best management practices are very important in managing any source of nitrogen to minimize nitrate leaching to water resources. To this point, this study has shown that through proper implementation of the above BMPs, swine effluent can be effectively used as a crop nutrient. However, the importance of training must be strongly emphasized. The technical content of the first three BMPs (Nutrient Management, Effluent Application, and Water Management) must be thoroughly understood and properly applied by operators of swine effluent application systems. Thus, ongoing training of such operators is strongly recommended as a key element in any program for swine effluent management.

For additional information about this project contact:
Mahdi Al-Kaisi, Regional Water Quality/Management Specialist,
CSU Cooperative Extension, P.O. Box 400, Akron, CO 80720
Phone 970/345-0508

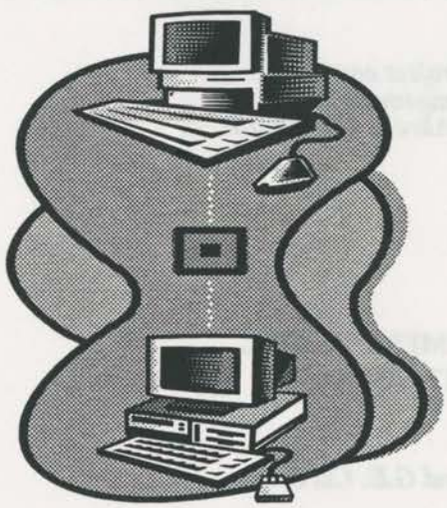
MODSIMQ -- RIVER BASIN MANAGEMENT MODEL WILL INTEGRATE WATER QUANTITY/QUALITY

by J.W. Labadie, T.K. Gates, I. Broner, and G.E. Cardon
Project Investigators

Within the State of Colorado, agricultural water is applied to approximately 1.3 million hectares of farmland. Inefficiency in irrigation practices has intensified problems of elevated water tables and high salinity and has resulted in the removal of approximately 36,000 hectares of agricultural land from production each year. Evaluating the economic and environmental outcomes of best management practices (BMPs) for alleviating these problems is hindered by the hydrologic, geohydrologic, geochemical and administrative (legal) complexities of appropriative river basin systems. A decision support system (DSS) that will enable water managers and policy makers to evaluate the integrated water quantity/quality impacts of BMPs on a basin-wide scale is needed.

This study advances previous work on a Colorado Agricultural Experiment Station project that resulted in development of the integrated water quantity/quality river basin management model (MODSIMQ).

The current study attempts to incorporate prediction of agricultural return flow water quality and recent scientific advances in stream-aquifer modeling, groundwater flow, and solute transport into MODSIMQ. A powerful graphical user interface is being designed to integrate all of these features with complex water rights, interstate compact, and other legal issues that control allocation and use of both surface water and groundwater in appropriative river basins. This study uses geographic information system (GIS) technology to create the spatial database required for implementation of the groundwater flow and solute transport model, which will be applied to Colorado's Lower Arkansas River Valley as a case study. Extensive field experiments and data collection, including aerial photos and LANDSAT imagery, provide the basis for model calibration and verification in support of detailed investigations on economic and environmental impacts of the implementation of various BMPs in the basin.



The Lower Arkansas River Basin Reference Database has been constructed and compiles all published, as well as a number of unpublished, reports and data relevant to the Lower Arkansas Valley geohydrology, geochemistry, agriculture, and administration. Active participation in the Arkansas River Basin Technical Group, comprised of representatives from various agencies addressing salinity problems in the valley, has greatly reinforced the practical relevance of this study. Aerial photography and LANDSAT satellite images have been acquired to provide a strong visual understanding of the basin in support of the modeling efforts. A detailed review of the Highly Integrated Model (HIM) of the Lower Arkansas River Valley was conducted in cooperation with the Office of the State Engineer, since it played a major role in the recent legal action between Colorado and Kansas over apportionment of Arkansas River waters. A statistical analysis of cropping patterns in the valley has been completed, along with a digital base map of basin agriculture for incorporation into a GIS to be linked with the DSS. Ongoing work includes transfer of all geo-spatial data into the GIS, construction of the groundwater flow and solute transport model, and appropriate modification of MODSIMQ.

The results of this study will enable a basin-wide evaluation of BMPs that minimizes environmental degradation without harming the agricultural economy. The creation of a tool that addresses problems on a basin-wide scale, while allowing for the modeling of localized changes, should have far-reaching scientific impacts in assessing the most effective BMPs for investigations in other river basins.

WATER RESEARCH AWARDS

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

Colorado State University, Fort Collins, CO 80523

GOCO/DOW IV, Christopher A. Pague, Fishery & Wildlife Biology. Sponsor: Colorado Division of Wildlife.
Wetlands Data Interpretation, William Given, Fishery & Wildlife Biology. Sponsor: Colorado Department of Natural Resources.
Enhancement of Wetland Data, William Given, Fishery & Wildlife Biology. Sponsor: Colorado Department of Natural Resources.
Development of Environmental Contaminant Encyclopedia, John D. Stednick, Earth Resources. Sponsor: NPS-National Park Service.
Field Studies & Modeling of Cropping Systems & Their Impact on Water Quality, Gary A. Peterson, Soil & Crop Sciences. Sponsor: USDA-ARS-Agricultural Research Service.
Atrazine Analysis of Ardec Soil, Philip Westra, Bioagricultural Science & Pest Management. Sponsor: USDA-ARS-Agricultural Research Service.
Effects of Woody Vegetation on Channel Roughness, Steven R. Abt, Civil Engineering. Sponsor: DOD-ARMY-Corps of Engineers.
Use of Zeoponic Mixtures for Sand-based Turfgrass Culture, Anthony J. Koski, Horticulture & Landscape Architecture. Sponsor: Boulder Innovative Technologies, Inc.
Development of an Integrated System of Flow Forecasting for the Maule R. Basin, Chile, Gustavo E. Diaz, Civil Engineering.
Assessing Transportation Effects no Biodiversity in the South Rocky Mountain Ecoregion, Lee Grunau, Fishery & Wildlife Biology. Sponsor: Colorado Department of Transportation.
Research Design, David C. Bowden, Statistics. Sponsor: Division of Wildlife.
Larimer County Horsetooth Mountain Park, Stephan M. Kettler, Fishery & Wildlife Biology. Sponsor: Larimer County.
Snow Monitoring in the Maule River Basin, Gustavo Eugenio Diaz, Civil Engineering. Sponsor: Colbun, Machicura, S.A.
Navigation Channel Widening at Crossings on Lower Mississippi, Daniel Gessler, Civil Engineering. Sponsor: Corps of Engineers.
Integrated Modeling and Assessment for Balanced Food Security, Conservation, and Ecosystem Integrity, Michael Coughenour, Natural Resource Ecology Lab. Sponsor: University of California at Davis.

The University of Colorado, Boulder, CO 80309

Recovery of Endangered Fish in the Upper Colorado River Basin, Harold Tyus, Cooperative Institute for Research in Environmental Sciences. Sponsor: Colorado River Water Conservation District.
Satellite Remote Sensing of Ecosystem Structural and Functional Changes: Integrating Spectral Mixture Analysis and BRDF Inversion, William Emery, Colorado Center for Astrodynamic Research/CIRES. Sponsor: NASA.
Validation Studies and Sensitivity Analysis for Retrievals of Snow Albedo and Snow-Covered Area from EOS AM-1 Instruments, Anne Nolin, Cooperative Institute for Research in Environmental Sciences. Sponsor: NASA.
Potential Effects of Global Climate Change on Western River Basin Study, Edith Zagona, Civil, Environmental and Architectural Engineering (CADSWES). Sponsor: Bureau of Reclamation.
Hydrology and Water Resources Research, Graduate School, Carol Lynch. Sponsor: U.S. Geological Survey.
Evaluating Stormwater Modeling Techniques Integrated with Geographic Information Systems (GIS) for Stormwater, Sanitary Sewer Overflow and Combined Sewer Overflow Management, James Heaney, Civil, Civil, Environmental and Architectural Engineering (CADSWES). Sponsor: (CADSWES). Sponsor: Environmental Protection Agency.
Arsenic Removal by Softening and Coagulation, Marc Edwards, Civil, Civil, Environmental and Architectural Engineering. Sponsor: Environmental Protection Agency.
Earth System Modeling as a Component of the Curriculum of Global Change and Environmental Studies Program Using Stella and GCMS Provided via Partnership between CU and NASA-GISS, James White, Geological Sciences. Sponsor: Universities Space Research Association.

Effects of Climate Change in the Colorado Alpine: Ecosystem Response to Altered Snowpack and Rainfall Regimes, Timothy Seastedt, Environmental, Population and Organismic Biology. Sponsor: National Science Foundation.

Passive Microwave Snow Cover Algorithm Intercomparison and Validation, Richard Armstrong, Cooperative Institute for Research in Environmental Sciences. Sponsor: NASA.

Study the Surface Properties and Chemistry of Model Polar Stratospheric Clouds, Cooperative Institute for Research in Margaret Tolbert, Cooperative Institute for Research in Environmental Sciences.

A 14000-Year Record of Decade-to-Century-Scale Tropical Climate Variability from Annually-Laminated Sediments of the Cariaco Basin, Venezuela, Jonathan Overpeck, Institute of Arctic and Alpine Research. Sponsor: NASA.

Quantifying Grassland-to-Woodland Transitions and the Implications for Carbon and Nitrogen Dynamics in the Southwest United States, Carol Wessman, Environmental, Population and Organismic Biology. Sponsor: NASA.

Robert M. Hirsch, Chief Hydrologist for the U.S. Geological Survey, announced on February 2, 1998, that the President's budget for fiscal year 1999 provides a $1 million increase for the State Water Institute Program. These additional funds would be earmarked for research on the causes, effects, and management of nonpoint-source pollution in support of the Administration's Clean Water and Watershed Restoration initiative.

