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COLORADO WATER

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

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SEPTEMBER, 1988

FUTURE DIRECTIONS FOR THE WATER INSTITUTE

It is a privilege to succeed Norman Evans as Director of the Colorado Water Resources Research Institute. Norm has contributed enormously to the water management profession and to water education and research in the Nation.

It is clear that the water management scene is dynamic in Colorado and in the Nation. The challenges presented by economic, political, technological and environmental considerations are awesome. The Federal Government is focusing on water policy and regulation, and it will be up to state governments to assume water management leadership in cooperation with local government and the private sector.

A previous tour as Director of the Water Institute in North Carolina convinced me that Institutes have a unique role in finding technology and management-based solutions to water problems, solutions that are badly needed in the midst of many conflict-filled situations. Water problems seem to be characterized by high conflict levels which inhibit the use of logical management and technological solutions. Scientists can aid in solving them by adding value to the hierarchy of levels of understanding of problems. This hierarchy begins with data, extending to information, knowledge and then wisdom. We will be looking for research-based solutions that involve science and technology, including the natural and social sciences, as well as engineering. This means both hard technology and soft technology, both based on interdisciplinary approaches. Hopefully this will give us wisdom to help solve water problems.

The water management community in Colorado is active, maybe the most active in the country. Several water associations and public interest groups contribute meetings and educational activities.

I invite you to contact me with your suggestions for Institute activities. Please note in this issue of the newsletter our announcement of a new program for the Water Issues Forum to be held monthly in Denver and an announcement for the Colorado Water Engineering and Management Conference to be held in February. We hope to see you at these events.

Neil S. Grigg

EPILOGUE

The Institute was born in 1964 out of Congressional determination that the Nation would face a water crisis by the year 2000 A.D. Establishment of a water research institute in each state was adopted as one of the preventive strategies. While the Institute has served well as the focal point for problem-solving water research, I believe it will be used increasingly in the future by water organizations to produce critically needed new scientific information and new water management technologies.

The Institute has a vast array of sciences and technologies at its command. Each of the state-supported research universities--University of Colorado, Colorado School of Mines and Colorado State University--contributes its unique expertise. The application of this tremendous scientific resource to Colorado's water problems is limited only by the extent to which CWRRRI can fund research projects.

The complexity of water problems and associated conflicts places them well beyond the realm of simple, easy solutions. The Institute should be developing new scientific information and advanced technologies to meet these needs. Another important need that CWRRRI can fill is to develop unbiased, objective and technically sound information on which water management decisions can be made.

The supreme challenge of today is to improve management so as to maximize use of the water supply. While management-related research offers promise, it requires knowledge of constraining factors (social, legal and political) which can best be evaluated by front-line water managers and professional practitioners. Our Research Planning Advisory Committee (RPAC) provides this dimension. The eight new projects described elsewhere are products of RPAC input.

CWRRRI is a "natural bridge" between water practitioners-managers and the specialists in Colorado's universities. Its contributions of science and technology toward solving water problems have been substantial, but promise to be far greater in the coming years. The Colorado General Assembly has mandated the Institute in this role, and we have an outstanding new director in Dr. Neil S. Grigg to give it leadership. This is a satisfying vision for me at the close of a 37-year career in water-oriented research and academic service in Colorado.

Norman A. Evans

PROJECTS SELECTED FOR FY1988-1989 WATER RESEARCH PROGRAM

The Institute will fund eight water research projects in FY1988-1989--two at Colorado School of Mines, three at the University of Colorado, and three at Colorado State University. The program focuses on six high-priority water policy issues and management problems: **impacts of agriculture-to-urban water transfers on the basin-of-origin, reclamation of polluted groundwater, the fate of metals in Colorado streams, conjunctive management of surface and groundwater, urban water supply reliability, and the water pollution potential of herbicides.** A total of 22 undergraduates, M.S. and Ph.D candidates will receive training in the program.

Selection of the eight projects resulted from an intensive review and evaluation of the proposed research by the Institute's Technical Advisory Committee and Research Planning Advisory Committee. The Institute received 34 preproposals in response to its initial RFP. TAC members (faculty from CU, CSM and CSU) ranked the preproposals for scientific merit and relevance to Colorado's water problems and narrowed the list to 16. The RPAC (water professionals representing industry, recreation/wildlife, state government, agriculture and municipalities) then ranked the top 16 for relevance to Colorado's water problems. Eight projects were selected based on the combined TAC/RPAC ratings.

**Socio-Economic Impacts
of Rural to Urban Water Transfers
on the Basin-of-Origin**

This project will produce an economic assessment of the nature, extent and magnitude of external impacts due to water transfers. Estimates of agricultural sector, private sector, and community economic impacts in the area of origin will be developed by case study.

