

Wyoming Hydrogram

October 1990

Wyoming Water Research Center Newsletter

Vol. 2, No. 4

State Water Meeting Held

Water managers and researchers from throughout the state attended the third annual meeting of the Wyoming State Section, American Water Resources Association, at the University of Wyoming, October 3-4, 1990. Highlights of the conference included eighteen technical presentations on the latest research and applied methods in water resources, a field trip to the Snowy Range hydrologic and climate observatory, and a cash award for the best student presentation. The meeting was held in collaboration with the Wyoming Water Research Cen-

ter. Sessions were held on channel morphology, water management and ground water, water quality, and analysis and collection of hydrologic data. Mark Blanchard, a graduate student in geology at UW, won the \$100 award for best student presentation with his paper on "Discrimination Between Flow-through and Pulse-through Components of an Alpine Carbonate Aquifer, Salt River Range, Wyoming." Nancy Driver, USGS, one of the judges for the student award said, "It was

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Mark Blanchard (right), UW graduate student in geology, receives a \$100 cash award for the best student presentation from Craig Goodwin, Vice President of States West Water Resources Corporation, Cheyenne, WY.

USGS Invites Research Proposals

The U.S. Geological Survey (USGS) is requesting applications for the FY 1991 Water Resources Research Program. This program, established under Section 105 of the Water Research Act of 1984, provides nationally competitive grants for water resources research administered by the USGS. It is anticipated that \$1.8 million will be available for this program in FY91. Individual projects may range up to three years in length, with grant amounts of up to \$175 thousand in federal funds requiring a 1:1 non-federal match.

This year the request for proposals is more explicit as to what research is considered a priority. The six research areas of highest interest and the approximate anticipated percentage distribution of funds are as follows:

Social Sciences	20%
Ground Water Flow & Transport	15%
Water Quality	15%
Biological Sciences	15%
Engineering	15%
Climate & Hydrologic Processes	20%

In addition, other topics may also be addressed. Proposals for any topic

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Water Quality Education Grant Awarded

A grant has been awarded by the Wyoming Department of Environmental Quality for a joint Wyoming Water Research Center and University of Wyoming Cooperative Extension Service project. The objective of this project is to develop and implement nonpoint source water quality education and information programs. The education program consists of three components designed to increase

public awareness of nonpoint water quality problems and provide information on implementing voluntary control strategies (Best Management Practices). The three components of the program are:

- 1) Educational brochures to develop public awareness,
- 2) Development of a "Wyoming Water Quality Reference Handbook" to provide a comprehensive

source of water quality information, and

- 3) Workshops to provide nonpoint source water pollution education and technical assistance.

These programs will be developed and implemented over a four year period. The education grant received is for the first program year.

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State Meeting continued

difficult to select the single best presentation. There was a high level of competition for the award and all of the presentations were excellent!"

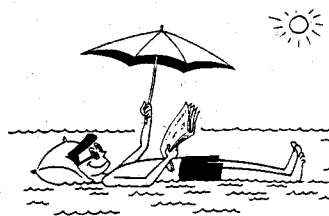
During the conference, a luncheon was held featuring Diane McKnight of the USGS who presented some unique findings of her ongoing hydrologic research on desert lakes in Antarctica. At the business meeting after the luncheon, members unanimously voted to support a proposal to host a national AWRA symposia in Jackson, WY, in 1994 and elected officers for the 1990-91 water year. The new Wyoming State Section officers are President Jim Rankl (USGS), Vice President Sue Lowry (WY State Engineers Office), Treasurer Kirk Miller (USGS), Secretary Mike Brogan (BLM), and Membership Chair Maria Plafcan (USGS).

Water Grant continued

The education program is one of twenty-three nonpoint source projects that were awarded by DEQ. A total of five projects were awarded for programs to be conducted at and through the University of Wyoming. These include demonstration and implementation programs on reducing nitrates in ground water, wildlife grazing impacts, soil tolerance, wellhead protection testing and education. The total federal contribution for the grants awarded in Wyoming is \$1.12 million. Individual project awards ranged from \$2,000 to \$243,717. Federal funding for these matching grant projects is authorized by Section 319 of the Clean Water Act, administered by the U.S. Environmental Protection Agency. For additional information please contact Beth Pratt, Water Quality Division, Wyoming Department of Environmental Quality, Cheyenne WY (307) 777-7781.

COMING SOON!