This proposed increase is a significant development for the Institute Program and the USGS. It is the first proposed increase in funding for the program since it was assigned to the USGS in 1984 and it is the first time that funding for the Institutes has been sought in direct support of a high-priority federal program. It is this latter development that is of special significance to the USGS in that it would set a precedent in working with the Institutes to either complement the work of internal USGS programs or extend the capabilities of the USGS into areas such as research on the regulatory and economic aspects of water quality management.

UNIVERSITY WATER NEWS

NEW FACULTY IN WATER

by Laurie Schmidt

Kathryn Nagy
Department of Geological Sciences
University of Colorado/Boulder

Kathryn Nagy is a new associate professor in the Department of Geological Sciences at the University of Colorado at Boulder. Dr. Nagy received her M.S. in Geology from Brown University and her Ph.D. in Geology from Texas A & M University. She was also a post-doctoral research associate at Yale University. From 1991-1994, she worked as a Senior Research Geologist at Exxon Production Research Company in Houston. For the past three years, she was a senior member of the technical staff in the Geochemistry Department at Sandia National Laboratories in Albuquerque.

As a low-temperature geochemist, Dr. Nagy's research interests lie in the interactions of rocks and minerals with water. She is also interested in the use of minerals in materials science, the protection of monuments from environmental weathering, and mineral/water interactions related to petroleum exploration and production. She is currently working on two research projects. One involves investigating the sorption of radioactive analogues onto phases found in the waste tanks at Hanford Washington (funded by the U.S. Department of Energy); the other involves developing a new technology for stable containment barriers by growing clays from aqueous gels injected into soils and sediments (funded by the U.S. Department of Defense). Both projects involve collaboration with researchers at Sandia National Laboratories.

Dr. Nagy teaches Aqueous Geochemistry, a course that focuses on the origin and composition of natural waters. Within the next two academic years, she also plans to teach a course in Soil Mineralogy and Chemistry and a seminar in Mineral/Water Interface Geochemistry. She serves as councilor for the Clay Minerals Society and is active in both the Mineralogical Society and the Geochemical Society.

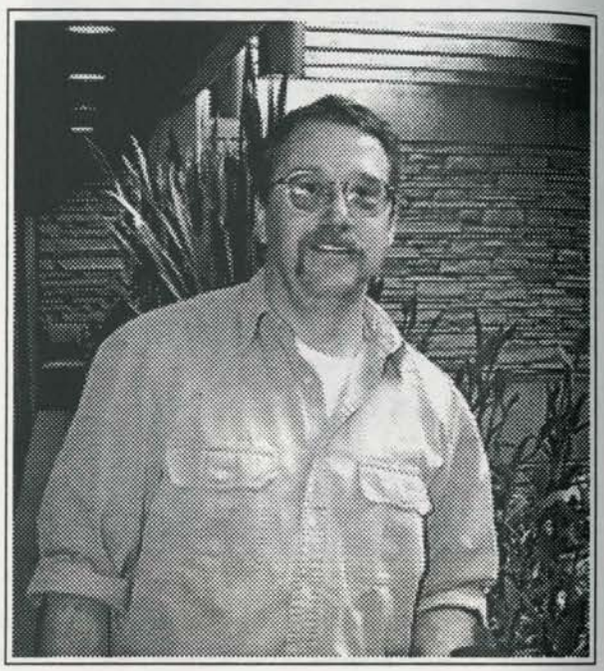
NATURAL RESOURCE AND AGRICULTURAL ECONOMICS
LUNCH TIME SEMINAR SERIES — SPRING 1998
WEDNESDAYS—12:10 TO 1:00 — 110 ANIMAL SCIENCE BUILDING
COLORADO STATE UNIVERSITY

Date	Topic	Speaker
Feb 25	**Environmental Impacts of Oil Exploration in Venezuela**	Francisco Rojas Navas, Visiting Professor
March 4	**Migration Effects of Olympic Games Siting**	Dawn Thilmany, CSU
March 6	**Special Presentation**	Norman Meyers, Volvo Environment Prize Winner
Friday, Noon	**The U.S. Stake in the Global Environment**	
Location:	Microbiology A101	
March 18	**Urban Sprawl Confronts Traditional Agriculture: The New Challenge Facing Agribusiness**	Sue Hine, CSU
March 25	**Climate Change Impacts on U.S. Water Resources**	Brian Hurd, Hagler Bailly
April 1	**Valuing Historic Preservation of Cultural Resources in Fort Collins: Results of a Survey**	Robert Kling, CSU
April 8	**Sportfishing Visits to the Brazilian Pantanal**	Andy Seidl, CSU
April 22	**An Analysis of Drought Response in the San Luis Valley: Results**	Marshall Frasier, CSU Mark Sperow, CSU

NEW FACULTY IN WATER

by Laurie Schmidt

William Sanford
Department of Earth Resources
Colorado State University



William Sanford joined the faculty in the Department of Earth Resources at Colorado State University in 1996. Dr. Sanford received his M.S. in Geophysics and his Ph.D. in Soil and Water Engineering from Cornell University. From 1992-1996, he was a Research Associate in the Environmental Sciences Division at Oak Ridge National Laboratory. There, he developed and performed natural gradient groundwater tracer investigations in fractured, weathered shales using dissolved noble gases and colloidal-sized particles. He also performed field studies that illustrated the role that dissolved organic matter plays in enhancing the transport of transuranic wastes and rare earth elements in groundwater.

Dr. Sanford's current research activities include laboratory studies on transport of dissolved noble gases through reactive substrates, field tracer experiments to examine the role of diffusion in contaminated sites, groundwater flow and transport in fractured and heterogeneous porous media, and the use of isotopes as tools to improve groundwater management. He is also interested in investigating the interrelationships of the physical, chemical, geological, and biological aspects of solute transport.

Dr. Sanford teaches Physical Geology, Environmental Geology, Hydrogeology, and Isotope and Tracer Hydrogeology at CSU. Beginning in Fall 1998, he will also teach a course entitled Groundwater Flow and Solute Transport in Fractured Media.

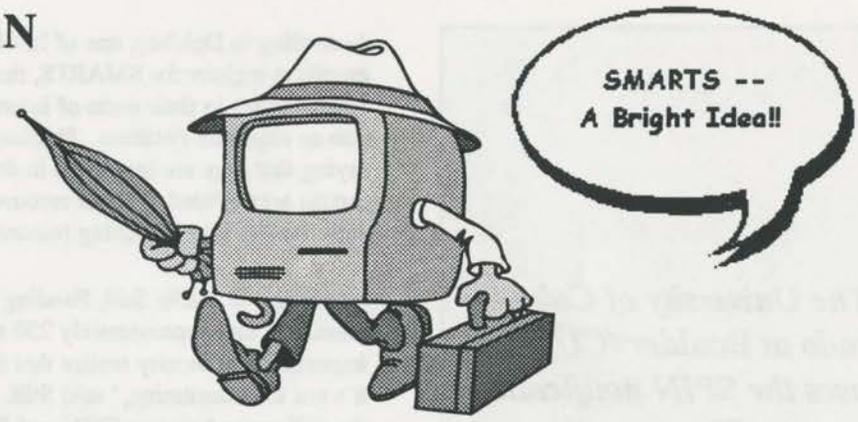
DEPARTMENT OF EARTH RESOURCES
GEOLOGY GEOGRAPHY WATERSHED SCIENCE
COLORADO STATE UNIVERSITY
EARTH RESOURCES DEPARTMENT SEMINAR SERIES, SPRING SEMESTER, 1998

NOTE: Talks begin at 4:10 p.m. and are scheduled for Room 316 in the Natural Resources Building on the main campus of Colorado State University. Room changes, if necessary, will be noted on the weekly announcement that is sent out prior to each seminar.

Date	Topic	Speaker
Feb. 20	**Bedload Transport Patterns in Coarse-grained Mountain Streams**	Sandra Ryan, U.S. Forest Survey Host: Ellen Wohl
Mar. 27	**Impact of Engineering on the Lower Mississippi River**	Lawson Smith, U.S. Army Corps of Engineers Host: Stan Schumm
Apr. 3	**1996 Experimental Flood in Grand Canyon**	Ned Andrews, U.S. Geological Survey, Boulder Host: John Stednick
Apr. 17	**Summary of the Status of Rocky Mountain Water Quality**	Jill Baron, Natural Resources Ecology Lab, CSU Host: Kelly Elder
May 3	**Title forthcoming**	Kelly Elder Department of Earth Resources, CSU

SMARTS and SPIN

by Laurie Schmidt



During the past year, innovative procedures for locating various sources of research funding have been adopted by Colorado universities.

SMARTS is a notification tool that matches faculty with relevant funding opportunities.

SPIN is a computer database with detailed and up-to-the-minute information about thousands of federal, non-federal, and international funding opportunities.

Research is an important function of higher education institutions. Not only does it help create an atmosphere that promotes scholarly inquiry and accomplishment, but it also supports graduate work and enriches the undergraduate experience.

During the past year, innovative procedures for locating various sources of research funding have been adopted by Colorado universities. These techniques are proving to be priceless tools for water faculty that are seeking to locate water research opportunities. Sponsored Programs Information Network (SPIN) is currently the number one source of funding information and provides institutions and regional economic development efforts with current and available sources of funds and sponsorships. SPIN is a computer database with detailed and up-to-the-minute information about thousands of federal, non-federal, and international funding opportunities.

Offices of Sponsored Programs assist university faculty and staff in research initiation by assisting them in identifying funding opportunities. According to Kathi Delehoy, Assistant Director of Sponsored Programs and Director of Preaward Services, Colorado State University strives to use as many tools as possible to communicate funding opportunities to its faculty and staff. For example, they have set up links on their web site to various agencies that would be of interest to faculty. "If a faculty member wants to find out what a particular sponsoring agency is doing in the area of water research, then they can very easily locate that information by going to our web site and linking to that agency," said Delehoy.

