Federal Budget Cuts Threaten OWRT

An important source of Utah's water research funding will be eliminated when the proposed presidential budget cutting axe falls on the Office of Water Research and Technology. OWRT was established in 1965 to administer a program providing federal research dollars to each of the 50 states. Conceived as a cooperative effort between the states and the federal government, the Office of Water Research and Technology was established to coordinate and stimulate effective research by the states. The land grant college in each state was selected as a "center" for water resources research and each received an equal annual allotment to pay for administrative costs and to be used by the state to initiate research projects. Additional research money was awarded to "centers" researchers on a competitive basis with the requirement that state money match the federal portion. A third portion of the federal money was apportioned by OWRT, again on a competitive basis, to completely fund merit proposals. OWRT did not maintain a research staff of its own, but it did maintain a Water Resources Scientific Information Center and it did disseminate the results of the states research to the general public. The FY81 budget was a modest $30.5 million of which $15.0 went to the states, $11.0 million went to saline water research and the rest was used for information dissemination and general support.

At the time of this writing, it is not known what the future holds. It is likely that about mid May the OWRT will be disbanded. Projects that have already been funded will continue to completion, and probably be monitored by the Water and Power Resources Service. It has also been announced that a new office within the Department of Interior will be established directly under the assistant secretary for Land and Water to be known as the Office of Water Policy. Since the Water Resources Council has also been axed by the budget cutters, this new office will likely take over some of the policy setting functions of that agency. Water resources research may also be a function of the new office.

The several states will now have to decide individually whether they want to continue and if so they must collectively decide how they will interact cooperatively. For the long run, efforts are already underway in Congress to seek out new and more effective organizational arrangements for cooperative state-federal water research.

In explaining why the OWRT was being dropped, Interior Secretary James Watt said that not all state centers were equal. Some were good, and some were bad. The states would probably step in to save the good ones.

What does this mean to Utah's center? "About $400,000 this year," says L. Douglas James, Utah Center director. "Over the years we have been extremely successful in competition with the other states for these federal dollars. In one year we had 10 out of 17 proposals funded, and we currently have 25 projects funded by OWRT. In total budget, we rate among the top 5 centers in the nation."

AWRA Asks An Important Question

What is happening to Utah's water?

That was the question discussed at this year's annual meeting of the Utah section of the American Water Resources Association.

The meeting, chaired by C. Eugene Bigler, this year's section president, was held at the Salt Lake Hilton March 19, 1981.

The sessions were jointly sponsored by the Utah Water Research Laboratory, the Utah Division of Water Resources, and the BYU Civil Engineering Department.

Governor Scott M. Matheson addressed the first session of the one-day conference and talked about the changes we would expect in water management policy and technique. He urged the use of a flexible state water plan that could bend with the times while still preserving that which is good. "The essence of planning is to preserve—not to preclude choices," he said alluding to the potential loss of choice from decisions like the MX missile siting in Utah and Nevada. The plans we make "... must accommodate environmental as well as developmental values," Matheson continued, "but it is vital that we also recognize new approaches to water resources management. We must not be afraid to challenge the assumptions upon which our policies are based in order to determine if they are equal to the needs of a dynamic 1980 society. We must be able to abide and even to encourage a little heresy in examining water policy issues. A little heresy is absolutely

(continued on page 2)
AWRA Asks Question

(continued from page 1)

necessary or changes will occur in spite of ourselves.”

Matheson then made reference to Interior Secretary James Watt, describing him as “a man of action who moves forward more swiftly and with more change in traditional policy than I have seen in many, many years.”

“We are dealing with a dynamic period of time with respect to water management in this country, and we are dealing with a reexamination of all traditional policies. I do not think there is a single sacred cow that will not be critically examined. If we are not bold enough to do something heretical about it we will be left at the switch and the momentum of change will run by us and if we are not careful, it will run over us.” Matheson concluded.

The afternoon session was devoted to the future demands on water by the energy, municipal and agriculture sectors. Booth Wallentine, Director, Utah Farm Bureau Federation, spoke optimistically about the future of agriculture and said he did not see “any one big dramatic thing happening in Utah over the next decade that will make a great deal of difference to Utah agriculture.” He forecast that the big issues which could threaten agricultural productivity would not be addressed for at least 15 years. These are

1) the abandonment of the market system of allocating resources and 2) the reservation of land to be used and preserved for agriculture. As to the first issue Wallentine expressed his belief that “in time the market system will redeem itself. In the long run it is still the best basic system.” Coupled closely to this market system is the recognition of private property rights. On this Wallentine said “property rights are so very essential to making this country different from all the rest ... this is what really makes America different.”

On the second issue Wallentine said “if you draw some lines and make sure this land is to be agricultural and this is for other purposes, you have done something to the incentive process to the farmer or to the rancher; and to do that is to infringe upon his ability and motivation to provide food and fiber; and you may have struck a serious blow, perhaps a death blow, to America’s production factor.”

Other speakers at the conference included N.W. Plummer, Regional Director, Water and Power Resources Service and Daniel H. Lawrence, Director of the Utah Division of Water Resources. The needs in research were presented by Jay Messer, from the Utah Water Research Laboratory.

Water Resources Council Also Axed

The water Resources Planning Act of 1965 (P.L. 89-80) created a Water Resources Council to coordinate federal programs for the development and utilization of water and related land resources. On a larger scale it was also created to coordinate federal activity with the water programs of state and local government. The Council, served by a Washington-based staff of about 100, is chaired by the Secretary of the Interior and made up of the Secretaries of Agriculture, Army, Commerce, Energy, Housing and Urban Development, and Transportation along with the Administrator of the Environmental Protection Agency. Official observers include the Attorney General, the Director of the Office of Management and Budget, and the Chairmen of the Council on Environmental Quality and the Tennessee Valley Authority. For administrative purposes, the Council divided the nation into 21 water resources regions, along river basin boundaries. Each region has either an interagency committee on a river basin commission. These committees or commissions are made up of federal and state officials who are also Council observers.