The Wyoming Water Atlas, a 136-page volume with 55 four-color plates showing many different aspects of Wyoming's water resources, will be available mid-November. High resolution maps in the atlas will provide interesting and new perspectives on Wyoming's water resources, availability and uses. The atlas is authored by Larry M. Ostresh, Jr., Richard A. Marston, and Walter M. Hudson. Governor Mike Sullivan authored the foreword, and the introduction is by Michael Purcell, Administrator of the Wyoming Water Development Commission. The atlas is being co-published by the WWDC and the University of Wyoming. A total of 1,500 copies will be printed and available for \$35 each. The Wyoming Water Atlas will be distributed through the Wyoming Water Research Center. For additional information, or to order a copy, contact the WWRC at (307) 766-2143.

*USGS continued*

of research must be well prepared. This program is highly competitive and only about 15-20 percent of proposals received are normally funded. Details about the program and application requirements are provided in USGS Announcement 7719. The deadline for applications is November 20, 1990. Please contact Pam Murdock at the WWRC (766-2143) for a copy of the USGS solicitation or for additional information.

Requests up 61 percent

Water Resources Data System (WRDS) staff have been responding to an increasing number of requests for data and analysis. More than 245 requests have been processed to date as compared with 152 requests at the same time last year. This represents a 61 percent increase, with the largest number of requests coming from the private sector.

WRDS is a computerized data storage and analysis system housing the largest single repository of hydrological and climatological data for the State of Wyoming. Data from more than 80 collecting agencies are housed on the system. Information on the system includes daily climatological data, daily stream flows, peak stream flows, water quality test results, wetlands, Water Resources Abstracts, and much more. WRDS is funded through an allocation from the Wyoming Water Development Commission and is administered through the Wyoming Water Research Center. For further information contact WRDS at the Wyoming Water Research Center (307) 766-2143 or FAX (307) 766-3718.

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Big Sandy River receives 150,000 tons of salt per year

Wyoming Helps Reduce Salt in the Colorado River

Efforts are underway in Wyoming to help solve an international problem. In 1973, following long and complex negotiations, the United States and Mexico reached an agreement over the quantity and quality of Colorado River water that is delivered to Mexico. As a result of this agreement, the United States is committed to doing whatever it takes to keep the salinity level of the water delivered to Mexico at or below 879 ppm of total dissolved solids (TDS), measured at the Imperial Dam in California. Salinity levels in the Colorado River are the result of both natural geologic conditions and irrigation that increases the amount of salts leached into the river.

Colorado River Salinity Control Program

The Colorado River Basin Salinity Control Act (PL 93-320) passed in 1974 and amended in 1984, is a basin-wide water quality program targeted at salinity reduction in the Colorado River Basin. The Act has taken two general approaches to reduce salinity to meet the agreement with Mexico. These two approaches are off-farm salinity reduction programs and on-farm salinity reduction programs. The U.S. Department of Interior, through the Bureau of Reclamation, is conducting off-farm salinity reduction practices such as lining irrigation canals to reduce leaching of salts and constructing a desalinization plant to remove salt from the river before it enters Mexico.

On-farm salinity control programs are being conducted by the U.S. Department of Agriculture through the Soil Conservation Service, Agricultural Stabilization and Con-

servation Service, and the Cooperative Extension Service. USDA on-farm salinity reduction programs include educational programs in irrigation water management and the installation of automated irrigation systems to improve water application and reduce the amount of salt leaching into the Colorado River system.

... the salt load to the Big Sandy could be cut by approximately 50,000 tons per year if 80 percent of the acreage could be converted from border dike flood irrigation to overhead low pressure sprinkler systems.