SPIN Matching and Researcher Transmittal System (SMARTS) is an electronic matching and funding opportunity notification system that provides faculty with a direct and targeted electronic link to comprehensive and current U.S. federal and non-federal research funding information. InfoEd then matches the profile information with the SPIN database. The two data sources interact regularly, so that "matchmaking" is conducted on a daily basis. When CSU faculty members register for SMARTS, they indicate their interest areas by using keywords. They then receive automatic electronic mail notifications alerting them of funding opportunities that match their profile and keywords.

The University of Colorado at Boulder (CU) also uses the SPIN notification system. However, they use their own in-house database to match their faculty to funding opportunities.

The main tool that CSM uses for this service is the ORD's web site. The site maintains subscriptions to two large databases of research opportunity announcements, including SPIN, and direct links to four e-mail "alert services."

According to Delehoy, one of InfoEd's most useful features is that when faculty members register for SMARTS, they are automatically notified of any research opportunities in their areas of interest, and their keywords also dump automatically into an expertise database. Delehoy explained, "If someone sends us an e-mail saying that they are interested in doing research or collaborating with someone in a certain area related to water resources, then we can use those keywords to locate other faculty who are doing research in those same areas and pair them up."

According to Millie Still, Funding Resource Coordinator, CSU has 1,400 faculty members, and approximately 250 are currently registered for SMARTS. "It's important that faculty realize that the registration process is an easy thing to do, and it's not too consuming," said Still. Another thing that faculty should understand is the difference between SPIN and SMARTS. SPIN is a searchable database that is accessible by all CSU users. SMARTS, on the other hand, is a notification tool that matches faculty with relevant funding opportunities. SMARTS requires registration, while SPIN does not.

The University of Colorado at Boulder (CU) also uses the SPIN notification system. However, they use their own in-house database to match their faculty to funding opportunities. The database, called the "Faculty Interest Profile System," is based on the keyword thesaurus compiled by Rodman and Associates. CU faculty members are asked to describe their research interests and list keywords from the thesaurus that relate to their areas of interest. The Office of Contracts and Grants then sets up a profile based on that information. Announcements about funding opportunities are then sent directly to faculty members who have chosen keywords that relate to the announcements. According to Karen Springfield, Information Officer at CU, nearly 400 CU faculty members are currently participating in the system.

At Colorado School of Mines (CSM), the Office of Research and Development (ORD) assists faculty in locating research funding opportunities. The main tool that CSM uses for this service is the ORD's web site. The site maintains subscriptions to two large databases of research opportunity announcements, including SPIN, and direct links to four e-mail "alert services." Other tools used by CSM's web site include direct links to research opportunity announcements, summaries of programs that may be of special interest to graduate students, listings of opportunities especially aimed at obtaining or developing research equipment, and direct links to nearly 40 sponsor web sites. According to Barbara Bosche, Director of Research Development and Technology Transfer at CSM, the ORD staff puts a lot of effort into ensuring that the web site contains complete and accurate information, and then follows that up by marketing the site to the research community at CSM. "In that way, we can most efficiently allocate our limited resources to assisting the greatest number of researchers," said Bosche.

The Office of Sponsored Programs at CSU holds regular workshops and training sessions to help faculty members get registered for SMARTS, and to familiarize them with the procedures and instructions. Sponsored Programs also holds training/registration sessions in departments where there are enough interested faculty members.

INVENTORY OF COLORADO'S HIGHER EDUCATION ACTIVITIES AND EXPERTISE IN WATER

Five years ago, CWRRI published an inventory of the water expertise available in Colorado's higher education system in its newsletter, *Colorado Water*. The inventory consisted of a list of water-related courses available and of faculty who apply their disciplines to water resources. It included water expertise at the Colorado School of Mines, the University of Colorado at Boulder, and Colorado State University.

Recently, the inventory was updated, and it is being provided again to the readers of *Colorado Water* in a sequence of issues. In this issue is a list of the "water"courses at the **Colorado School of Mines**. Copies of the complete inventory of "water" faculty and courses are available on the CWRRI website (**http://www.ColoState.EDU/Depts/CWRRI**) or upon request from CWRRI. During the year, the **complete** inventory list will be published in *Colorado Water*.

COLORADO SCHOOL OF MINES WATER COURSES, 1997/98

The following courses offered at the Colorado School of Mines (at the senior level and above) are particularly relevant to water (eg water quantity, water quality, and the causes and management of both). The following course letters refer to the department or college in which the course is taught:

CHGC	Chemistry & Geochemistry	
CRGN	Chemical Engineering & Petroleum Refining	
EBGN	Economics & Business	www.mines.edu/econbus/
EGGN	Engineering	www.mines.edu/academic/eng
ESGN	Environmental Science & Engineering	
GEGN	Geological Engineering	
GPGN	Geophysics	
LISS	Liberal Arts & International Studies	
PEGN	Petroleum Engineering	

Course # (Credits)	Title
Economics	
EBGN 510	Natural Resource Economics
EBGN 570	Environmental Economics
Groundwater	
CHGC 509	Aqueous Geochemistry
CHGC 681	Special Topics in Aqueous and Sedimentary Geochemistry
GEGN 467	Hydrogeology
GEGN 470	Groundwater Engineering Project Design
GEGN 481	Advanced Hydrogeology
GEGN 483	Mathematical Modeling of Ground Water Systems
GEGN 570	Case Histories in Geological Engineering and Hydrogeology

Course # (Credits)	Title
GEGN 576	Engineering Geology and Hydrogeology of North America
GEGN 581	Advanced Hydrogeology
GEGN 585	Hydrochemical Evolution and Modeling of Ground-Water Systems
GEGN 669	Advanced Topics in Hydrogeology Seminar
GEGN 681	Vadose Zone Hydrology
GPGN 473	Fundamentals of Engineering Geophysics
GPGN 574	Groundwater Geophysics
PEGN 311	Drilling and Development
PEGN 312	Drilling and Production Lab
PEGN 414	Well Completion, Testing and Design
PEGN 419	Subsurface Engineering
PEGN 513	Reservoir Simulation
PEGN 607	Partial Water Drive Reservoirs
PEGN 606	Advanced Reservoir Engineering
PEGN 608	Fluid Displacement in Porous Media
PEGN 614	Reservoir Simulation II

Hydraulics

CRGN 508	Advanced Fluid Mechanics
CRGN 307	Fluid Mechanics
EGES 551	Intermediate Fluid Mechanics
EGES 552	Advanced Fluid Mechanics
EGES 598C	Mechanics of Incompressible Fluids
EGES 638	Fluid-Structure-Ice Interactions
EGES 649	Hydrodynamics
EGGN 351	Fluid Mechanics
EGGN 451	Hydraulic Problems
EGGN 473	Fluid Mechanics II
PEGN 310	Fluid Properties

Hydrology

EGES 553	Engineering Hydrology
EGES 554	Open Channel Flow

Irrigation and Drainage

EGGN 461	Soil Mechanics

Law, Policy, History, Sociology

ESGN 501	The Natural Environment: Components and Processes
ESGN 502	Environmental Law
ESGN 593	Environmental Permitting
ESGN 591	Environmental Impact Analysis
ESGN 596	Environmental Ethics and Decision Making
LISS 431	Global Environmental Issues
LISS 480/503	Environmental Politics and Policy
LISS 482/504	Water Politics and Policy
LISS 4xx	Environmental Problems and Policies of the Former Soviet Union

Management and Planning

ESGN 571	Environmental Project

Models/Computer Data Management/GIS

ESGN 505	Experimental Design and Environmental Data Analysis
GEGN 575	Applications of Geographic Information Systems
GEGN 583	Mathematical Modeling of Groundwater Systems
GEGN 675	Advanced Topics in Geographic Info. System
GEGN 683	Advanced Ground-Water Modeling

Oceans

EGGN/PEGN 408	Introduction to Offshore Technology
EGES/PE 538	Introduction to Offshore Technology
EGES/MNGN 539	Marine Mining Systems

Sediment Transport

GEGN 315	Sedimentology and Stratigraphy
GEGN 442	Advanced Engineering Geomorphology

Stream and Riparian Zone Biology/Wetlands

CHGC 562	Microbiology and the Environment
ESGN 513	Limnology

Toxicology

ESGN 545	Environmental Toxicology

Water Quality Management/Monitoring

CHGC 530	Environmental Chemistry and Geochemistry
CHGC 555	Environmental Organic Chemistry
ESGN 520	Surface Water Quality Modeling

Water and Wastewater Treatment/Environmental Engineering

CHGC 541	Hydrochemical Systems
ESGN 500	Principles of Environmental Aquatic Chemistry
ESGN 504	Treatment of Water and Waste
ESGN 541	Biochemical Treatment Processes
ESGN 540	Physical & Chemical Treatment Processes
ESGN 575	Hazardous Waste Site Remediation

PUBLICATIONS

CWRRI PUBLICATIONS

Grow with the Flow: Growth and Water in the South Platte Basin, Proceedings of the 1997 South Platte Forum, October 29-30, 1997, Longmont, Colorado, Jennifer Mauch, Editor. The 1997 South Platte Forum focused on the timely issue of growth in the basin. Forum keynote speakers were James S. Lochhead, Colorado Department of Natural Resources; former Colorado Senator Hank Brown; Colorado Senator Don Ament; Mark Schaefer, Interim Director, U.S. Geological Survey; and Paul D. McIver, Public Outreach Coordinator, Ecosystems Protection Program, USEPA Region 8, Denver. Panel topics were "Land of Plenty," "Land of Depletion," "Show Me the Money," and "What's Afoot with the Headwaters." The forum also included a poster session.

To obtain a copy of the proceedings, contact the Cooperative Extension Resource Center, General Services Building, Colorado State University, Fort Collins, CO 80523; Phone 970/491-6198, FAX 970/491-2961. Price: $5.