Over the last 15 years, the Council has had two major roles. One has been to compile, store, and analyze information to be used in projecting future national water needs. A more recent effort produced two national water assessments. These assessments contained current and projected water use information by region for use influencing national water policy and program direction.

The Utah Legislature has passed Senate Bill 42 which gives water conservancy districts the power to issue revenue bonds without submitting the question to the voter. The prefaced bill passed the Senate with only two dissenting votes. In the House it did not do so well and was killed. The WCD lobbies were successful, however, in bringing the bill back, amending it slightly, and getting it passed.

Since revenue bonds are supported entirely by water sales and other district income and not by tax revenues, the power to sell revenue bonds without voter approval is the usual practice for governmental entities. But most governmental entities are managed by elected officials. Administrators of WCDs are appointed by the District Court. Some fear that the increased power to command financial resources without visible accounting to a public which will result from this new law will make WCD actions even less visible.
CUP—Who Controls The Spotlight?

Recent articles appearing in the Salt Lake Tribune (Friday, November 21, 1980, and Sunday, December 14, 1980) and the comments on those articles which appeared in the newsletter of the Utah Environment Center for Dec./Jan., 1981 indicate the concern that some people have for the governmental decision making process involved in the promotion of water projects in Utah. The governmental agency in question is the Water Conservation District with particular focus on the Central Utah Water Conservancy District. The news media often refer to this as the CUP which is a misnomer because CUP refers to the Central Utah Project—a massive construction project conceived by the federal government. It is hard to dissociate the two, however, because the CUWCD, a state agency, is purchasing, with Utah tax dollars, the CUP from the feds. References to the CUP in articles quoted below actually refer to the CUWCD.

It all began when officials of the CUWCD attended a meeting of the Salt Lake City Public Utilities Advisory Board to enlist the support of Salt Lake City to have the CUP debt ceiling increased so that the CUWCD could legally pay the skyrocketing costs of the CUP. The UEC newsletter reports that:

Mr. Clifford Ashton, Salt Lake City public utilities advisory committee member, who also sits on the CUP board, said government agencies should take steps to "control" employees who are making statements against the CUP.

Specifically mentioned was Jerry Kinghorn, director of Salt Lake County's division of water quality and water pollution control. Mr. Kinghorn has said the water project isn't needed. A group at Utah State University and another at the state Division of Wildlife Resources were also recommended for "control."

Mr. Edward Clyde, CUP attorney, said he'd like to discourage Ted Arnow, water resources chief of the United States Geological Survey from making public statements about suspected vast groundwater resources beneath the Salt Lake Valley.

(In response to these comments,)

Alice Griffith, President of the Utah League of Women Voters, said in an open letter to CUP general manager Lynn Lindley she is "concerned" by suggestions from CUP board members that government agencies "control" employees making statements critical of the project.

Mr. Griffith says she wants an open discussion of issues surrounding the CUP.

Utah citizens should also be concerned about the impact of this alleged practice. When an autonomous sub-government of a state can direct the spotlight of public attention to only those areas that it wants exposed and lets other areas remain dark or unseen by "controlling" sources of valid information or even controlling biased opinions, it's time to "be concerned."

If Aquarius readers have other viewpoints, let us hear from you.

Weather Modification

Geoffrey Illi and his crew, Duane Woffinden, Verl Bindrap, E. J. Ballos, Brad Miller, Martin Miller, and Darrell South spent much of the winter near Beaver, Utah, seeking a better understanding of the problems of increasing precipitation through cloud seeding. The $422,000 project is funded by the National Oceanic and Atmospheric Administration (NOAA). A new microwave radiometer is being tested to measure the liquid water in the clouds above the mountain.

Solar Energy To Help In Pollution Control

In a joint venture between the United States and Israel, Aurel J. Acher will team with Dean Adams and E. J. Middlebrooks in a study entitled "Use of Solar Energy for the Detoxification of Organic Pollutants in Water for Agricultural Reuse." Acher represents the Institute of Soil and Water, Division of Soil Residue Chemistry located at Bet Dagan, Israel.

When To Use State Money On Water Projects

A report of "A Preliminary Study on Expanding and Financing State Water Development" has been completed by Daniel H. Hoggan, Kirk R. Kimball, and Jay M. Bagley.

The effects of recent energy price increases, domestic inflation rates, financial market fluctuations, and changing public attitudes toward federally sponsored water resource development and management have brought economic and financial considerations to the forefront of Western water management issues.

Recently enacted federal policies place increased responsibility on the states and localities for the development and management of their water resources. A response common to many of the western states has been to strengthen traditional, and often small, water financing and development programs. In creating and sustaining such a posture, however, state governments must address the important questions pertaining to the economic and financial impact of greater state involvement, the distributive impacts of state taxing and lending programs, and the state social goals relating to such managerial involvement.

The traditional and recently expanded water development programs of the State of Utah have been reviewed in the light of such management issues. The demand for state financing of water projects was addressed through an examination of economic indicators and an inventory of potential projects. State options for obtaining capital financing also were examined. This review indicates that increased financing activity and the potential for increased concentration of water development project benefits to specific social groups have created a need for greater clarity in the legislative mandate and greater accounting and visibility of water project impacts through the use of improved economic and social evaluation procedures. Moreover, in the absence of such safeguards, the continued investment of state funds might be considered premature and not always in the best interest of the state's residents.

Copies are available for $4.00 each. Please request "Water Resources Planning Series UWRP/P-80/07."
When Is A Drought A Drought?

A report "Vulnerability of Water Supply Systems to Droughts" has been completed by David S. Bowles, Trevor C. Hughes, W. Robert James, Donald T. Jensen, and Frank W. Haws.