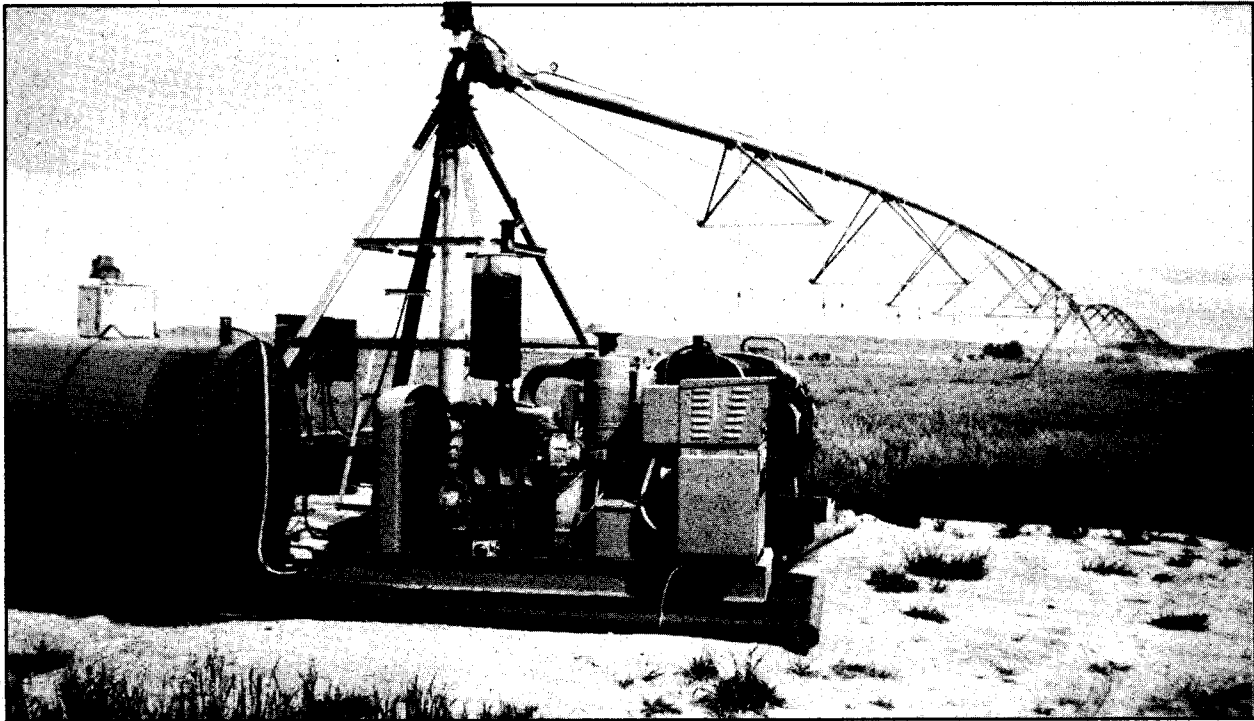
There are about 25 locations throughout the entire River Basin that receive salinity control program funding. Fiscal year appropriations for these programs in 1990 was about \$12.5 million. Control projects are being implemented from Yuma, Arizona to Farson, Wyoming.

Wyoming's Eden-Farson Project

The Eden Valley Irrigation and Drainage District located in Eden-Farson in southwestern Wyoming was selected as one of the salinity control program projects. It was determined that some 150,000 tons of salt per year was entering the Big Sandy River, a tributary of the Green,
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"Turbulent Fountain" type moss and vegetative trash screen for water used in a 95-acre, center pivot irrigation system on the Jim Hodder farm, Farson, WY. Canal water enters the base of the inner well via 10" PVC pipe with about 1.5-2.0 feet of head. The resulting fountain of water falls back into the well after passing through a screen rack.



This portable 50KW diesel generator supplies 3-phase electrical power to the 30 HP pivot sprinkler electric motor. This system services a 120-acre area and was installed in May 1990, on the Kim Brown farm, Farson, WY.

downstream from the irrigation district. Eighty-five percent of this salt was attributed to irrigation return flows. Percolating irrigation water dissolves salts in the shallow marine shales that lay under this area and enter the river. The Big Sandy flows southwesterly to the Green River a few miles below Fontenelle Dam. Wyoming's Green River is a major tributary to the Colorado River. Further studies determined that the salt load to the Big Sandy could be cut by approximately 50,000 tons per year if 80 percent of the acreage could be converted from border dike flood irrigation to overhead low pressure sprinkler systems. The net result, if this conversion could be achieved, is a projected decrease in salinity at the Imperial Dam of about 5.5 ppm TDS.

... crop yields are up about 100 percent and water use on these farms is down 50-75 percent.

Following environmental assessment studies and because of opposition to a reduction in irrigated acreage, the plan adopted by the USDA for salinity reduction in Wyoming calls for voluntary conversion by landowners from border dike flood irrigation to low pressure overhead sprinkler irrigation. The central thesis is that sprinklers would allow farmers to raise at least the same crop yield while using dramatically less water. The "saved" water would be a reduction in the amount that previously percolated through the soil, thereby reducing the salinity in irrigation return flows.