OTHER WATER REPORTS

Sustaining Water, Easing Scarcity: A Second Update — Revised Data for the Population Action International Report, Sustaining Water: Population and the Future of Renewable Water Supplies, by Tom Gardner-Outlaw and Robert Engelman. Available from: Population and Environment Program, 1120 19th Street, NW, Suite 550, Washington, DC 20036; Phone 202/659-1833, FAX 202/293-1795, Web site http://www.populationaction.org.

Final Environmental Impact Statement, Record of Decision, and Final Revised Forest Plan, Arapaho and Roosevelt National Forest and Pawnee National Grassland, U.S. Department of Agriculture, Forest Service, 240 West Prospect Road, Fort Collins, CO 80526-2098. The Acting Regional Forester approved the Record of Decision selecting Alternative B from the Final Environmental Impact Statement on November 11, 1997. Priorities in Alternative B are:

- Ensuring the long-term of the land and restoring ecosystems.
- Providing a mix of high-quality recreation opportunities within the capability of the land.
- Providing sufficient quantities of clean water to the extent possible for domestic, industrial and agricultural use within the capabilities of the land, and maintaining aquatic and riparian habitat.
- Promoting goals and objectives that contribute to the economic and social vitality of local communities, providing opportunities for partnerships, and improving services to the American public.

These documents are available for use at the CWRRI Office Library — 410N University Services Center.

Draft Report — The Denver Basin and South Platte River Study —The 1996 Colorado General Assembly's Senate Bill-74 authorized the establishment of a Special Water Committee to investigate Denver Basin groundwater management and South Platte River Basin issues. The bill also specified that the State Engineer and the Director of the Colorado Water Conservation Board would direct a study of the Denver Basin. The South Platte Basin, and their interaction. The study included the following issues:

- Long-term depletions of the South Platte River caused by the withdrawal of water from the Denver Basin.
- Effects of runoff from impervious surfaces, due to land development, on flows in the South Platte River.
- Effect of water reuse, conjunctive use, and non-tributary groundwater use on future water supplies and water rights in the South Platte River.
- Possible funding mechanisms and water augmentation mechanisms that can serve Colorado's participation in the three-state Platte River endangered Species Recovery Program.
- The economic life of the Denver Basin aquifers.

A status report on SB 96-74 can be found at the website
http://www.dnr.state.co.us/cwcb/secb/sb74stat.htm.
The website provides background information about SB96-74 and links to the following:

- Progress on the Economic Life of the Denver Basin Aquifers Study
- Progress on SB 74 Documentation/Coordination of Resource Data by Hydrosphere, Inc.
- Progress on the State Engineer's Office Denver Basin Groundwater Model
- Progress on the Platte River Project White Paper
- Peer Review Group Meetings Held and Scheduled Progress for Next Reporting Period.

To be incorporated in the study is information developed by HRS Water Consultants, Inc. as directed by Senate Bill 96-153:

- an estimate of groundwater production from the Denver basin aquifers;
- an estimate of groundwater return flows to the surface water system; and
- an identification and quantification of groundwater reuse.

Completion of the Draft Final Report is scheduled for August, and submittal of the Final Report to the Special Water Committee is scheduled for September.

Try the SB74 Interactive Tool found at the website

This illustrative tool was developed as part of the SB74 study to demonstrate the interrelationships between population, water demands, water supply options and resulting effects on surface water and groundwater resources within the South Platte basin of Colorado.

The tool allows the user to select a future water supply scenario based on population growth and water supply options for each of three regions within the South Platte basin. Relevant information on population, existing water supplies and future water supply plans is provided in the input page along with several example future scenarios.

The tool illustrates the effects of a specified scenario with respect to surface water flows; transbasin diversions, Denver Basin groundwater use and conversion of in-basin irrigated agriculture. Effects on surface water flows are shown at five gage locations on the South Platte River.

U.S. Geological Survey

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

Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States, by Blakemore E. Thomas, H.W. Hjalmarson, and S.D. Waltemeyer. ***The following is a brief summary of U.S. Geological Survey Water Supply Paper 2433.***

Flood-frequency information is needed for the cost-effective design of bridges, culverts, dams, and embankments and for the management of flood plains. In this study, methods were developed by the U.S. Geological Survey (USGS) for estimating magnitude and frequency of floods of streams in basins of less than about 200 square miles in the arid southwestern United

States. The reliable estimation of flood-frequency relations for both gaged and ungaged streams that drain these arid basins is complex because rainfall is variable in time and space and because the physiography of the drainage basin is extremely variable. The development of accurate flood-frequency relations at gaged sites is unlikely in some areas because of the variability of annual peak discharges and short records. At some sites, most years have no flow. At other sites, commonly used probability distributions do not appear to fit the plot of annual peak discharges.

The understanding of the flood characteristics of streams in arid lands is improved because of the regional perspective of this study. A large database of streamflow-gaging-station records was evaluated for most of the southwestern United States. The study was done in cooperation with the Departments of Transportation of nine states – Colorado, Arizona, California, Idaho, Nevada, New Mexico, Oregon, Texas, and Utah.

Equations for estimating 2-, 5-, 10-, 25-, 50-, and 100-year peak discharges at ungaged sites in the southwestern United States were developed using generalized least-squares and multiple-regression techniques and a hybrid method that was developed in this study. The equations are applicable to unregulated streams that drain basins of less than about 200 square miles. Drainage area, mean basin elevation, mean annual precipitation, mean annual evaporation, latitude, and longitude are the basin and climatic characteristics used in the equations. The study area was divided into 16 flood regions.

Floods in the northern latitudes of the study area generally are much smaller than floods in the southern latitudes. Typical unit peak discharges of record range from 316 cubic feet per second per square mile for sites between 29° and 37° latitude to 26 cubic feet per second per square mile for sites between 41° and 45° latitude. An elevation threshold exists in the study area above which large floods caused by thunderstorms are unlikely to occur. For sites between 29° and 41° latitude, the elevation threshold is approximately 7,500 feet. For sites between 41° and 45° latitude, the elevation threshold decreases in a northward direction at a rate of about 300 feet for each degree of latitude.

Preliminary Estimates of Water Use in the United States for 1995, by Wayne B. Solley. The report presents a summary of preliminary 1995 water-use estimates by state for the United States, Puerto Rico, the Virgin Islands, and the District of Columbia. Preliminary estimates of water withdrawn from surface- and ground-water sources for offstream water-use categories also are presented in the report. Wayne Solley, author of the report and Manager of the USGS National Water-Use Information Program, said: "Estimates indicate that water use in the United States decreased from 1980 to 1995, even though population continued to increase during the same period. The withdrawal of freshwater and saline water in the United States during 1995 is estimated to have been 400,000 million gallons per day (Mgal/d) for all offstream uses. The estimate of water use in 1995 is two percent less than the 1990 estimate and nearly 10 percent less than the estimate for 1980, the peak year of water use documented in the five-year compilations that began in 1950."

The report is available in PDF format from the Water Use in the United States Home Page:
http://water/usgs.gov/public/watuse/pr_rel.html

Water-Quality Assessment of the Rio Grande Valley, Colorado, New Mexico, and Texas — Water-Quality Data for Water-Column, Suspended-Sediment, and Bed-Material Samples Collected at Selected Surface-Water Sites in the Upper Rio Grande Basin, June and September 1994, by Lynn K. Miller, Robert L. Moqino, and Bruce A. Hill. National Water-Quality Assessment Study Unit. Open-File Report 97-644.

Interim Results of Quality-Control Sampling of Surface Water for the Upper Colorado River National Water-Quality Assessment Study Unit, Water Years 1995-96, by Norman E. Spahr and Robert W. Boulger. National Water-Quality Assessment Program. Water-Resources Investigations Report 97-4227.

Environmental Protection Agency

Now available to the public is an EPA report to Congress, **The Incidence and Severity of Sediment Contamination in Surface Waters of the United States**. The report is required by the Water Resources Development Act of 1992. It describes the accumulation of chemical contaminants in river, lake, ocean, and estuary bottoms and includes a screening assessment of the potential for associated adverse

effects to human and environmental health. EPA studied available data from 65 percent of the 2,111 watersheds in the continental U.S. and identified 96 watersheds that contain "areas of probable concern." In portions of these watersheds, environmental conditions may be unsuitable for bottom-dwelling creatures, and fish that live in these waters may contain chemicals at levels unsafe for regular consumption. Areas of probable concern are located in regions affected by urban and agricultural runoff, municipal and industrial waste discharge, and other pollution sources. EPA recommends that resource managers fully examine the risks to human health and the environment in these watersheds. Authorities should take steps to ensure that major pollution sources are effectively controlled and that plans are in place to improve sediment conditions and to support long-term health goals.

Requests for copies of the report ***Incidence and Severity of Sediment Contamination in Surface Waters of the United States*** (Volume 1 EPA document number EPA 823-R-97-006; Volume 2 EPA document number EPA 823-R-97-007; Volume 3 EPA document number EPA 823-R-97-008) should be sent to USEPA, National Center for Environmental Publications and Information, 11029 Kenwood Road, Building 5, Cincinnati, Ohio 45242; Phone 513/891-6561, FAX 513/891-6685.

EPA now has over 6,000 EPA publications available on the Internet. From the National Environmental Publication Information Site (NEPI) you can search and view these full-image scanned publications from the EPA public access server at: http://www.epa.gov/cincl/. Questions may be directed to Shannon McFarland, Project Manager, at 513/569-7762; or to wright.ed@epamail.epa.gov.

Bureau of Reclamation

The Bureau of Reclamation has released ***Achieving Efficient Water Management: A Guidebook for Preparing Agricultural Water Conservation Plans***, a manual supporting Reclamation's responsibilities under the Reclamation Reform Act to help irrigators prepare water conservation and management plans. The guidebook, prepared by Hydrosphere Resource Consultants, is aimed at irrigation organizations of all sizes and complexities.