Principal Investigator:
Robert A. Young
Department of Agricultural
and Resource Economics
Colorado State University

**Biological Denitrification of
Polluted Groundwater**

A promising method of nitrate removal by a fixed media biofilm process using acetic acid as a supplemental carbon source will be investigated. The reliability of the process will be tested under time varying nitrate concentrations. Further, the effect of this process on the disinfection process will be determined to evaluate its practicality for application in domestic water supply.

Principal Investigators:
JoAnn Silverstein and Nevis Cook
Department of Civil, Environmental
and Architectural Engineering
University of Colorado

**Enhanced Microbial Reclamation
of Groundwater Polluted with
Toxic Organic Chemicals**

An inexpensive and practical microbiological system for reclaiming groundwater degraded by toxic organics (PCP, TCE and DNP) will be developed. A sequencing batch reactor will be used in which operating parameters will be optimized (including microbial species composition, type and concentration of carbon compounds, cell recycle and retention time). The process will be especially valuable where chemical concentrations are too low for efficient removal by nonbiological technologies.

Principal Investigator:
Steven K. Schmidt
Department of Environmental, Population
and Organismic Biology
University of Colorado

**Acid Mine Drainage:
Streambed Sorption and Microbial Uptake
of Copper and Cadmium**

This research will examine the fate of copper and cadmium in a subalpine stream contaminated by acid mine drainage. Pertinent natural processes, including sorption and microbial fixation, involved in the mobilization and transport of these metals will be investigated. The advances to be made in this research should be useful in design of processes for removal of the metal pollutants from acid mine drainage and other metal-contaminated wastewaters.

Principal Investigator:
Donald M. Macalady
Department of Chemistry and Geochemistry
Colorado School of Mines

**Efficient Estimation of
Water Supply Augmentation Needs
in Real Time Allocation Operations**

A technique will be developed to calculate on a day-to-day basis the current damage to senior surface water rights occurring due to past pumping in an alluvial stream-aquifer system. With the addition of the procedure to be developed a groundwater simulation model can be used to make daily, real time operational decisions for augmentation of river-flow. Improvement in administration and protection of surface rights should allow increased pumping and utilization of a large volume of unused groundwater stored in the alluvial aquifer of the South Platte Basin.

Principal Investigator:
Hubert J. Morel-Seytoux
Department of Civil Engineering
Colorado State University

**Improved Methods for
Modeling Conjunctive Management
of Surface and Groundwater**

A calibrated, three-dimensional model of the Denver Basin bedrock aquifer system will be developed having realistic provisions for variable river stage to better simulate stream-aquifer interaction. The model should improve on existing estimates of the boundaries of a tributary zone associated with pumping from the bedrock aquifers.

Principal Investigator:
Eileen Poeter
Department of Geology and Geological Engineering
Colorado School of Mines

**Urban Water Supply Reliability:
Preferences of Managers,
Elected Officials and Water Users**

This project will design and test a procedure for quantifying the preferences on reliability of supply of urban water managers, elected officials and water users. Their willingness to commit public funds and to pay the cost of various levels of reliability will be evaluated. This project will advance the state of public decision-making in urban water supply.

Principal Investigators:
Charles W. Howe and Robert Hamm
Institute of Behavioral Science
University of Colorado

J. E. Flack
Department of Civil, Environmental
and Architectural Engineering
University of Colorado

**Surface and Groundwater
Pollution Potential from Herbicide Use
in Colorado Agriculture**

A practical basis for managing herbicide (atrazine) in corn production will be developed using the Colorado State Outdoor Rainfall Facility. Chemical and physical processes will be studied including adsorption, degradation, volatilization, advection and erosion. The final product of this research will be an agricultural management and chemical transport model appropriate for Colorado conditions.

Principal Investigators:
Jim C. Loftis, Deanna S. Durnford and Bruce E. Dale
Department of Agricultural and Chemical Engineering
Colorado State University

Gregg Butters and Steve Workman
Department of Agronomy
Colorado State University

**REGIONAL PROJECT COMPARES
WATER RIGHT TRANSFER/EXCHANGE
PROCESS IN SIX WESTERN STATES**

Reallocation of water rights through transfers and exchanges is attracting increased attention. To better understand the reallocation process, a knowledge of actual practice and experience in the sales and exchanges of water rights is needed. In a new regional project, a team of investigators from six Colorado River Basin States (Arizona, California, Colorado, New Mexico, Utah and Wyoming) will compare and analyze sales and exchanges of water rights in their states. The comparison includes individual state water codes, administrative procedures, case law pertaining to water allocation and transfer, and organizational and institutional operating policies for administering and managing water rights. Case histories of specific water transactions in each state will be used to measure the relative importance of factors impacting the process and their influence on transaction costs.

Larry MacDonnell, Director of the Natural Resources Center, University of Colorado, is principal investigator. Co-investigators are: Gary C. Woodard, College of Business and Public Administration, University of Arizona; Brian E. Gray, Hastings College of the Law, University of California (San Francisco); F. Lee Brown, Department of Economics, University of

New Mexico; J. Paul Riley, Department of Civil and Environmental Engineering, Utah State University; and Victor R. Hasfurther, Associate Director, Wyoming Water Research Center, University of Wyoming.