The summary completion report describes the project work completed in three areas: 1) the development and preliminary testing of drought severity and vulnerability indices, 2) the impacts of Utah's 1977 drought, and 3) an operation comparison of stochastic streamflow models. The drought indices were evaluated for three municipal and three irrigation water supply systems in Utah.

The news media often compares the current year's rainfall, snowpack, or streamflow to the long term average. The percent of average is in a sense an index of drought. This index does not indicate how much moisture is stored in soil because more recent rainfall and less intense rainfall may contribute more to the current soil moisture.

To account for soil moisture a complicated number known as the Palmer Index is sometimes used for estimating drought severity from recent rainfall data. Even this index, however, is not a good measure of water supply availability because water is also stored for long periods, either in deep underground or surface reservoirs. Such water supplies may last for years during periods of precipitation shortage.

A water user is most concerned as to whether his own water supply will last the season. The drought index that means most is one that tells him his probability of suffering a water shortage (drought vulnerability) and the probable degree of that shortage (drought severity).

Three Utah municipal systems (Milford, Monticello, and Orangeville) and three Utah irrigation systems (the Milford area, the Logan, Hyde Park, and Smithfield Canal, and the Oberto ditch near Helper) were selected for preliminary testing of drought severity and vulnerability indices. One conclusion, after studying these areas, was that the vulnerability index should be defined using a continuous loss function for estimating damages rather than as the probability of a drought of sufficient severity to cause long-term economic losses. The use of average annual drought loss conforms with experience which shows that long-term economic losses do not occur suddenly at a threshold water shortage.

Information on the impacts of Utah's 1977 drought was collected by surveys of many of the state's municipal and rural domestic water systems, by a questionnaire sent to farmers, stockmen, ranchers, and irrigation company officials throughout the state, and from information given by water users in Salt Lake County. Survey results were used to examine drought effects in different regions of the state with respect to size of the municipal supply system.

To obtain a copy of the publication, please request Water Resources Planning Series UWRL/P-80/08. Price is $4.00.

NEWS NOTES

Utah Water Research Laboratory editor, Donna H. Falkenberg, and husband Oliver welcomed a baby boy on March 19, 1981. He is greeted by two sisters. Congratulations Donna!

Dennis B. George has been practicing his southern Texas drawl prior to leaving UWRL to accept a position in Lubbock, Texas. Utah's loss, but we wish him success.

Colorado River Researchers Need To Exchange Notes

Dean Adams and Vince Lamarre are seeking money to pay for a conference to bring researchers together so they can compare and exchange scientific findings on the effects of land and water uses on the aquatic ecosystems of the Colorado River. It is hoped the conference can be held in November of 1981 in Las Vegas, Nevada.

Western States Water Council Makes Staff Changes

D. Craig Bell recently replaced Jack Barnett as executive director of the Western States Water Council, and Bell will soon announce an engineer addition to his staff. This reorganization is to facilitate the function of the Council in serving the water administrators of 12 western states by keeping them informed on water facts and issues. The Council addresses issues concerning water resource allocation and management and monitors proposed federal legislation.

Utah Center for Water Resources Research
Utah Water Research Laboratory
UMC 82, Utah State University
Logan, Utah 84322
They’ve Looked At Clouds From All Sides Now

By John Flannery

Ever sit outside and watch fleecy white clouds drift overhead, then across the mountains and out of sight?

Ever wonder what was going on inside those clouds—why some brought rain or snow and others didn’t?

Dr. Geoffrey E. Hill, a Utah Water Research Laboratory meteorologist, watched clouds a lot when he was a kid. His early curiosity about nature became focused on weather after an enormous hurricane wreaked its devastation.

Today, Dr. Hill heads the UWRL weather modification group which has recently completed a season of collecting information concerning clouds moving through Utah. The purpose is to evaluate the effectiveness of Utah’s state cloud seeding program. The USU research program is currently funded by a $422,000 NOAA contract.

“We want to learn what kinds of clouds under what conditions will yield precipitation by seeding, and how to seed effectively,” Hill says. “The data collected this season should give us a number of answers needed to achieve those two goals.”

To assist the UWRL team a venerable pre-World War II twin engine bomber was provided by the University of Washington, under subcontract. Its sensing equipment has entered the clouds of Cape Canaveral after rocket launches, felt the volcanic dust of Mt. St. Helens and several Alaskan volcanoes, and made measurements inside fluffy clouds over France.

From January through March, seven UWRL researchers were based at Beaver, Utah, with equipment they designed, built, or adapted to make specific measurements of the clouds moving over their site. Making Beaver their

UWRL team had two trailers equipped with radars, a balloon tracking device which receives signals sent from equipment carried aloft by weather balloons, and radio equipment for communications with the aircraft and other sites. High on a mountain near Mt. Holly Ski Area, was another research trailer, accessible only by snowmobile. Inside, two pieces of highly specialized equipment added to the story of what happens when clouds are seeded.

As clouds passed over the trailer, a newly developed radiometer provided continuous readings of vapor and liquid water. A computer in the trailer then calculated and recorded the amounts of each. The amount of liquid water passing over is a direct measurement of the potential for increasing precipitation by seeding.

At the other end of the trailer, an ice nuclei detector sampled and recorded the number of silver iodide crystals in the outside atmosphere.

When a storm moved toward the Tushar Mountains east of Beaver, the B-23 was “scrambled” from its St. George base and headed into the storm. At the Beaver site and at Mt. Holly, Dr. Hill and his staff operated their equipment and launched balloons with sensing packages to transmit data on temperature, humidity, pressure, and wind. In addition, a new device created by the UWRL researchers was added. It was a vibrating wire whose natural frequency changes according to the mass of ice accumulated when supercooled liquid water touches the wire. By monitoring the natural frequency the concentration of liquid water can be determined. This measurement provides another look at the critical ingredient for increasing precipitation.