This informal and simple tool identifies communication with water users, government agencies and the public as the central focus of water conservation planning. The guidebook assists the reader in identifying problems and opportunities, setting priorities and goals, and evaluating options in a step-by-step process. Included are discussions of traditional problem areas such as scheduling of deliveries and efficiency of application, as well as increasingly important issues such as drainage, wetlands and water quality. Each discussion of problem areas poses questions to help leaders communicate the issues and guide an involved group through the problem identification process.

The reader is led through an evaluation of water management options. The guidebook describes a variety of water management measures and asks questions to help the reader identify measures that best fit the reader's unique situation, then provides guidance on comparing measures. Remaining steps covered include selecting measures for implementation, defining a plan of action, projecting results of selected measures, and, finally, implementing and monitoring the plan. At each step the guidebook provides checklists and highlights important considerations for the reader to examine.

To obtain a copy of the guidebook or its companion document, ***Incentive Pricing Handbook for Agricultural Water Districts***, contact Craig Phillips at 303/236-1061 x285 or email him at cphillips@do.usbr.gov.

National Small Flows Clearinghouse

NSFC, a nonprofit, federally funded environmental health program for small communities, announces the release of its new product catalog, the 1997 Products Guide. The catalog lists more than 250 educational products about small community wastewater treatment. Included are design manuals, posters, videotapes, topical computer searches, case studies, computer software, fact sheets, newsletters, and other materials. An index in the back of the Guide enables customers to use 100 key words to search for products by topic, and an order form that can be mailed or faxed to the NSFC also is included. To order the 1997-1998 Products Guide, call the NSFC at (800) 624-8301 or (304) 293-4191 and request Item #WWWCAT. The catalog also is available on the NSFC's Web site, http://www.nsfc.wvu.edu, on the site's "Products" page. Orders can also be placed via e-mail at nsfc_orders@estd.wvu.edu.

WWW WATER PATHS

DESCRIPTION	WEBSITE
The **Environmental Protection Agency** now has over 6,000 EPA publications available to you on the Internet. From the National Environmental Publication Information Site (NEPI) you can search and view these full-image scanned publications from the EPA public access server. Questions may be directed to Shannon McFarland, Project Manager, at 513/569-7762; or to wright.ed@epamail.epa.gov.	**http://www.epa.gov/cincl/.**
The **Environmental Protection Agency** has published a booklet titled The Top 10 Watershed Lessons Learned. Visit the Lessons Learned web site at	**http://www.epa.gov/OWOW/lessons**
Desdemona's SPLASH — a CD-ROM game for elementary students that combines fun and education to teach students about protecting the water quality of their lakes. Desdemona the dragonfly shows students the lake and how their choices affected the lake's water quality. To order visit the web site at:	**http://www.ctic.purdue.edu Click on Desi to see a preview.**
Wildlife Habitat Council has developed a Corporate Lands for Learning program. Partnering with National Environmental Education led to publishing a guidebook that provides a blueprint for corporations and schools to follow in building their own environmental education project. Based on lessons learned from seven pilot sites.	**http://www.wildlifehc.org**
Soil and Water Conservation Society's new bimonthly magazine will debut in February 1998. Visit the SWCS website at:	**http://www.swcs.org**
International Erosion Control Association —check the website for the publications catalog. Information is included on erosion and sediment control and stormwater and watershed management.	**http://www.ieca.org**
Draft - Denver Basin and South Platte River Basin Technical Study (SB96-74)— A report prepared by the State Engineer and the Director of the Colorado Water Conservation Board for the Colorado Legislature's Special Water Committee. See the PUBLICATIONS section of this newsletter (page 22) for more detailed information about this study.	**http://www.dnr.state.co.us/cwcb/secb/sb74stat.htm**
The **SB-74 Illustrative Tool** is available on the Internet at: This tool allows the user to input water user options for the South Platte Basin and then view the impacts on the basin.	**http://www.dnr.state.co.us/cwcb/secb/sb74exsu.htm**
The **SB-74 Executive Summary** is available on the Internet at:	**http://colorado.on-line.com/rmaf/**
Rocky Mountain Aquarium Foundation	
The **City of Fort Collins Emergency Management Web Page** is now available to the public. The flooding section has good info on the July 1997 flood as well as some of the historical floods in Fort Collins.	**http://www.ci.fort-collins.co.us/C_SAFETY/oem/index.htm**

WATER SUPPLY

January, 1998 — This month's SWSI values dropped from last month's values in all basins except the South Platte. The South Platte SWSI indicates an above normal supply, the Yampa/White SWSI indicates a below normal supply, and the value in all the remaining basins shows a near normal supply. The drop in SWSI values is most likely due to a statewide reduction in snowpack from the previous month. According to the Natural Resources Conservation Service, the statewide snowpack averaged 81 percent of normal on January 1, with the Arkansas basin being the only basin with an above-average amount at 135 percent of normal. The reason for the increase in the South Platte basin's SWSI is not known. Stream flow and reservoir storage conditions remain good throughout the state.

The Surface Water Supply Index (SWSI) developed by the State Engineer's Office and the U.S.D.A. Natural Resources Conservation Service is used as an indicator of mountain-based water supply conditions in the major river basins of the state. It is based on stream flow, reservoir storage, and precipitation for the summer period (May through October). During the summer period stream flow is the primary component in all basins except the South Platte basin where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven major basins for January 1, 1998and reflect conditions during the month of December.

Basin	Jan. 1, 1998 SWSI Value	Change From Previous Mo.	Change From Previous Year
South Platte	3.0	+1.0	+0.4
Arkansas	0.8	-1.8	-2.1
Rio Grande	-0.9	-1.0	-2.9
Gunnison	-0.4	-1.6	-4.1
Colorado	0.1	-1.7	-3.2
Yampa/White	-2.9	-2.3	-6.0
San Juan/Dolores	-0.3	+0.4	-2.6

SCALE

-4	-3	-2	-1	0	+1	+2	+3	+4

Severe Drought — Moderate Drought — Near Normal Supply — Above Normal Supply — Abundant Supply

WATER NEWS DIGEST

by Laurie Schmidt and Maile Ceridon

ALLOCATION

Front Range Runoff Reduction Plan Means Lower Flows in Colorado

A proposal to store spring runoff water in aquifers beneath Douglas County subdivisions has gained a foothold among Front Range water providers. It would, however, lead to serious impacts in Summit County and reduced peak flows in the Colorado River through the Grand Valley. Half of the runoff used in the project, about 30,000 acre-feet of water, would be diverted from the Blue River via Dillon Reservoir. The spring runoff-aquifer storage idea, called conjunctive use, has emerged from the four-year Metropolitan Water Supply Investigation as the first of several new water supply ideas. According to Hydrosphere, the Boulder firm commissioned to do a $35,000 hydrologic study, the project could deliver a total of 60,000 acre-feet of new water supplies to Douglas County and Denver—enough water for 300,000 residents. But it would also mean depletions to West Slope and East Slope river flows, impacts on recreation and fisheries, and reduced flows for endangered fish species in the Colorado River. The concept would also result in more frequent drawdowns of Dillon Reservoir. The Colorado River Water Conservation District questions whether recharging Front Range groundwater is a use allowed under the Blue River Decree, a 1955 court settlement that allowed Denver to build Dillon Reservoir. The River District's board will take up the issue at its January meeting.

Grand Junction Daily Sentinel, 1/2/98

Minturn Battling Vail over Water Ownership

Minturn town officials say they will not surrender their water rights to avoid a possible lengthy battle against Vail Consortium in water court. The consortium, which includes the Eagle River Water & Sanitation District, Upper Eagle Regional Water Authority, and Vail Associates, contends that Minturn has illegally been taking water from area supplies. Minturn filed a motion asking the court to dismiss two claims submitted by Vail Consortium in a suit filed in July. A judge dismissed one claim that the town's water rights were restricted to serving only the 1916 Minturn population of 500. The town now supplies water to more than 1,150 residents. Vail Consortium attorney Glenn Porzak said they will provide "clear evidence of Minturn's water use in 1916 and further assist the Vail Valley water users in proving that Minturn has significantly expanded its water use, and could continue to expand its use."

Grand Junction Daily Sentinel, 12/25/97

ENDANGERED SPECIES

Decision on Preble's Jumping Mouse Delayed

A decision by the U.S. Fish and Wildlife Service to declare the Preble's meadow jumping mouse as endangered will be pushed back to allow time for more public comment. The comment period will be extended until January 22, and a final decision on the proposed listing is expected in March. The mouse is a small rodent found only in eastern Colorado and southeastern Wyoming.

Grand Junction Daily Sentinel, 12/30/97

Cutthroat Trout could be Pot of Gold at the End of the Rainbow

A disease once thought to be a problem only in hatcheries has decimated or destroyed wild rainbow trout populations across the state. Now, the Colorado Division of Wildlife is spending $20 million on a long-term cleanup of its hatchery system in an attempt to stop the spread of whirling disease. Part of this cleanup might mean the end of the division's longtime reliance on rainbow trout as the backbone of its stocking program. Although it's unlikely that the division will ever divorce itself completely from rainbow trout, there are signs that the Snake River cutthroat trout might be the stocker of the future. According to a DOW fisheries researcher, studies on the Colorado River indicate Snake River cutthroats are highly resistant to the whirling disease parasite. Research has also revealed that rainbow trout from the South Platte River are more resistant to whirling disease than rainbows from the Colorado or Gunnison Rivers. Using more resistant fish, whether Snake River cutthroats or South Platte rainbows, combined with the ongoing hatchery cleanup, could mean the division reaches its goal of growing whirling disease-free fish by 2003.

Grand Junction Daily Sentinel, 1/14/98

ENVIRONMENT

Environmental Organization to Bequeath Gift of Water

An environmental organization is expected to bequeath to the state $1 million worth of water rights on Snowmass Creek near Aspen for conservation purposes. The water rights date to 1898, making them among the oldest claims on the tributary to the Roaring Fork River. The seniority of the claim virtually guarantees that the local ecosystem will have plenty of water during even the driest of summers, said a spokesperson for the state department of natural resources. The Colorado Water Conservation Board, under the jurisdiction of that agency, will received the property's rights to Snowmass Creek water. The claim will strengthen the state's existing claim for a minimum in-stream flow of 12 to 15 cubic feet of water per second.