The two and one-half year regional project is funded under the Water Resources Research Act (Sec. 105, Matching Grants) and conducted under the auspices of the Colorado River Basin Water Institutes and Centers (CWIC). Administrative management is by CWRII.

**LEGISLATURE HOLDS FORUM
ON WATER POLICY**

On July 14 a public forum on water policy was held at the State Capitol. Chaired by Representatives Chris Paulson and Scott McInnis and Senator Tillie Bishop, the forum focus was: **Does the current state water policy protect the future needs of the State?**

Several speakers explained the complexity of the issues surrounding water policy. Felix Sparks, for example, presented an historical account of the efforts made to store West Slope water during his long tenure as Director of the Colorado Water Conservation Board. Many past efforts, going back to 1935, to deal with the question of water planning and policy were described. The Legislative Council staff presented results of a computerized search that revealed 242 references and 62 statutes dealing with water resources in the Colorado Revised Statutes. Of these, 94 references and 21 statutes dealt with water policy.

Governor Roy Romer appeared at the forum and presented a suggested agenda for water, briefly summarized here:

Goals: To make water consumption in Colorado as efficient as possible, to make our institutions better reflect the common values and interests of Coloradans, and to bring state laws and regulations more into line with these values and interests.

Statewide Agenda:

1. Colorado should consider a statewide water conservation program.
2. The General Assembly should investigate ways to encourage water savings in the State's agricultural sector.
3. Review how the diversion of water from one basin to another affects the basin of origin.
4. Review our current instream flow program to see if it is adequate to protect certain clearly beneficial uses of water; namely, recreational uses.
5. Consider whether the Cheeseman Canyon is of such statewide significance that it should not be flooded.
6. Give serious thought to how to adapt our system for making water decisions to the new realities created by increasing federal involvement.

Local Agenda:

1. Foster greater cooperation in the Denver Metropolitan area.
2. Develop interim supplies for the Metropolitan area.

After the forum, the Legislative Council staff prepared a summary of major issues presented. Most issues related to water marketing and management or to drought and water conservation. Other categories included: water quality, public interest values, agricultural water and groundwater. Samples of specific suggestions included: water quality issues to be addressed by water court, need for a statewide drought severity study, need for state water conservation standards, consideration of public interest values in water management, reevaluation of water marketing in appropriation doctrine management, agricultural water conservation and nontributary groundwater management.

CONGRESS APPROPRIATES \$77 MILLION FOR COLORADO WATER AND ENERGY PROJECTS

Congress has appropriated \$77 million for 17 Colorado water and energy projects. The Senate approved the bill 91-3 on July 7.

<u>Project</u>	<u>Amount</u>
Dolores	\$26.3 million
Paradox Valley	7.7 million
Grand Valley	7.6 million
Frying Pan-Arkansas	6.7 million
Westerly Creek	5.1 million
Fountain Creek	2.7 million
Stagecoach	2.0 million
Animas-La Plata	1.9 million
John Martin Reservoir	1.7 million
Chatfield Lake	1.5 million
Big Thompson	1.1 million
Cherry Creek	\$375,000
Dallas Creek-Ridgeway	198,000

Also included is \$548,000 for an engineering study at Trinidad Lake, \$337,000 to rehabilitate Uncompahgre irrigation canals, and \$250,000 for the Gunnison Basin water-use efficiency study.

COLORADO WATER WORKSHOP COVERS BROAD ISSUES

Western State College held its 13th annual Colorado Water Workshop on July 11-13 with over 300 participants. The topic of the workshop was **Water for Sale, Colorado in the Balance**. Discussion was lively about the State's most controversial water policy issues, including the need for a state water plan, techniques for multiobjective decision making, rural-to-urban transfers, and maintenance of instream flows. It was clear at the workshop that Colorado has many diverse water interests and regional questions with which to deal.

Several noted speakers addressed the State's main problems. In his keynote speech Attorney General Duane Woodard spelled out the complexity of the problems that Colorado faces, and concluded that we must find ways to deal equitably with all users and that there will be no simple and quick answers. Colorado Representative Scott McInnis called for a statewide water plan and a metropolitan water authority. The plan would provide for compensatory storage for areas of origin and for mitigation of the effects of transbasin diversions. Denver Water Board President Monte Pascoe stated that the Board would not share its reserves with suburban water agencies unless it is assured of a future supply, such as Two Forks. Dale Mason, incoming chairman of the San Diego County (California) Water Authority, explained San Diego's

inferior position relative to water rights in Southern California, and made a plea for understanding of their desire to lease Colorado River Water. Uli Kappus, Director of the Colorado Water and Power Resources Development Authority, described the authority's program of water resources studies and development and the promise implicit in the continued development of the satellite stream monitoring program.