Along with the aircraft measurements and the work on the ground, the re(continued on page 3)
A Needed Federal Role In Water Research Funding

By
L. Douglas James

For over 15 years, the Office of Water Research and Technology has had the central coordinating role that has reduced duplication and increased productivity within a nationwide collaborative federal-university program of water resources research. Through funding which covered about 30 percent of the total national cost, OWRT was able to coordinate state efforts, identify regional and national research priorities, and provide supplemental funding for research in the national interest. As examples, problems were found in one state where the most qualified researcher was found else-

where; research completed in one state was more quickly transferred to applications in others.

Should the plan of the Department of the Interior come to pass, this program will end by September.

National water resources research will suffer a major blow. Scattered efforts will continue because water supply, water management, and water quality problems will continue. But the research will cost more because the central coordinating mechanism on which university and governmental scientists depended for problem identification and information exchange will be gone.

In the long run, water problems will become more severe. Today's research reduces tomorrow's cost. Today's research provides tomorrow's productivity; the one real basis for overcoming inflation. And yet today we see research being cut in the name of cutting budgets and reducing inflation. Tomorrow we will all pay in higher cost for water and for water quality protection. Costs that will be passed on to consumers and raise prices for everyone.

This concern for the future does not mean that the present national problems with the federal budget and with inflation should be forgotten and research funding increased. Another alternative exists. Large amounts of money are budgeted federally to water development, management, and quality protection agencies. These agencies specifically can expect their program costs to increase without continuing research support. A relatively small amount of money ($20 million) taken from these programs and dedicated to research would restore the federal coordinating focus.

This has been recommended by the Senate Committee on Environment and Public Works (Congressional Record, March 31, 1981, p. S3073), and used as a basis for the Water Resources Planning Act of 1981 as proposed in Senate Bill 1095. The idea is a good one. We hope you agree, but remember that silent concerns are never heard.

Great Salt Lake Update Completed

A report "Update on Estimation of Water Surface Elevation Probabilities for the Great Salt Lake" has been completed by L. Douglas James, David S. Bowles, W. Robert James, and Ronald V. Canfield.

The process for estimating the probabilities of Great Salt Lake levels rising or falling to selected elevations of interest needed data refinement and methodological checking before making specific year-by-year estimates. The purpose of this project was to provide that refinement as a basis for regular lake level estimation. Simulations were used to compare alternative multivariate ARMA processes for flow generation.

The report will be followed by an annual publication of curves showing the probability distribution of annual peak water surface elevation in the Great Salt Lake that can be expected year by year up to a maximum of 35 years into the future, given the high water surface elevation of the current year. In 1980, the known high was 4200.45 feet msl. The further you go into the future, the greater the spread of probable levels. In 2015, the most likely level is 4195.2, but there is one chance in 100 that the level could be as high as 4205.21 or as low as 4185.2.

The update curves will be published shortly after July 1 of each year for distribution to those involved in managing lake shore businesses or property or who are otherwise interested in the lake.

To obtain a copy of the report please request Water Resources Planning Series UWRL/P-81/01. Cost is $2.00. Copies of the one-sheet annual forecast update are free.

Call For Papers
(And Sponsors)

The time has been set—the place has been designated—now all that is left is to get a program! That's what Dean Adams and Vince Lamarra are trying to do now.

Invitations have been sent, and the call is being made for papers to be presented at Las Vegas, Nevada, next November 16 to 19 related to "Aquatic Resources Management of the Colorado River Ecosystem." The symposium is to be a forum to exchange information on the effects of energy development, reservoir regulation, land use and basin development, and water transfers between basins on the aquatic resources of the river. The information exchanged will help in protecting the river as development occurs.

The symposium is being sponsored by the Utah Water Research Laboratory and the Office of Water Research and Technology. Additional sponsors would also be welcomed.

If you are interested in giving a paper at this symposium or in co-sponsoring this opportunity to exchange information on protecting the river environment write to Dean Adams, UMC 82, Utah State University, Logan, Utah 84322.
Clouds From All Sides
(continued from page 1)

searchers made use of Federal Aviation Administration (FAA) aircraft icing reports to obtain a better picture of what happens in Utah skies.

While it is difficult to affix a price tag to a snowlake artificially produced and deposited on the Intermountain Region, there are ways to look at economic values.

Increasing the snowpack or available irrigation water could mean increased acreage under production in Utah, or water at prices which agriculturists can afford. With rising demand for water, including new and unanticipated demands like those of MX, power projects and slurry plants, certainly the UWRL research is highly important to the future of the Beehive State. Dr. Hill believes there is indeed a potential for increasing the snowpack in the Utah mountains by cloud seeding. Yet he cautions the science of weather modification is complex, and it will require advanced technology and innovation in order to realize the potential benefits.

Water Leader Dies

Ernest Oliver “Ole” Larsen, 86, former regional director of the Bureau of Reclamation died April 2, 1981, of a heart attack.

A native Utahn, Mr. Larsen attended Utah State University and graduated in 1918 with a bachelor’s degree in irrigation and drainage engineering. He later returned to get his master’s degree in civil engineering.

His professional career began with the Department of Agriculture in 1918, and in 1938 he joined the Bureau of Reclamation. He directed studies of the Hyrum, Ogden River, Moon Lake, Sanpete and Provo River projects and he was chief engineer for several of the works.

He was appointed director of Region 4 in 1943 and in that position guided many projects important to the expanding economy of the area. The Colorado River storage project was initiated under his direction and included the Flaming Gorge and Lake Powell dams.

He received many honors for his contribution in water engineering including an honorary doctorate degree at Utah State University which also awarded him the USU distinguished service award.

Demands Studied At Recreation Sites

A report on “Water Demand at Recreation Development” has been completed by Simon Lam and Trevor C. Hughes.