Denver Post, 1/7/98

LEGISLATION

Ute and Collbran water district officials claim that proposed changes to a bill authorizing the sale of the Collbran Water Project to local water districts would usurp local land-use authority and hold the deal hostage to the whims of U.S. Interior Secretary Bruce Babbitt. The authors of the amendments, which were requested during a U.S. Senate hearing on the proposed $12.9 million sale in October, include environmental organizations, the town of Collbran, and Boulder attorney Bruce Driver. Under a bill sponsored by U.S. Senator Ben Nighthorse Campbell, R-Colo., the federally-owned irrigation and hydropower project located on top of the Grand Mesa would be transferred to the local districts. The proposed buyers of the project argue that the environmentalists' amendments would require the approval of Babbitt on Mesa County land-use decisions and district water rates in order for the sale to go through. Driver's group counters that Campbell's bill, as originally written, would relieve the water districts from the responsibilities of various environmental laws for 40 years.

Grand Junction Daily Sentinel, 12/19/97

POLICY

Congressional Budget Office Study Questioned

Rep. Bob Smith (R-Or), Chair of the Committee of Agriculture, and Rep. John Doolittle (R-Ca), Chair of the Subcommittee on Water and Power Resources of the House Committee on Resources, have written Congressional Budget Office (CBO) director June O'Neill strongly expressing a number of concerns about a report released this past fall. The CBO study is dated August 1997 and is entitled, "Water Use Conflicts in the West: Implications of Reforming the Bureau of Reclamation's Water Supply Policies." The January 5 letter says, "This study incorrectly characterizes the role of the Bureau of Reclamation in any number of areas, particularly in the allocation of water from federal reclamation projects and in price-setting policies." The letter also says, "[T]he 'policies' cited...are not simply discretionary policies of the Bureau, they are statutory mandates. The entire report fails to distinguish the difference between administrative policies and the law."

Western States Water, 1/9/98

PROJECTS

Arvada OKs New Reservoir

The Arvada city council has approved construction of a 160-acre reservoir near the southern border of Rocky Flats that backers say will protect water taps in Lakewood and Wheat Ridge from drying up. The $10 million reservoir, near the intersection of Colorado 72 and Indiana Street, will be about a fifth the size of Standley Lake and may be opened for shore fishing, biking, and hiking. The reservoir has drawn some criticism because of its proximity to Rocky Flats, the former nuclear weapons factory. Company officials dismissed those concerns, saying the site has received a clean bill of health.

Denver Post, 12/18/97

Dam Repair Won't Require Expensive Study

The U.S. Fish and Wildlife Service (FWS) agrees to allow the Denver Water Board to replace a safety device on the Williams Fork Reservoir without conducting an expensive study. The water board wanted to replace a portion of a dam on Williams Fork, but the FWS wanted Denver to do a consultation under the Endangered Species Act on the impact of their proposal on the Colorado and South Platte Rivers, which could have cost up to $1 million. U.S. Sen. Wayne Allard said that the FWS acknowledged that its regulations were unnecessarily expensive.

Fort Collins Coloradoan, 12/17/97

Second Flooding of the Grand Canyon Deemed Successful

It appears the flooding of the Grand Canyon last month was successful. The 48-hour release from Glen Canyon Dam was smaller than the first one, which helped restore several major rapids, debris-clogged side canyons, old beaches, and nutrient-rich sediment for native fish and plants. The second release on November 3-5, 1997 allowed the maximum amount of water possible to pass through the dam without bypassing it. The water flow was about 50 percent higher than normal. Preliminary analysis indicates that the second release helped add sediment to the sand bars created in the first flood, but the results still must be finalized as scientists decide how much and where the sediment was deposited. The silt helps create beaches, sandbars, and other natural habitats that existed in the canyon before dams were built to harness the river's energy.

Grand Junction Daily Sentinel, 12/97

Moffat Tunnel Deal Would Let City Soak up Savings

Denver will save 5 billion gallons of drinking water a year and more than $1 million in park irrigation fees in a deal involving the sale of the Moffat Tunnel to the Denver Water Department. The savings would stem from the development of an irrigation system using proceeds from the tunnel's sale. The system would use nonpotable treated sewer water to irrigate some of the city's parks and golf courses, replacing the more expensive drinking water now in use. Denver's water board agreed this week to buy the tunnel for $7 million from the Moffat Tunnel Commission, an independent entity of the state. Denver will receive 90 percent of the sale proceeds, or $6.3 million, and city officials have agreed to earmark $3.3 million to develop the irrigation system. The city council must approve the wastewater deal.

Denver Post, 1/9/98

Ute Water's Population Projections Doubted

Local Sierra Club members are criticizing the Ute Water Conservancy District for using high-end population projections to justify the expansion of Ute" water pipeline from Molina. A Ute District consultant used a 2.18 percent population growth rate in planning for future demands on the pipeline. By comparison, the state demographer's office uses a declining rate of growth that is at 1.9 percent now and declines to 1.4 percent by 2020. The $30 million, 48-inch pipeline proposed by Ute would serve the maximum demand of 200,000 people, a figure that closely matches Ute's 50-year population projection of 197,000 for its service area. Sierra Club members are concerned that other growth-restraint mechanisms won't stop sprawl, and Ute's willingness to serve outlying areas will lead to a tripling of Mesa County's population in 50 years. Mesa County's planning director said Ute's projections are defensible, given the water district's mission.

Grand Junction Daily Sentinel, 11/30/97

TRANSFERS

Interior Secretary Announces Water Transfer Plans

A federal plan for transferring Colorado River water between Western states reinforces Colorado's position on making other states live within their means, according to Jim Lochhead, head of Colorado's Department of Natural Resources. Interior Secretary Bruce Babbitt unveiled a plan that would allow interstate water transfers from the Colorado River for the first time. Babbitt outlined his water transfer plan at the annual meeting of the Colorado River Water Users Association. The plan would have a major impact on booming southern Nevada, which uses about 250,000 acre-feet of its annual 300,000 acre-foot allocation from the Colorado. The new rules would allow Nevada to bank the additional water in aquifers in Arizona, drawing against those reserves after the turn of the century when growth demands require more water. Babbitt told delegates that California must work harder to live within its Colorado River allocation of 4.4 million acre-feet of water. The state currently draws more than 5.2 million acre-feet from the river annually, tapping water unused by Arizona and Nevada. The 1922 Colorado River Compact allocated amounts for each of the seven states in the basin, and California's excessive use of water over its compact limit led to Babbitt's decision.

Denver Post, 12/19/97, 12/20/97; *Fort Collins Coloradoan*, 12/19/97; *Grand Junction Daily Sentinel*, 12/19/97; 12/21/97

WATER LAW

Arapahoe County Fighting for Water

Arapahoe County is waiting for a judge to rule on whether it can proceed with building a $900 million reservoir on the Western Slope to trap runoff from the upper Gunnison Basin. Backers of the project, dubbed Union Park, say it would quench the fast-growing county's thirst for water indefinitely and generate millions in revenue. Arapahoe County purchased the rights to the project 10 years ago. Since then, however,

the county has been wrangling in court over whether there is enough water to build the project. Union Park would be nestled in a mountain bowl at about 10,000 feet, 25 miles east of Crested Butte. It would be constructed to store water diverted only during wet years from the headwaters of the Taylor and East Rivers that flow into the Gunnison River. A series of pipes and tunnels would transport the water to the South Platte River and then to Arapahoe County. The court has not yet ruled on the complicated issue.

Denver Post, 12/8/97; *Fort Collins Coloradoan*, 12/9/97

WATER QUALITY

Animal Waste Threatens Water

The staggering amount of animal waste produced on American farms often pollutes water, and the risk is growing as more large-scale livestock operations take hold. A new U.S. Senate study found that the amount of animal manure produced in the U.S. is 130 times greater than the amount of human waste, and there are no national standards for dealing with the animal waste. The study was compiled by the Democratic staff of the Senate Agriculture Committee.

Fort Collins Coloradoan, 12/29/97

Bacteria Clean Drinking Water

University of Colorado (CU) engineering professor JoAnn Silverstein says help is on the way for towns and cities plagued with rising levels of nitrates in their drinking water. Her novel, efficient, and cost-effective process uses bacteria to gobble up nitrates from agriculture, industry, and development that contaminate wells and water sources. A demonstration project in Wiggins drew interested visitors from as far away as Thailand. Measurements showed the bacteria-cleared water meets all federal and state drinking water standards. Ion exchange and reverse osmosis, the common ways to remove nitrates from groundwater, are expensive and labor intensive. Silverstein's simple system requires little maintenance. The method, patented by CU, is licensed to Denver's Nitrate Removal Technologies for commercialization.

Views From CU, December 1997

Bent County Residents Against Hog Farm

The most important consideration for Bent County commissioners deciding whether to issue a permit for a hog farm should be that most people don't want it, opponents say. Bell Farms, near Las Animas, is seeking a special-use permit that would allow the $42 million project to proceed. Opponents claim that their well water has deteriorated since Bell Farms started pumping water on its land. Others warned the smell of the farm's waste lagoons would chase away visitors from John Martin Reservoir. Some fear the lagoons will flood during heavy rains. Some are residents support the hog farm, saying that it will bring jobs to the area and increase the county's tax base. Bell Farms is seeking a permit for six sites south of the John Martin Reservoir. Two of the sites would have nursery units for 7,000 pigs. Farrowing units would be on the other sites.