Dikes to Pivots

In 1988, conversion began on the first few farms and the "project pivots" produced their first crops in 1989. By 1990, 11 pivots, one wheel-line, and one surge valve/gated pipe system have been installed through the program. Early numbers indicate that crop yields are up by about 100 percent and water use on these farms is down by 50-75 percent. Total salt savings are estimated at 6,600 tons per year from the 1,100 acres under contract in the program.

Farmers are required to sign a twenty-five year operations and maintenance agreement in exchange for a 70 percent federal cost share for their systems. The program also authorizes cost share payments to farmers who voluntarily choose to replace wildlife habitat that may decline or disappear due to the project. Specifically, the irrigation induced seasonal saline wetlands (formed by return flows) are expected to dry up as water tables decline from reduced water applications. According to Joe Hiller, Area Water Management Agent, University of Wyoming Cooperative Extension Service, several farmers are looking at this component of the program as an avenue to maintaining and enhancing local wildlife populations and diversifying farm revenues.

Current plans show an additional two thousand acres coming under pivots in the next few years bringing the total Salinity Program acreage to around 3,000. The 80 percent goal (14,000 acres) is expected to be met well within the ten year program plan.

WWRC Research

Adaptive Gridding Techniques for Groundwater Contaminant Modeling: Final Project Report. Submitted by Myron B. Allen, August 1990.

Modeling sharp fronts in groundwater contaminant flows, such as those resulting from a contaminant spill or leak, is important for estimating the movement, extent and concentration of the contaminant flow and to reduce the high cost of numerous monitoring wells. Sharp concentration fronts occur and persist in contaminant flows where spreading attributable to hydrodynamic dispersion is small compared with advective transport along the groundwater velocity field. Steep concentration fronts in advection-dominated flows pose severe problems for most standard numerical models. Such models usually rely on approximation schemes in which one treats the real continuous aquifer as a discrete network of cells or nodes, called a grid. When a steep front is present, many small cells are needed in the vicinity of the front to produce accurate approximations of the local variations in contaminant concentra-

tion. In addition, as contaminant fronts move, the regions of refined grid must move adaptively. Mathematically, moving a zone of a locally refined grid changes the algebraic relationships among the cell variables in a complicated manner that one cannot predict in advance of running a model. The purpose of this project has been to develop innovative algorithmic methods that can be used to model grids with moving zones of local refinement and that are computationally efficient.

As a first step in this research, a finite-element collocation scheme was devised for adaptive gridding techniques of contaminant transport in one space dimension that is also readily amenable to implementation on parallel-processing computers. Next, a parallelizable alternating-direction scheme suitable for tensor hydrodynamic dispersion modeling was developed in collaboration with researchers at the University of Vermont. Components of the finite-element research were then used to incorporate grid refinement in these two dimensional codes. The actual implementation of this technique is the subject of a Ph.D. dissertation (Cur-

ran, 1990) and is being used in ongoing work.

The development of accurate and efficient contaminant transport codes lead naturally to the study of the effects of aquifer heterogeneity, a topic of much current interest in the water resources community. Accurate transport models enable researchers to study the numerical problem of scaling up from small scale heterogeneities in an aquifer to the scales comparable to practical cell diameters in numerical models. During the course of this research some of these considerations were outlined and work has been initiated into numerical schemes for groundwater flow that will complement the transport codes developed in this research.

Four journal articles, several conference proceedings and three graduate dissertation/papers have been produced from this work. For additional information please contact Myron B. Allen, Department of Mathematics, University of Wyoming (307) 766-4221 or the Wyoming Water Research Center at (307) 766-2143. This research project was funded by the Wyoming Water Research Center.

WWRC Calendar

AWRA National Meeting in Denver

The 26th Annual Conference of the American Water Resources Association will be held in Denver, Colorado November 4-9, 1990, at the Hyatt Regency. The theme of the conference is "The Science of Water Resources: 1990 and Beyond." Technical sessions will be held on water resources education, managing rural nonpoint source pollution, water supply and conservation, riparian management, water rights, markets and politics, and forest and wildland hydrology. For additional information call (301) 493-8600.