On the light side, the conference heard from Marty Hatcher, Western State College professor and former State Senator, and from L. Richard Bratton and Duane Vandenbusche, the founders of the water workshop. Workshop organizer Marlene Zanetell of the Rural Communities Institute at Western State College deserves credit for an outstanding event.

GOVERNOR ROMER RECEIVES DROUGHT REPORT

On June 30 Governor Romer received a report on the drought from the State Drought Water Availability Task Force. The task force is comprised of representatives from the National Weather Service, Soil Conservation Service, State Climatologist, Division of Water Resources, U.S. Geological Survey, Bureau of Reclamation, Division of Disaster Emergency Services, Bureau of Land Management and the private sector. The task force reported that snow pack was 55 percent of the 25-year average, which reflected an earlier than normal spring runoff. Statewide reservoir storage was 123 percent of average, reflecting an excellent condition which was due to the wet years Colorado has recently experienced. Regarding precipitation for the water year October through May, the State is only slightly below the 20-year average. Soil moisture in Colorado, measured by the Palmer index, is excellent as a result of the last five consecutive wet years. The consensus of the task force was that the potential for significant drought impacts to occur on a statewide basis during the remainder of the year is very low. The task force did express two concerns: first, that Colorado may be entering a dry cycle; and second, that the State is experiencing a slightly drier than average year.

In addition, the Governor was furnished with the Colorado Drought Response Plan which was published in 1981. It is noteworthy that Colorado is one of few states with a plan, and that plan has received wide distribution and interest nationally and internationally. Colorado is seen as a leader in drought contingency planning. The plan institutionalizes drought monitoring, early detection reporting, impact assessment and response action. Anyone desiring information on Colorado's plan should contact John B. Byrne, Director of the Division of Disaster Emergency Services.

THE 1988 DROUGHT -- HOW IS COLORADO FARING?

by

Nolan Doesken
Assistant State Climatologist
State Climate Center
Colorado State University

The word "drought" has not been in our Colorado vocabulary for several years. Since 1982, consecutive wet years have resulted in great snow for winter recreation, high streamflows, excellent carry-over reservoir storage, and adequate irrigation water. While localized flooding and landslides were a problem in parts of the State during this wet period, these problems were minor compared to the benefits reaped by having consistently abundant snowpack and water supplies.

During the winter of 1986-87, the northern Rockies and much of California and the Pacific Northwest were noticeably drier than average. However, Colorado and other southern Rocky Mountain states managed to have another good precipitation year. Below average precipitation was observed in our northernmost watersheds, but farther south precipitation was heavy, and in the Rio Grande basin high water and some snowmelt flooding occurred. The summer of 1987 brought average or above moisture to most lower-elevation areas in Colorado, but most mountain areas were relatively dry.

The winter of 1987-88 brought the second consecutive winter of low snowpack to the west. Driest areas were again in the northern Rockies, and by early spring it was apparent that a serious drought was well established. Again Colorado was lucky. The winter snowpack in Colorado, and subsequent predictions for summer runoff, were below average in a number of areas, and statewide it was the driest winter since 1981. However, soil moisture and reservoir storage remained above average following several consecutive wet years. Although some areas were as much as 30 percent below long-term precipitation and snowpack levels, most reservoirs filled to capacity by early summer and surface water supplies have been good.

From the first of April through June 1988 almost the entire country was dry, with many portions of the Mississippi Valley receiving less than half of their normal rainfall. As crops began to wither, national media went into a near frenzy over the developing drought. But again Colorado was fortunate. Spring and early summer delivered fairly normal precipitation here. April moisture was short, and showers were few and far between in early May, but a major slow-moving storm May 17-23 rescued many dryland farmers from a potentially poor year. As much as 4" of gentle rains soaked the ground in Colorado's best winter wheat areas. June was scorching hot, but summer rains that often wait until late July and early August to appear developed over much of the State already in mid-June, helping to offset the effect of the heat.

In summary, it is true that Colorado is experiencing drier conditions than we've seen for a number of years. The 1980s as a whole have been an unusual decade here. By comparison, what we are experiencing now may be construed as drought. It is actually a taste of more normal weather. So far, we have been spared from what truly is a serious drought for many parts of the country. Even if the next few months are dry here (which would be contrary to the National Weather Service long-range forecast), it is unlikely that Colorado will experience significant negative drought impacts in the short term. It is likely, however, that by the Fall reservoirs will be drawn down to lower levels than they have been for a number of years and soil moisture will likely be short (normal for late summer). Next winter's precipitation, particularly the high elevation snowpack, will be a major factor in determining if we are headed toward more significant drought or if we are having just a brief and very normal dry spell. We will have to wait and see.

Finally, it is good to remember that Colorado is a state where the majority of the land area receives less than 16" of moisture per year. Significant year-to-year variation in precipitation is normal and should be expected. Periodic drought episodes are normal and will occur several times in our lifetime. Rather than crying and screaming about climate change, El Niños and the like, it is wise simply to anticipate and plan for what history has shown to be inevitable.