Grand Junction Daily Sentinel, 12/28/97

Former Inmate Claims Rifle Officials Hid Sewage Dumping

Allegations that state Department of Corrections officials diluted a sewage sample and drained raw sewage from lagoons into Rifle Creek are under investigation by the Corrections Office of Inspector General. The investigation stems from allegations made last summer by a former inmate at the Rifle Correctional Facility who claims to have seen a Rifle Correctional Facility staffer take samples of sewage from the prison's four lagoons and dilute them in the prison shop with tap water. He also claimed that in late May, the same staffer ordered inmates to cut the bank of the lower sewage lagoon and push raw sewage into Middle Rifle Creek. The creek drains directly into Rifle Gap Reservoir, a state park. An environmental protection specialist for the health department is awaiting the Inspector General's report.

Grand Junction Daily Sentinel, 12/28/97

L.A.'s Water Supply Could be Harmed by Volcanic Eruption

After recent swarms of earthquake tremors in Los Angeles' main watershed, authorities are worried about what would happen to the city water supply if a volcano were to erupt. A magnitude 4.9 earthquake struck the Mammoth Lakes area on November 30, and U.S. Geological Survey scientists came close to declaring a "yellow volcano watch," the second level of a four-step alert system. Department of Water and Power geologists recommended that the agency update its plan for dealing with a possible eruption in the Mammoth Lakes area. Two-thirds of all water used in Los Angeles comes from a network of streams, reservoirs, and aqueduct that stretches for hundreds of miles down the eastern Sierra Nevada through the remote Mammoth Lakes area. The Mammoth Lakes area is part of the Long Valley Caldera, a huge crater-like basin that measures 20 miles long by 10 miles wide. An eruption would force the city to draw heavily on other water sources,

including pumping groundwater in the San Fernando Valley and buying far more costly water from the Colorado River and the State Water Project.

Grand Junction Daily Sentinel, 12/16/97

Rio Grande's Arsenic Levels 100 Times Above Standards

Arsenic levels in a 57-mile stretch of the middle Rio Grande are more than 100 times higher than allowed by Isleta Pueblo's water quality standard, a federal study says. The U.S. Geological Survey study found that samples taken from 18 sites contain arsenic ranging from 1.8 to 3.6 micrograms per liter. Isleta's standard is 0.0175 micrograms per liter; New Mexico's is 20 micrograms per liter. The city of Albuquerque, upstream from the pueblo, has not yet been forced to meet the strict arsenic standards, but that may change when the EPA issues a new permit next May to discharge waste into the Rio Grande. The cost of compliance could be as high as $300 million and probably would be passed along to Albuquerque citizens.

Denver Post, 12/16/97

State Water Quality Control Commission Upholds Rule on Draining Silver

Colorado water officials have voted down a plan to allow large companies to flush traces of silver down drains and eventually into creeks and rivers. Colorado Springs Utilities and other companies, including Kodak and Climax Molybdenum Co., submitted a proposal to do away with a rule regulating discharges of silver into state waterways, calling the rule unnecessary and difficult to obey. However, the nine-member State Water Quality Control Commission unanimously sided with the Colorado Division of Wildlife and state health officials, who argued the rule is needed to protect fish and other aquatic life from toxins. Some 600 to 700 Coloradp Springs businesses use silver to develop film and X-rays.

Fort Collins Coloradoan, 12/13/97

WEATHER

State Insurance Fund to Cover Costs of Flood Cleanup at CSU

Colorado State University can continue to clean up from the summer flood without worrying about whether insurance will pay for the costs. The state insurance fund will cover the entire cleanup because the damage was caused by sheet water, not an overflowing body of water. Since sheet water was viewed as the cause, the university is eligible to tap the entire $250 million insurance fund. More then 35 buildings were damaged in the July 28 flood, causing an estimated $100 million in damage at the Fort Collins campus. More than $30 million in flood damage was to books in the Morgan Library, where more than 425,000 volumes were damaged.

Grand Junction Daily Sentinel, 11/26/97

WILDERNESS

Big Thompson Watershed Forum Organizing to Protect River

After a year of discussions, the Big Thompson Watershed Forum became a reality in November. The main idea behind the group is the protection of the Big Thompson River watershed and the quality of its waters. Rob Buirgy, the group's coordinator, said the group will strive to work through the coordinated efforts of all interested stakeholders, including individuals, government entities, and businesses. Buirgy said the official ratification of the bylaws will likely take place in January.

Fort Collins Coloradoan, 11/18/97

Colorado Lawmaker Sues Clinton over American Heritage Rivers Initiative

Congressman Bob Schaffer is suing President Clinton over the American Heritage Rivers Initiative in an effort to protect Colorado water rights. Schaffer, R-Colo, said he filed a complaint in U.S. District Court seeking a ruling that the president has no authority to implement the initiative and that it violates the U.S. Constitution. Joining Schaffer in the lawsuit are Rep. Don Young, R-Ark.; Rep. Helen Chenoweth, R-Idaho; and Rep. Richard Pombo, R-Calif. Schaffer said the rivers initiative violates the 10th Amendment of the U.S. Constitution, which gives states and local governments authority to engage in land-use planning and local zoning. He said it also violates other federal laws and "is an example of the president's continued abuse of the Executive Order privilege." Clinton's rivers initiative proposes to protect rivers for

"natural, historic, cultural, social, economic, and ecological diversity." The president already has final approval for the plan and is expected to appoint a selection committee to make land-use decisions.

Fort Collins Coloradoan, 12/12/97; *Grand Junction Daily Sentinel*, 12/12/97

Ten Rivers to Receive Heritage Tag

Nearly two dozen rivers in the West are among those being considered nationally as candidates for President Clinton's new river heritage program. Communities across the United States have submitted 126 nominations asking that their local rivers be among the10 American Heritage Rivers to be designated by the President. The western rivers or segments thereof that were nominated include: Arizona – the Santa Cruz River; California – the Gualala, Lower American, San Joaquin, San Luis Rey, Santa Clara Rivers, and Santa Rosa Creek; Colorado – the Gunnison (north fork) and South Platte; Hawaii – Hanalei; Idaho – Clearwater; Montana – Clearwater, Missouri, and Yellowstone; New Mexico – Rio Grande and San Juan; North Dakota – Missouri and Yellowstone; Oregon – Columbia and Willamette; South Dakota – Missouri; Texas – Brazos, Rio Grande, Sabine, and San Antonio; Utah – Jordan and San Juan; Washington – Puyallup and Snohomish; and Wyoming – Yellowstone. Each community submitted a detailed plan for restoring and protecting the environmental, economic, and cultural values of its river and riverfront.

Grand Junction Daily Sentinel, 12/24/97; *Western States Water*, 1/2/98

MISCELLANEOUS

Over the River and Through Salida

Imagine rafting down the Arkansas River and looking up into a billowing piece of transparent fabric that drapes your raft and the river. Artists Christo and Jeanne-Claude propose to suspend fabric panels above certain stretches of the Arkansas River between Canon City and Salida. The work of art, called "Over the River," could conceivably attract a million viewers over a two-week period. Though only a work of art, the proposed project has many hurdles to clear before the lofty concept becomes reality. Among major concerns are how the small communities of Salida and Canon City can accommodate the needs of one million people – especially when it comes to handling traffic. Some have voiced concerns about effects on the river's ecosystem, suggesting that the fabric panels could block sunlight, impacting growth of microscopic organisms and eventually the fish. About 80 people attended a public hearing held in Canon City in December, as part of the permitting process. Of those who spoke, a few more spoke for rather than against the project. Christo and Jeanne-Claude would like to hang the fabric in August or September 2001, for a period of 14 days. They would like to know by next year whether they can go ahead with the project.

Pueblo Chieftain, 12/4/97; *Salida Mountain Mail*, 12/5/97

Regional Collapse May Hold Answers to Geologic Mysteries

Recent geologic mapping and historical hydrological data may hold the key to solving geologic mysteries that have baffled scientists, planners, and builders in Western Colorado for years. The presence of high concentrations of dissolved salts in the Colorado River basin and sinkholes throughout the Glenwood Springs-Carbondale-Eagle area are well-documented phenomena that cause millions of dollars of damage to industry, agricultural producers, and local residents. Data collected by CGS and USGS scientists has led to the conclusion that during the past several million years, large areas of West Central Colorado have collapsed over half a mile. They estimate that as much as 550 cubic miles of ancient layers of sea salt have been dissolved and transported down the Colorado River and that about 1,800 square miles in the Glenwood Springs-Carbondale-Eagle area have been affected. The conceptual model of the fundamental earth processes that are causing the collapse could help scientists determine the extent to which human activities may affect the natural rate of salt dissolution and collapse.

Natural Resource News, November 1997

Regional Council Wants to Limit Growth in Colorado

The Denver Regional Council of Governments wants to draw the line on urban sprawl in the Denver metro area until the year 2020. The agency will consider whether to approve a map limiting the amount of land that can be developed to 721 square miles. Eventually, DRCOG officials would like to whittle that number down to 700 square miles. DRCOG, however, has little muscle to back up the proposal. It will be up to the communities to police themselves and abide by the plan. Colorado is the fifth-fastest growing state in the nation with a one-year population gain of 76,465 residents, according to U.S. Census Bureau data . The overwhelming majority of growth is likely concentrated in the greater Denver metro area. DRCOG estimates that the eight-county area's population increased by 63,000 people between 1996 and 1997.

Boulder News, 12/16/97; *Denver Post On-line*, 12/31/97

Shrinking Dawson Aquifer Causing Water Crisis for Residents

Residents who rely on the Dawson aquifer, the shallowest part of the Denver Basin that covers 6,700 square miles and holds about as much water as Lake Erie, are finding themselves without water. Experts say the aquifer has begun to shrink because of the sharp increase in residential growth. About 200 residents in four subdivisions south of Chatfield Reservoir are being forced to haul in water for household use. Several water districts turned down the homeowners' pleas to let them hook into their water systems. Finally, the Denver Water Department relented, and a 1.5-mile pipeline will be built from their neighborhoods to a Denver Water pipe on the west side of Chatfield Reservoir. Homeowners can expect to pay a $2,200 tap fee to hook into the system and roughly $100 a month in taxes. Some residents in Foxfield, a small town of 750 just southeast of Aurora, have also experienced water shortages. According to an Arapahoe County Commissioner, the situation is proof of the need for the Union Park reservoir, a $1 billion water project Arapahoe County wants to build on the Western Slope east of Crested Butte. But Union Park, bitterly opposed by environmentalists and the federal government, is tied up in court.