State regulatory agencies are faced with selecting appropriate design criteria for sizing systems delivering water to recreation developments. Water use patterns set the peak use rates that determine pipeline size, and the patterns at recreation sites (both individual summer homes and multiple unit condominiums) are quite different than those in conventional residential areas. In order to have pipelines large enough to maintain flows during peak demand periods but not so large as to be unnecessarily costly, engineers need specific quantitative information on water use patterns.

This study sought to help state regulatory agencies and design engineers by defining reasonable flow rate standards for drinking water systems at various types of recreation developments. The study gathered and analyzed both historic water use measurements and additional daily and instantaneous measurements during peak seasons at 11 Utah and one Wyoming development. These included single family residence mountain cabins, resort condominiums (both summer and winter), marinas with overnight camping facilities, and recreation vehicle campgrounds.

The measurements estimated water use for average, peak month, peak day, and instantaneous events. These results were compared with the existing design criteria of the Utah Division of Environmental Health and used to suggest some changes of state minimum design standards.

 Copies of the report may be obtained by requesting Water Resources Planning Series UWRL/P-80/05. Cost is $5.00.

Report Completed On Fielding Pipeline

Almost immediately after being put into operation, the Fielding Ditch Company Pipeline in Northern Utah began to experience repeated structural failures.

Because of these failures, the Soil Conservation Service, which had constructed the pipeline and was responsible to make sure that the system was hydraulically and structurally sound before turning it over to the local farmers, entered into a cooperative agreement with the UWRL to analyze the hydraulic transients that might arise in the normal operation of this pipeline and determine whether these high pressures associated with opening and closing gates could be the cause of the failures.

The results are given in a report “Fielding Ditch Pipeline Computer Simulation Study” by Calvin G. Clyde, J. Paul Tullis, and Roland W. Jeppson.

The study began with a program of measurements to determine the characteristics of hydraulic transients in the pipeline. These field data provide the basis for the analysis and a means of verifying the computer model. The report continues with a description of the pipeline, a discussion of the principles and concepts of unsteady flow, the methods of solving the equations of flow, the field verification data collection program, the various computer models that were developed during the study, and the suggested modifications to protect the pipeline from further damage.

Hydraulic transients were found to be the problem and the recommended pipeline modification was to install pressure relief standpipes at selected interior turnout locations. The study showed that this would provide the required pressure surge protection while limiting the spillage at the standpipes to an acceptable amount.

Copies of the report are available for $2.00. Please request Hydraulics and Hydrology Series UWRL/H-81/01.

NEWS NOTES

Frank Dupree, Administrative Assistant at UWRL, is moving to the Contracts and Grants Office on the main campus where he will be a Contracts Specialist. We wish him well in his new endeavors.

Connie Wengreen has joined UWRL staff as a secretary.

V. Dean Adams and wife Joyce welcomed a new son to their family May 8. Congratulations!
New Research In Progress

Precipitation In Droughts

Everyone knows that a drought occurs when there is no precipitation. Long droughts, however, are interspersed with storm events. The drought is less severe if the precipitation during those events can be increased. Hence the title of a research project in which the UWRL is a participant.

Funding for the study comes from the U.S. Bureau of Reclamation to the Utah Division of Water Resources. Under the guidance of Paul Summers, specific tasks are assigned.

The project's purpose is to learn more about the effects of cloud seeding on water supply and to discover techniques of utilizing cloud seeding more effectively to reduce the damage of droughts. Four tasks will be accomplished as Utah's portion of a regional study. The first task to be done by Arlo Richardson and Kenneth Hubbard of the Utah Office of Climatology is to collect and analyze climatic data needed by the other researchers.

In conjunction with this, David Bowles of the UWRL will study the effects of weather modification on several storage reservoirs in Utah and attempt to provide an early warning system to modify reservoir operation to accommodate pending drought conditions.

Other USU researchers, Herbert Fullerton and Terrence Glover will be determining the economic benefit to be derived from cloud seeding. The North American Weather Consultants will design a standby seeding program to be ready when conditions are right so that storm situations occurring during a dry period might be made to yield some additional precipitation.

Clean Lake Study

The Bear River Regional Commission has contracted with the UWRL to make a comprehensive study of Bear Lake in Utah and Idaho. Under the direction of Vincent Lamanna and Dean Adams, the project will develop limnological, morphological, demographic, and socioeconomic profiles of the lake. The profiles will provide the basis for a diagnostic study to identify existing and future pollution problems in the lake. When these are known, a feasibility study will search out the most cost-effective method to solve the water quality problems and keep Bear Lake an attractive and wholesome resource.

Testing Erosion Inhibitors

The UWRL rainfall simulator will be used again to test erosion control materials, but this time the force of wind will be added. Earl Israelson is directing the project for Conwed Corporation, a manufacturer of erosion inhibitors. This will be the first time wind has been simulated along with rainfall, a capability demonstrating the versatility of the facility.

Immediate Effects Of OWRT Budget Cuts Felt

Three specific projects at the Utah Water Research Laboratory will end in September because of a loss of $115,000 in Office of Water Research and Technology (OWRT) funding to Utah. These are part of the annual federal-state cooperative program.

The three lost projects are:

1. A project led by Roland Jeppson to define the hazards from flash floods and mud flows coming from canyons onto lowlands. The project has particular importance for urban areas in the path of potential flash floods.

2. A project to assess the effect of drought on water supply with the transfer of water from agricultural use to industrial and urban uses conducted by Ranges Narayanan and David S. Bowles. The project would specifically examine what should be done to protect streamflow patterns, fishing, recreation, water quality, and aesthetics as waters move from agriculture to energy development and other new water uses.