Call For Papers

A call for papers has been issued for the 1991 Colorado Water Engineering and Management Conference. The conference will be held February 27-28, 1990 in Denver, Colorado. A broad range of water issues will be addressed at the conference. Sessions will be held on interstate water transfers, non-point source water quality problems and best management practices, climatic issues, drought planning, water transfers and exchanges, groundwater management, and water conservation. To submit a paper for consideration please contact Neil Grigg, Director, Colorado Water Resources Research Institute, Colo-

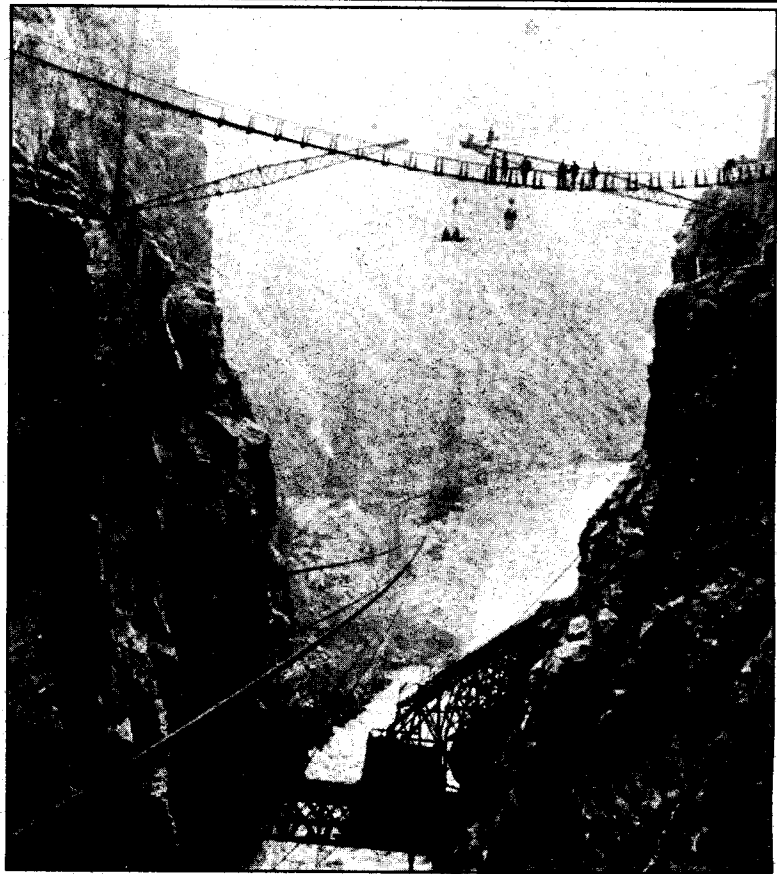
rado State University, Fort Collins, CO 80523 or call (303) 491-6308. Abstracts are due by November 1, 1990. The Wyoming Water Research Center is a cosponsor of the 1991 Water Management Conference.



Water Under the Bridge

On October 5, 1990, the American Heritage Center (AHC) at the University of Wyoming opens a new exhibit entitled "Wyoming Water: A Lasting Legacy." The exhibit covers the period from 1868 to 1943. The show includes 87 historical photographs and reflects the significance and value of water in Wyoming. Photographs depict the development and importance of water in agriculture, dam construction, irrigation canals, water holes, bridges, lumbering, river crossings and ice making. A number of the photographs in the exhibit were taken by well-known Wyoming Photographers W. H. Jackson and F. J. Haynes. Both photographers used the wet plate process, in use from the 1850's to the early 20th century, where photographic images were made from glass negatives. These glass plates were carried into the field by the photographer and had to be developed quickly after the photograph was taken, usually within fifteen minutes.

According to Tom Wilsted, Associate Director of the American Heritage Center, "This is one of our most interesting displays to date and shows a wide spectrum of water use." The material in the exhibit reflects only a small portion of the water-related collections in the AHC. In addition to the photographic material, there are more than 600 other collections dealing with water issues in



Secretary Garfield and his party, July 21, 1908, on the footbridge overlooking construction of the Shoshoni Dam. Construction of the 328-foot high dam was started in November 1905 and completed in January 1910.

Wyoming and throughout the Western United States. Some of the significant collections include papers of: Izaak Walton League, Raymond Lund, William E. Warne, and Dewey Anderson. These and other collections are available to researchers from Monday through Saturday at the AHC.

The Wyoming Water exhibit, open daily through February 1991, is located on the third floor of the Coe Library at the University of Wyoming campus in Laramie, WY. For further information, or to obtain posters of the exhibit, contact Tom Wilsted at (307) 766-4114.

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