USGS CHANGES PROPOSAL DEADLINE

Proposals for the Section 105 Water Research Grants Program will be due at the U.S. Geological Survey in October this year instead of January as in previous years. The Institute has received the program announcement and proposal guidelines. Contact the Institute secretary at 491-6308 if you wish to receive the announcement.

NOTED WATER LAWYER PASSES AWAY

Charles W. Meyers, prominent water law professor and Denver attorney, died July 17th. Meyers came to Colorado in 1981 as a partner in the Denver office of Gibson, Dunn and Crutcher. He previously had a distinguished career as a law professor, teaching at the University of Texas, Austin, Texas; Columbia University, New York; and Stanford University in California where he was dean of the Stanford University Law School.

Meyers served as assistant general counsel to the National Water Commission, president of the Association of American Law Schools, and vice chairman of the California Governor's Commission to Study California Water Rights Law. At the time of his death he was Special Master for the Pecos River Compact dispute between New Mexico and Texas.

WATER RESOURCES EXPERTISE DIRECTORY SERVICE AVAILABLE FROM UCOWR

The Universities Council on Water Resources has compiled a **Water Resources Expertise Directory** of faculty from its 72 member universities. The computerized directory contains names, addresses and expertise of UCOWR's faculty members. It provides a locator by which faculty available for research and consulting opportunities can be contacted, and also facilitates contact by potential students with prospective professors concerning future graduate study. Names of experts can be retrieved by the use of keywords describing the expertise desired.

Access to the directory can be obtained by contacting Dr. Duane Baumann, Executive Director, Universities Council on Water Resources, Department of Geology, Southern Illinois University, Carbondale, IL 62901. (618)536-7571.

CALL FOR PAPERS

The American Water Resources Association's 1989 Spring Symposia with topics of "Headwaters Hydrology" and "Indian Water Rights and Water Resources Management" will be held in Missoula, Montana on June 27-30, 1989. Papers will cover the breadth of water resource management problems and controversies encountered in headwaters regions.

ABSTRACT DEADLINE: November 15, 1988. For further information contact the Institute or Headwaters Hydrology Technical Chairman: Dr. William W. Woessner, Department of Geology, University of Montana, Missoula, MT 59812. Telephone: (406)243-5698.

**REAUTHORIZATION OF WATER RESEARCH ACT
IS TOP PRIORITY FOR FY1989**

Reauthorization of The Water Resources Research Act of 1984 (P.L. 98-242) will hold top priority in the coming months for the National Association of Water Institute Directors (NAWID). The Act expires in 1989. Congress overrode a presidential veto in 1984 to pass the Act by votes of 87-12 (Senate) and 309-81 (House). It authorized an annual funding level of \$10 million for the State Water Research Institutes (\$150,000 for each Institute). Annual appropriations have not reached this level, however, and averaged only \$105,000 per year. The Act also authorized \$20 million annually for Matching Grants and \$6 million for Water-Related Technology Development.

Henry P. Caulfield, Jr., a speaker at the 1987 NAWID annual meeting, gave a brief historical analysis of water resources research legislation. "Some 25 years ago I was involved in drafting what became the Water Resources Research Act of 1964," he said. "I have followed its administration, reauthorizations, and appropriation history ever since." He noted that Senator Clinton Anderson (NM), then Chairman of the Senate Committee on Interior and Insular Affairs, was a prime mover in the genesis of the water research program. Anderson's staff assistant, the late Benton J. Stong, and Eugene Eaton drafted the original bill. It was closely modeled on the Hatch Act of 1887 that created the state agricultural experiment stations.

Colorado had key role...

Dr. William E. Morgan, then President of Colorado State University, played a leading role in testimony and other supportive activities, said Caulfield. Acknowledging Morgan's efforts upon passage of the bill, Senator Anderson sent him a letter and enclosed one of the three pens used when President Lyndon B. Johnson signed the bill.

In a June 9, 1988 memo to Judson M. Harper, CSU Vice President for Research, Dr. Morgan said: "For the 19 years since I left the campus, the frame[ed letter] has hung in my study at home...During my four-year term as Chairman of the Water Resources Committee of the Association of Land Grant Colleges and State Universities, the Committee's principal activity was the lobbying effort with both the 88th and the 89th Congresses to obtain passage of the bill. This involved numerous strategy conferences with Senator Anderson and countless calls to my colleagues at other Land Grant institutions where help was needed from senators or congressmen in their respective states. The exercise left me with a towering respect and genuine affection for Senator Anderson. Thus you will understand the sentimental meaning to me of his very cordial letter and his thoughtful consideration in presenting to me one of the pens used by President Johnson in signing the bill."