3. A study by Jay Messer and Dean Adams of the movement of toxic heavy metals and cancer-carrying organisms out of soil banks and other disposal areas from refining of oil shale and tar sands. It seeks to determine the rate of movement, changes that affect toxicity and the threat to health, fishing, and the ecosystem of streams.
Colorado River Ecosystem Symposium Topic

The "1981 Symposium on the Aquatic Resources Management of the Colorado River Ecosystem" will be held November 16-19, 1981, at Las Vegas, Nevada, under sponsorship of the Utah Water Research Laboratory and the Office of Water Research and Technology.

As all of us from the West know, the Colorado River is a primary water source for our arid section of the country. The Bureau of Reclamation can be proud of its leadership role in river management through the construction of storage reservoirs and other facilities that have supplied water needs of millions of people.

These manifold benefits have, however, brought major changes to the aquatic environment of the river and we are only beginning to understand the physical, chemical, and biological processes at work and how they are affected by river management. This symposium is planned to aid in this understanding.

Although many papers have already been accepted for presentation, if you still have a paper that you would like to have considered please contact V. Dean Adams at UWRL as soon as possible.

The symposium is intended to bring scientists working on many aspects of the river environment (salinity, algae, fish, endangered species, etc.) together to exchange information. Professionals in industry, local, state, and federal agencies, consulting firms, universities, and water users will interact in determining what can be done to do a better job of managing aquatic resources of the Colorado River.

The sources of impact examined will include: 1) energy resource developments and new energy use technologies; 2) major reservoirs; 3) interbasin water transfers with their associated legal aspects and potential impacts on water (continued on page 4)

A UWRL Service

Research Facilities Used For Testing

Visitors to the Utah Water Research Laboratory are usually impressed by the spaciousness of the building, the abundant water supply for hydraulic experiments, the pipes, and valves, machinery and gadgets, tools, fancy instruments, and shining glassware. The facilities to do research are impressive!

The results of research are also impressive, but there are times between projects when the facilities are not used for research. It is during these times that the facilities and technical staff who operate them are available to serve the public with testing services.

At the present time these testing ser-

Bishop Named Assoc. Director

A. Bruce Bishop has returned to the UWRL as Associate Director, replacing Frederick J. Post who is on sabbatical. For the past 3½ years Dr. Bishop has been Executive Director of the New York State Energy Research and Development Authority in Albany, N.Y.

At the Authority, Dr. Bishop directed a research program with an annual budget of a million $, and a staff of scientists, engineers and economists who managed over 100 different research projects. The research program, especially aimed at reducing New York State's heavy dependence on imported energy sources, included the development of renewable energy sources, such as solar, wind, fuel from biomass and solid wastes, and an aggressive program to rehabilitate or develop some 1,500 small sites to produce hydro-power. The Authority program also pursued development of technologies for more efficient energy use in power generation and in the residential, commercial, industrial, and transportation sectors.

Water Quality Analysis

The water quality laboratory is certified with the State of Utah and the Environmental Protection Agency. It is housed in a new modern addition to the Main Laboratory and has the latest available testing equipment. A competent staff uses these facilities to provide water quality analysis for research projects but can also use them to examine water samples for individuals or agencies. Water samples can be tested for as many as 60 chemical and 10 bacteriological parameters. If you want to know if your (continued on page 2)
Research Facilities Used For Testing -- A UWRL Service

(continued from page 1)
drinking water is safe, this is the place to come.

The lab is under the general direction of V. Dean Adams with Mary Pitts and Albert J. Seierstad providing necessary support.

Rainfall Simulator

Questions ranging from how well a product performs in preventing erosion to how far one can see at night through a heavy rain can be answered without going out in the rain to find out. The 400-square-foot rainfall simulator at the Utah Water Research Laboratory is one of the few facilities in the world that can provide controlled uniform (or spatially variable) rainfall over a wide range of intensities inside a laboratory. Constructed initially for measurement of rainfall-runoff characteristics on highway slopes so that adequate design methods could be formulated to size the inlet structures to drainage systems on interstate highways, the simulator has since been used to test the reflectivity of safety clothing worn by highway workers during rainstorms, to test the reflective coatings on license plates and highway markers during nighttime storms, and to evaluate the effectiveness of various erosion control measures.

A tilting flume located beneath the simulator can be filled with soil, or soil planted to crops, or soil covered with erosion control products, and raised upon to test the erosion resistance of the soil, or the effectiveness of the control product to prevent erosion and to foster plant growth. Erosion control products have been tested for various manufacturers on slope angles up to nearly 45°. If you have a product that needs to be tested in a good rainstorm, come to the UWRL. Each client’s results are treated as proprietary information so comparative results are not available.

The man in charge of this testing activity is C. Earl Israelson who has help from other staff members as needed.

New Project Puts River In A Greenhouse

With funds released by Congress toward the end of the fiscal year, CWRT awarded a research grant to the UWRL to study the “Effects of Organic Ligand Complexation on Heavy Metal Bioaccumulation in Crops, Soils, and Stream Benthic Communities Subject to Runoff Contaminated by Spent Oil Shale Leachate.” That title alone seems worthy of further study. To find out what it means, Aquarius went to Dr. Jay Messer, project leader.

The problem begins when the shales of eastern Utah, which are rich in oil, are heated until the oil runs out and then discarded. One can envision huge piles of “spent” shale lying in the sun waiting to be rained upon. The rain water and water from melting snows would percolate through the shale pile and eventually reach surface streams or underground water supplies. These percolating waters could carry all kinds of soluble pollutants from the shale pile.

What one envisions and what actually happens may not be the same. There are many unknowns about what takes place as the water moves through the shale. It is some of these unknowns that Messer and his colleagues hope to discover with the aid of the new grant.

Messer says that there are organic molecules which “complex,” that is they link themselves with other molecules, including molecules of heavy metals, and then become soluble in water and move with the stream. Studies have shown that heavy metals such as lead, cadmium, mercury, iron, and copper, move more rapidly from a source such as shale than would be predicted from normal solubility of the metal. This “organic ligand complexation” is the reason.