Denver Post, 12/7/97, 1/19/98; *Fort Collins Coloradoan*, 12/8/97

CALLS FOR PAPERS

CONSERVE 99
WATER EFFICIENCY: MAKING CENTS IN THE NEXT CENTURY
January 31-February 3, 1999

The American Water Works Association has announced a call for papers for Conserve 99, Water Efficiency: Making Cents in the Next Century, to be held January 31-February 3, 1999 in Monterey, California. Presenters have the option of submitting abstracts electronically in addition to the more traditional means. The complete announcement and abstract submission form are available through the AWWA website: http://www.awwa.org/tande/cs99call.htm. Deadline: April 13, 1998.

XTH WORLD WATER CONGRESS
MELBOURNE 2000
March 11-17, 2000

In the 21st Century, the water industry will face threats to sustaining valuable water resources and achieving a balance between urban and rural water demands and environmental needs. The Xth World Water Congress will address these challenges while highlighting such critical issues as: Sharing the Waters of the Earth and Sustainable Water Management in a New Millenium. Deadline: March 8, 1999. Authors are required to prepare a 500-word abstract for inclusion in the Congress proceedings. The presenter of each accepted paper should register as a paying delegate upon submission of the final manuscript. For further information on the Xth World Water Congress contact the Congress Secretariat: ICMS Pty Ltd., 84 Quennsbridge Street, Southbank Victoria Australia 3006, Phone +61 3 9682 0244, FAX +61 3 9682 0288.

MEETINGS

13TH HIGH ALTITUDE REVEGETATION WORKSHOP
March 4-5, 1998
University Park Holiday Inn, Fort Collins, Colorado

Topics of specially invited speakers will include long-term reclamation research results, new products, collection and use of native seed, ecological restoration in the National Parks and plant materials. Presentations stress "nuts and bolts" reclamation and include the full gamut of current problems, solutions and case studies presented by speakers from academia, government and industry. Cost: Regular: $170 with lunches, banquet and proceedings; Student: $15 without proceedings and meals. Please direct questions or address corrections to Gary Thor, Phone 970/491-7296; FAX: (970)491-0564; e-mail: garythor@lamar.colostate.edu.

MINING IN COLORADO: WATER ISSUES AND OPPORTUNITIES
AWRA Colorado Section Annual Meeting
March 13, 1998 — Mount Vernon Country Club, Golden, Colorado

As we approach the end of this century, we face a myriad of challenges related to mine water at abandoned mines, at currently active operating mines, and at proposed future mine sites. This one-day symposium will address all aspects of mine water issues and opportunities, including pre-mining water rights, water quality of mine discharge, and utilization of existing mines as water storage reservoirs. For further information contact Isobel McGowan at 303/477-5338.

MODFLOW'98
October 4-8, 1998
INTERNATIONAL GROUND WATER MODELING CENTER(IGWMC)
COLORADO SCHOOL OF MINES, Golden, Colorado

The IGWMC, in cooperation with the Office of Special Programs and Continuing Education of the Colorado School of Mines, is organizing its 3rd international conference, MODFLOW '98 focusing on MODFLOW, its add-ons, extensions, plug-ins, spin-offs, interfaces, shells, etc. The conference will bring together the users and developers of MODFLOW and related modeling programs to present the latest innovations in model applications, discuss the capabilities and limitations of MODFLOW, and explore the needs and directions for future developments. The conference will include a series of keynote presentations on topics ranging from the history of MODFLOW to the visions for groundwater modeling in the 21st Century, demonstrations of the latest MODFLOW-related software products, and participation in workshops, seminars and poster sessions. The conference will be held on the Colorado School of Mines campus in Golden, Colorado, October 4-8, 1998. Conference registration is $545 which covers the conference proceedings, evening receptions, lunches and breaks. A reduction will be made for students registered for a degree. For more information, contact the Colorado School of Mines, Office of Special Programs and Continuing Education at 303/273-3321, FAX 303/273-3314, e-mail space@mines.edu. ***Co-sponsored by U.S. Geological Survey and Waterways Experiment Station, U.S. Army Corps of Engineers.***

HOT TOPICS

The University of Colorado Natural Resources Law Center
Announces a Luncheon Program on
UPPER COLORADO RIVER FISH RECOVERY PROGRAM
Wednesday, April 29, 1998

Eric Kuhn, Secretary and General Manager of the Colorado River Water Conservation District, and Robert Wigington of the Nature Conservancy will discuss the Recovery Implementation Program for endangered fish Species in the Upper Colorado River Basin. They will focus on the programmatic biologic opinion for water depletions above the 15 mile reach of the Colorado River in the Grand Valley. By April, the most recent round of heated negotiations on the programmatic opinion should either be close to producing an agreement or breaking down. Kuhn and Wigington will highlight selected issues from their perspectives. Dan Luecke, Director of the Rocky Mountain Regional Office of the Environmental Defense fund and a Natural Resources Law Center Advisory Board member, will moderate the discussion. ***For further information, contact the University of Colorado Natural Resources Law Center – 303/492-1272.***

CALENDAR

Feb. 26	NORTH PLATTE RIVER BASIN WATER POLICY CONFERENCE, Scottsbluff, NE. Contact: University of Nebraska Panhandle Learning Center at 308/632-1319.
Mar. 20-29	WETLANDS ENGINEERING & RIVER RESTORATION CONFERENCE, Denver. CO. Contact: American Society of Civil Engineers, Phone 703/295-6029; FAX 703/295-6144, or visit ASCE Web Site at http://www.asce.org.
Mar. 25'	DECISION '98, The Water Foundation's 15th Annual Executive Briefing, Sacramento, CA. Contact: Water Education Foundation, 717 K St., Ste. 517, Sacramento, CA 95814, Phone 916/444-6240.
Mar. 30-Apr. 3	HYDROLOGY DAYS, Colorado State University, Fort Collins, Colorado The program and registration information are available at: http://www.lance.colostate.edu/depts/ce/netscape/wnew.html. or contact: Janet Lee Montera, Civil Engineering Department, Colorado State University, Fort Collins, CO 80523-1372. Phone: 970/491-7425 — FAX 970/491-7727; E-mail: jmontera@engr.colostate.edu
Apr. 19-22	INTEGRATING WILDLIFE HABITATS AND PEOPLE ACROSS LANDSCAPES: CONFLICTS, CONSEQUENCES AND SOLUTIONS FOR THE NEW WEST, Glenwood Springs, CO. Contact: Thorne Ecological Institute, Phone 303/499-3647, FAX 303/499-8340, E-mail dir@thorneecoinst.org.
Apr. 19-23	FIRST FEDERAL INTERAGENCY HYDROLOGIC MODELING CONFERENCE, Las Vegas, NV. Contact: Don Frevert or Jim Thomas, Phone 303/236-0123 x235; FAX 303/236-0199; or E-mail dfrevert@do.usbr.gov or jthomas@do.usbr.gov.
Apr. 26-28	WATER DISTRIBUTION SYSTEM DISINFECTION RESIDUALS WORKSHOP, Philadelphia, PA. Complete information is available on the Internet at http://www.awwa.org/tande/dsdrw.htm.
Apr. 28-30	SOURCE WATER PROTECTION INTERNATIONAL 98, Dallas, TX. Contact: National Water Research Institute, 10500 Ellis Ave., PO Box 20865, Fountain Valley, CA 92728-0865, FAX 714/378-3375, E-mail NWRI-1@worldnet.att.net.
May 3-6	WATERSHED '98 — WATERSHED MANAGEMENT: MOVING FROM THEORY TO IMPLEMENTATION, Denver. CO. Contact: Water Environment Federation at 800/666-0206 or E-mail confinfo@wef.org.
July 5-9	BALANCING RESOURCE ISSUES, Soil and Water Conservation Society Annual Conference, San Diego, CA. Contact: SWCS, Phone 513/289-2331, FAX 515/289-1227, webpage http://www.swcs.org, or Email swcs@swcs.org/.
Aug. 10-14	The 1998 U.S. Committee on Large Dams (USCOLD) 18th Annual Meeting and Lecture, MANAGING THE RISKS OF PROJECT DEVELOPMENT, SAFETY OPERATION, Buffalo, New York. Contact: Richard C. Harlan, Chair, 1998 USCOLD Lecture, FAX 415/288-9881, E-mail rcharlan@email.msn.com.
Sept. 27-Oct. 2	GAMBLING WITH GROUNDWATER, Physical , Chemical, and Biological Aspects of Aquifer-Stream Relations, Las Vegas, NV. Contact: IAH/AIH Conference Las Vegas — Conference Headquarters, Attn: Helen Klose, 2499 Rice St., Suite 135, St. Paul, MN 55113-3724, Phone 612/484-8169, FAX 612/484-8357, E-mail AIHydro@aol.com.
Aug. 4-7	CROSS CURRENTS IN WATER POLICY — UCOWR '98, Sponsored by the Universities Council on Water Resources, Hood River, OR. Contact: Dr. Tamim Younos, Virginia Water Resources Research Center, 10 Sandy Hall, Virginia Tech, Blacksburg, VA 24061-0444, Phone 540/231-8039, FAX 540/231-6673, E-mail tyounos@vt.edu.
Oct. 11-14	DAM SAFETY '98, Las Vegas, NV. Contact: Assoc. of Dam Safety Officials, Phone 606/257-5140, FAX 606/323/1958, E-mail damsafety@aol.com.

Colorado Water Resources Research Institute
410N University Services Center
Colorado State University
Fort Collins, CO 80523

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