CLYTON F. ANDERSON, N.M., CHAIRMAN
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United States Senate
COMMITTEE ON
AERONAUTICAL AND SPACE SCIENCES

MAY 2 1966
April 27, 1966

Dr. W. E. Morgan
President
Colorado State University
Fort Collins, Colorado

Dear Dr. Morgan:

When President Johnson signed S. 22 the other day he completed action on a successful legislative project of ours in which you played a very vital role. The enactment of S. 22, which was Title II of S. 2 in the 88th Congress, was especially the result of your timely and effective intercession on its behalf at the right time and place.

The White House has given me three pens used by the President in signing the bill, and I can think of no one more entitled to one of them than you are. It carries with it my own appreciation for all you did to help bring about the enactment of both S. 2 in the 88th Congress and S. 22 in the 89th Congress.

The importance of the water resources research program these two bills are getting under way will become increasingly apparent to the public generally as time elapses. It was the Nation's good fortune that you and several of your associates in the university field had the foresight to appreciate that importance and to support it so effectively.

Sincerely yours,
Clinton P. Anderson
Clinton P. Anderson



CPA:dc

The framed letter and pen will remain on permanent display in the offices of the Colorado Water Resources Research Institute.

(Henry P. Caulfield, Jr. is Professor Emeritus, Political Science Department, Colorado State University and former Executive Director of the U.S. Water Resources Council.)

NEW INSTITUTE PUBLICATIONS

Completion Report No. 147--**Evaluation of Design Flow Criteria for Effluent Discharge Permits in Colorado**, by Cynthia L. Paulson and Thomas G. Sanders. Price: \$15.00

The criteria for appropriate design flows for NPDES permits in the State of Colorado are based on the requirements of the most sensitive water use, which in most cases is aquatic life. Alternatives to annual 7Q10 have been analyzed with respect to flow magnitude, level of protection, and potential economic impact on dischargers. The choice of acute and chronic design flows must take these factors into account in addition to the biological requirements of aquatic life communities reflected in water quality criteria.

In this investigation it was found that the design flows meeting the criteria currently recommended by the U. S. Environmental Protection Agency were the annual 1Q10 for acute flows and 7Q10 or 7Q15 for chronic flows. These design flows are very restrictive and do not take advantage of the assimilative capacity of the stream.

It was also found that monthly or seasonal design flows offer the possibility to increase the use of assimilative capacity and still maintain existing instream uses. The choice of whether to use monthly or seasonal design flows (rather than annual) may be a compromise between increased complexity of implementation and greater utilization of assimilative capacity. The differences between annual and monthly design flows are much greater than the differences between annual and seasonal design flows. Therefore the use of monthly design flows could result in substantially higher effluent permit limits than seasonal or annual flows, depending on the number of flow excursions allowed. The ability of dischargers to adjust their treatment processes on a monthly basis and the increased complexity of implementation, however, may discourage the use of monthly low-flow criteria.

A water-quality control program based on the number of streamflow excursions is not the same as one based on the number of water quality excursions. For example, in the case of unionized ammonia, the sensitivity of the concentration of unionized ammonia to the combination of pH and temperature is so strong that in many cases the streamflow has little effect on whether or not the water quality standard is violated. A given design flow will therefore not guarantee that a water quality standard will not be violated.

This report gives very good estimates of the magnitude and frequency of low-flow events in the several streamflow reaches analyzed in Colorado. With the uncertainty of these parameters thus removed, it may be prudent for municipalities or industries in these reaches to reassess their effluent limitations. For example, the frequency distributions of the upstream and effluent unionized ammonia concentrations may allow the effluent limit to be raised.

Information Series No. 59--**Proceedings: High Altitude Revegetation Workshop No. 8**, Edited by Warren R. Keammerer and Larry F. Brown. Price: \$12.00

The 8th biannual High Altitude Revegetation Workshop was held at Fort Collins Colorado in conjunction with the Colorado State University Agronomy Department. The workshop proceedings presents papers given in the several sessions of the workshop.

The first High Altitude Revegetation Workshop was held at Colorado State University in the spring of 1974. Enthusiasm for the conference resulted in the formation of a High Altitude Revegetation Committee comprised of volunteers from the mining and ski industries, revegetation/reclamation materials suppliers, consultants, various governmental agencies and universities. The Committee meets once each year to select sites to be toured on summer field trips and to plan the biannual conference.

Publications are available at prices listed plus postage. Send order and check payable to Colorado State University to:

	<u>Price</u>	<u>Postage</u>
Bulletin Room	Up to 99¢	\$.75
171 Aylesworth Hall	\$1.00-4.99	\$1.00
Colorado State University	\$5.00-\$9.99	\$1.50
Fort Collins, CO 80523	\$10.00 and over	\$2.00
(303)491-6308		