“Whatever we don’t know,” Messer said, “is if these metals are available to stream biota, whether they are absorbed to stream sediments—broken down by organic molecules—and then released, or whether they are oxidized by light from the sun.” Messer is also concerned with whether these compounds, if allowed to enter irrigation water, would be taken up by the crops or whether they would interfere with the normal fertility of the soil.

To get answers to the questions, Messer will build a greenhouse as an addition to the present UWRL facility and run streams of river water through it under precisely controlled conditions. This river water will be dosed with metal-organic compounds and the dose traced through the stream to determine the final fate of the complex. He will look for changes in algae, insects, and bacteria as the metals move. Messer will also do experiments with potted plants to determine uptake of metals by crops.

Calcium Carbonate Topic Of Report

A project report “Calcium Carbonate Precipitation as Influenced by Stream Primary Production” has been completed by Gretchen L. Rupp and V. Dean Adams.

In this project laboratory and field studies investigating the environment of calcium carbonate precipitation in hardwater streams were carried out for the Logan River. The objective was to assess the importance of a particular biological reaction, the photosynthesis, to calcium carbonate precipitation. The result was that biogenic calcium carbonate precipitation was found to be very important.

The Logan River experiments found that the biological induction of calcium carbonate precipitation was not correlated with water nutrient level. It did, however, vary with temperature, increasing to a maximum at 10°C, and decreasing with increasing velocity. The results suggest that biological activity has its greatest influence in the high-altitude, first and second-order tributaries to the river and declines in the downstream direction.

The results of this study suggest that diversions or other water use patterns that alter the flow regimes of western streams may affect the periphyton impact streamwater chemistry. The beginnings are made for future quantitative assessment of the consequences for stream water quality.

To order the publication, request Water Quality Series UWRL/Q-81/02. Cost is $3.00.

Aquarius

a newsletter for the
Utah Center for Water Resources Research
Utah Water Research Laboratory
Utah State University

L. Douglas James ............ director
Frank W. Haws ............... editor
Donna Falkenberg ............ editor

We invite you to submit your news items for inclusion in the Aquarius Newsletter. The letter will be sent free of charge to those requesting it.

Utah State University is an equal opportunity employer. All programs are available to everyone regardless of race, color, religion, sex, age, or national origin.
NEWS NOTES

Frederick J. Post, associate director at UWRL and professor in the Biology Department, is on sabbatical leave through June 30, 1982. He is working with the Roche Research Institute in Marine Pharmacology in New South Wales, Australia.

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Calvin G. Clyde, professor, is on a 3-month sabbatical and is working with EG&G in Idaho Falls.

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I. Wayne Noble, principal electronics technician, UWRL, has joined EG&G in Mercury, Nevada. We wish him success in this new endeavor.

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Mardiynne Matthews is now administrative assistant at UWRL, a move from classified to professional status.

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New additions to the staff include: Christopher J. Duffy, who joins the staff as a research assistant professor. He comes to USU upon completion of his PhD at New Mexico Institute of Mining and Technology, Socorro, New Mexico. His specialties include modeling groundwater flows and quality and related aspects of geohydrology. Vincent Lamarra comes to us from the wildlife science faculty as a research assistant professor working in the water quality area and particularly on lake pollution. Edward P. Fisk is research engineer/geologist working on groundwater studies on a part-time contract. Cathy Richards is a lab aide in water quality.

-0-

Duard Woffinden, senior research engineer, is recovering from a June 20 heart attack. We hope he will be back to work soon. We miss you Duard.

-0-

Mary Ann Nelson, department clerk in water quality, was a June bride, and is now Mary Ann Nielsen. We wish her and husband, Shaun, years of happiness.

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David S. Bowes has joined LAW Engineering Testing Company as the Engineering Manager of their Denver Branch Office.

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Daisy Hughes, wife of Trevor C. Hughes, is recovering from a serious illness. They are in Austria. We wish Daisy a speedy recovery.

Health Related Research Discussed By Officials

Officials from the Utah State Health Department were invited to tour the Utah Water Research Laboratory May 28, 1981, to discuss with UWRL researchers the current projects related to health problems and water. Mr. Jay Pitkin, assistant director of the Bureau of Water Pollution Control; Len Bousfield, assistant director of Public Water Supply; Mervin Reid, director of the Bureau of Sanitation; Wanness Southwick, environmental epidemiologist; and Dennis R. Dalley, assistant director of the Division of Environmental Health talked with UWRL researchers about chlorine and hydrocarbons, trihalomethanes, water pollution from shale and coal, heavy metal transport, carcinogenic organics, virus removal studies, and other related water studies.

Bishop Named (continued from page 1)

Prior to his assignment in New York, Dr. Bishop served as professor in the Civil and Environmental Engineering Department and with the Utah Water Research Laboratory. While at the UWRL he directed numerous multidisciplinary research projects for a variety of funding agencies. His work has combined research with teaching in resources and public work systems, emphasizing system analysis and interdisciplinary planning, including evaluation of the environmental, economic, and social aspects of projects.

Dr. Bishop has engaged in various water and energy related resource research programs. These have included studies in the optimization of energy development and water use, energy efficiency of coal-conversion, pollution control processes, energy development in relation to agricultural production and water use, and impacts on water quality, and aspects of public participation in resource planning and management.

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Ken Hubbard, research scientist, UWRL, and assistant state climatologist, is leaving USU to be climate resources specialist for the Center for Agricultural Meteorology and Climatology at the University of Nebraska, Lincoln. He will be heading up the State Climatology Program for Nebraska. We wish Ken well.

D.M. Corbett Dies

On a sad note, Don M. Corbett, 81, passed away June 26, in Salt Lake City. Mr. Corbett was a long time supporter of Utah State University. He was a member of the Old Main Society, and in 1975 established a scholarship for women to study engineering at USU. That same year he was awarded the Distinguished Service Award. In May of 1980 the auditorium of the engineering building at USU was dedicated as the Corbett Auditorium in his honor.