CONFERENCES

- Aug. 28-31 SYMPOSIUM ON WATER-USE DATA FOR WATER RESOURCES MANAGEMENT, Tucson, AZ. Contact: Richard A. Herbert, USGS-WRD, Box 25046, Federal Center, MS406, Denver, CO 80225 (303) 236-5928.
- Sept. 14-17 11TH TECHNICAL CONFERENCE ON IRRIGATION, DRAINAGE AND FLOOD CONTROL, San Diego, CA. Contact: Executive Vice President, USCID, P.O. Box 15326, Denver, CO 80215 (303)236-6960.
- Sept. 26-30 INTEGRATING TECHNOLOGY AND GEOSCIENCE APPLICATIONS, Denver, CO. Contact: GIS Symposium, Buhler and Abraham, Inc., 8700 First Ave., Silver Spring, MD 20910.
- Oct. 1-4 GEOTECH '88, GEOCOMPUTING TOOLS--PCs, WORKSTATIONS AND MORE--Lakewood, CO. Contact: Chuck Bierley, CEM, 133 S. Van Gordon #200, Lakewood, CO 80228 (303)980-1648.
- Oct. 6-7 WATER MARKETING 1988: The Move to Innovation, Denver, CO. Contact: Water Marketing Conference, Univ. of Denver College of Law, 7039 E. 18th Ave., Rm. 140, Denver, CO 80220 (303)871-6125.
- Oct. 24-25 AGRICHEMICALS AND GROUNDWATER PROTECTION: RESOURCES AND STRATEGIES FOR STATE AND LOCAL MANAGEMENT, St. Paul, MN. Contact: Freshwater Foundation, 2500 Shadywood Rd., Box 90, Navarre, MN 55392 (612)471-8407.

Nov. 6-11

WATER FOR THE YEARS AHEAD-QUALITY AND QUANTITY: 1990 AND BEYOND, 24th Annual AWRA Conference, Milwaukee, WI. Contact: Dr. N. Earl Spangenberg, College of Natural Resources, Univ. of Wisconsin, Stevens Point, WI 54481 (715) 346-2372.

...program based on the number of stream kilometers... not the same as one dated on the number of water quality excursions. For example, in the case of untreated effluents, the sensitivity of the concentration of untreated effluents to the concentration of untreated effluents is so strong that in many cases the streamflow has little effect on whether or not the water quality standard is violated. A given design flow will therefore not guarantee that a water quality standard will not be violated.

...gives very good estimates of the frequency of low-flow events in the reaches analyzed in Colorado. With these parameters thus removed, it is possible to analyze the frequency of low-flow events in reaches for which data are not available. The frequency distributions of the upstream and effluent untreated effluent concentrations may allow the effluent limit to be raised.

Information Series No. 59--Proceedings: High Altitude Reclamation Workshop No. 8, Edited by Warren R. Klemm and Larry F. Brown. Price: \$12.00

The 8th Annual High Altitude Reclamation Workshop was held at Fort Collins, Colorado in conjunction with the Colorado State University Agency. The workshop proceedings presents papers given in the several sessions of the workshop.

The first High Altitude Reclamation Workshop was held at Colorado State University in the spring of 1974. Entitled "The Colorado State University Agency: Formation of a High Altitude Reclamation Committee" the workshop was a success in that it brought together a group of volunteers from the mining and oil industries, reclamation, and other agencies to discuss the problems of high altitude reclamation.

Colorado Water Resources Research Institute
Colorado State University
Fort Collins, Colorado 80523

This newsletter was financed in part by the Department of the Interior, U.S. Geological Survey. The contents of this publication do not necessarily reflect the views and policies of the Department of the Interior, nor does mention of trade names or commercial products constitute their endorsement by the United States Government.

...Evaluation of Design Criteria for Effluent Discharge Permits in Colorado, by Cynthia J. Paulson and Thomas G. Sanders. Price: \$12.00

The criteria for appropriate design flow for water permits in the State of Colorado are based on the requirements of the most sensitive water use, which in most cases is aquatic life. Alternatives to annual 1010 have been analyzed with respect to flow

In this investigation it was found that the design flows meeting the criteria currently recommended by the U.S. Environmental Protection Agency were the annual 1010 for acute flows and 1010 or 1015 for chronic flows. These design flows are very restrictive and do not take advantage of the assimilative capacity of the stream.

It was also found that monthly or seasonal design flows offer the possibility to increase the use of assimilative capacity and still maintain existing instream uses. The choice of whether to use monthly or seasonal design flows (rather than annual) may be a compromise between increased complexity of implementation and greater utilization of assimilative capacity. The differences between annual and monthly design flows are much greater than the differences between annual and seasonal design flows. Therefore the use of monthly design flows could result in substantially higher effluent permit limits than seasonal or annual flows, depending on the number of flow excursions. The ability of dischargers to adjust their flows to meet a monthly permit is a function of the complexity of implementation, however, may be the use of monthly low-flow criteria.

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Aug. 28-31 SYMPOSIUM: WATER AND WASTEWATER TREATMENT TECHNOLOGY AND DESIGN APPLICATIONS, Denver, CO. Contact: G12 Symposium, Butler and Sherman, Inc., 6700 First Ave., Silver Spring, MD 20910. Price: \$12.00 and over

Sept. 14-17 11TH INTERNATIONAL SYMPOSIUM ON WATER QUALITY CONTROL, San Diego, CA. Contact: IWS (303) 336-8980. Price: \$12.00

Oct. 1-4 GEOTECH '88: BECOMPUTING TRENDS-PER WORKSTATIONS AND MORE-Lakewood, CO. Contact: Chuck Skerfve, CEM, 123 S. Van Gordon #200, Lakewood, CO 80228 (303) 940-1848. Price: \$12.00

Oct. 6-7 WATER MARKETING 1988: The Move to Innovation, Denver, CO. Contact: Water Marketing Conference, Univ. of Denver College of Law, 2033 E. 18th Ave., Rm. 148, Denver, CO 80202 (303) 871-8125. Price: \$12.00

Oct. 24-25 AGRICULTURAL AND GROUNDWATER PROTECTION: RESOURCES AND STRATEGIES FOR STATE AND LOCAL MANAGEMENT, St. Paul, MN. Contact: Freshwater Foundation, 2500 Shadywood Rd., Box 90, Navarre, MN 55392 (612) 471-8407. Price: \$12.00

COLORADO WATER ENGINEERING AND MANAGEMENT CONFERENCE

February 27-28, 1989

Colorado State University

Fort Collins, Colorado

CALL FOR PAPERS

Conference Objectives:

The purpose of the 1989 Colorado Water Engineering and Management Conference is to evaluate technical methods necessary to manage and solve state water problems. Colorado is dependent on water management for economic and social development, and engineers and managers have key roles in water decision-making. The conference serves as a forum to exchange ideas about technological and management solutions for current state water problems.

Who Should Attend:

The conference will be of interest to water resource engineers, water district managers, utility and municipal officials, agricultural and industrial water managers, public officials, and other citizens interested in the engineering and managerial aspects of Colorado water management.

Conference Topics:

- * Water Resources Management and Problem-solving
- * Water Management by Exchanges, Banking, Conjunctive Use
- * Drought Planning
- * Computing and Telecommunications in Water Management
- * Flood and Stormwater Management
- * Urban Water Supply
- * Wastewater and Water Quality Issues
- * Groundwater Management
- * Climatic Issues
- * Agricultural Water Management

Conference Format:

The two-day conference will feature invited and contributed papers. Topics of general statewide interest will be discussed at the plenary sessions. Specific technical topics will be discussed at individual sessions.

To Submit a Paper for Consideration:

Send a 200 word abstract by November 1, 1988 to:

Neil S. Grigg, Conference Chairman
Department of Civil Engineering
Colorado State University
Fort Collins, Colorado 80523
(303)491-5247/6308

Abstracts should be single spaced and the full names and mailing addresses of the authors must follow the title of the paper. Notification of acceptance of abstracts will be made by December 1, 1988. Five-page papers for preprinting in the conference handouts will be due January 13, 1989.

Cosponsors Sought

The 1987 Conference was cosponsored by several state water associations. They are being invited to cosponsor again. If your organization with an educational or research mission desires to cosponsor, please notify us. No financial commitment is required.

General Information

Registration:

All authors and attendees will be expected to pay the registration fee of approximately \$125. Requests for partial waivers will be considered for organizations with multiple attendees and for individuals with special circumstances.

COLORADO WATER RESOURCES RESEARCH INSTITUTE
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Cooperative Extension
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COLORADO WATER ISSUES PUBLIC FORUM



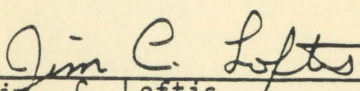
THIRD TUESDAY of Each Month
No-Host Noon Luncheon -- 11:45 a.m.-1:30 p.m.
WYATT'S CAFETERIA--Lakeside Shopping Center
on 44th Ave. between Sheridan & Harlan.

[Exit #270 on I-70 (Harlan St.) opposite Lakeside
National Bank, then 2 blocks south on Harlan]

All interested citizens are invited to attend and provide input into the discussion generated by our expert presenter. Proceed through cafeteria line for meal service, then to designated meeting room.

- Sept 20-- **APPLICATION OF A BASINWIDE HYDROLOGIC MODEL**--Alan Burns, District Groundwater Specialist, U.S. Geological Survey, Denver. Also, discussion of new CWRI programs--Neil Grigg, CSU-CWRI.
- Oct. 18 -- **INSTREAM FLOW NEEDS IN COLORADO**, Chris Meyer, Attorney with the National Wildlife Federation. Join us for a provocative discussion of one of Colorado's most important water problems.
- Nov. 15 -- **METRO DENVER WATER GAME**, Lynn Johnson, Civil Engineering Department, University of Colorado at Denver. Can computers provide insight into the Two Forks controversy? Make up your own mind after seeing Lynn Johnson's presentation.

Please mark your calendar for the 3rd Tuesday of each month through June 1989.



Jim C. Loftis
Extension Specialist

491-7923