Mr. Corbett, a 1923 graduate of USU, joined the U.S. Geological Survey in 1924 as a hydraulic engineer. Over his long career he served in Utah, Alabama, Mass., Texas, Mich., and Indiana. He retired from the Survey 1961 as Chief Hydrologist and earlier this year moved back to Salt Lake City. Don held a position as an adjunct senior research engineer at UWRL and had worked with us on projects related to the hydrologic effects of mining.

Mr. Corbett is survived by his wife, Melba.

Wastewater Filtration Evaluation Completed

Because of increasingly stringent water quality standards for wastewater treatment plant effluents, it is more often becoming necessary to utilize advanced treatment processes to improve the overall performance of wastewater treatment plants.

A report “Evaluation of Wastewater Filtration” by B. L. Bench, E. J. Middlebrooks, D. B. George, and J. H. Reynolds, explains the use of experimental filter columns operated at the Preston, Idaho, Wastewater Treatment Plant to evaluate the effectiveness of four granular media with gravity filtration. The Preston plant is a trickling filter secondary treatment plant that serves about 3600 people. The four filter columns studied were 1) coal-sand-garnet, 2) coal-sand, 3) sand-garnet, and 4) all sand.

The study found that filtration with granular media is not a reliable treatment process for removing soluble biochemical oxygen demand from wastewater. Granular filtration is however, effective in removing suspended solids from wastewater.

Copies of the report are available for $3.00. Please request Water Quality Series UWRL/Q-81/01.
In Pleasant Valley

Shallow Groundwater Pollution Studied

Pollution of shallow groundwater due to wastewater disposal in Pleasant Valley (including the town of Scofield), Utah, was studied from October 1979 through August 1980, and results are presented in a report "Water Quality in Pleasant Valley, Utah" by Calvin G. Clyde, Dennis B. George, Kun Mo Lee, Phil Puecl, and William Hay.

Summer recreation swells Scofield's population of about 35 through the winter to about 70,000 person-days of activity annually. The valley drains into the 66,000 acre-foot Scofield Reservoir. At Scofield, the valley floor is about 1500 feet wide, and the alluvium averages about 7 feet thick. Domestic waters are discharged into septic tanks, holding tanks, and pit privies. Agricultural wastes are spread on the land surface.

The situation is generating concern as to pollution of the groundwater and of the lake and of threats to drinking water safety. The threat is expected to worsen with the growth in population and human activities in Pleasant Valley due to the attractive recreation, summer home, and mining opportunities in the basin.

The investigation focused mainly on shallow groundwater contamination due to domestic and agricultural wastes. Water samples were collected from 23 wells and 5 stream sampling sites. Analyses of these samples revealed a variety of pollution problems at several sites, and suggested potential health hazards for people who depend on the Scofield Reservoir for drinking water. Recommendations are made for preventative measures.

Copies of the report are available for $3.00. Please request Hydraulics and Hydrology Series UWRL/H-81/02.

Model Made Of Salt

The chemical diffusion process whereby salts are carried with sediment particles into streams was examined, modeled, and reported in a publication, "Salt Release from Suspended Sediments: A Simulation Model" by S.R. Peterson, J.J. Jurinak, R.J. Wagener.

The results of the sediment-salt studies provide an approach to estimating how much of the salt load of the Colorado River comes from suspended sediments.

The model constitutes the first comprehensive attempt to quantify and mathematically formulate the variables that affect the release of salt from suspended sediments. It allows insight into the role of sediments as a diffuse source of salinity. The model provides a tool to use in assessing the effectiveness of land management practices on agricultural and natural resource lands as related to erosion control.

Symposium (continued from page 1)

quality; 4) land use and basin development; they affect groundwater and overland flow to the reservoirs and inter-reservoir systems; and 5) collective effects of water and land use practices in the Upper and Lower basins.

For more information about the conference, please contact Dr. Adams or Vincent A. Lamarr at the Utah Water Research Laboratory, UMC 82, Utah State University, Logan, Utah 84322 (phone 801-750-3185).

Release In Streams

and the reduction of the salt loading of the Colorado River and other surface streams. Salt release from both a moderate and a high salinity sediment system was investigated in water of varying chemical quality.

The chemical kinetic model developed simulates the variability of both total salt and individual ion concentrations in solution with time. The model was successfully validated in laboratory studies. The kinetic model was coupled with an equilibrium model which calculated the degrees of saturation which the contacting waters have attained with regard to 15 common salt-bearing minerals found in the Upper Colorado River Basin.

The publication is Research Report 62 of the Utah Agricultural Experiment Station at USU. Copies may be obtained from the UWRL for a $2.00 handling fee. Please request UAES Report 62.
Salt Gradient Solar Ponds
1-Day Conference Planned

A one-day conference on the "Potential of Salt Gradient Solar Ponds in Utah" will be held at the State Capitol in Salt Lake City, November 20, beginning at 8:30 a.m., sponsored by the Solar Pond Development Team (a consortium involving Utah State, the University of Utah, and Weber State) and the Utah Energy Office.

The program will present solar pond development currently underway, such as in Israel and California; describe how solar ponds might provide electrical and industrial energy; summarize active solar pond research at Utah universities; and provide opportunity at the end for inter-

(Continued on page 3)

November Symposium
Aquatic Resources Management

A 1981 Symposium on "The Aquatic Resources Management of the Colorado River Ecosystem" will be held in Las Vegas, Nevada, November 16-18, under sponsorship of Utah Water Research Laboratory and the Office of Water Research and Technology.

Some 45 technical papers will be presented in ten sessions following a keynote session on "Colorado River Management to Meet Water Supply Needs and to Enhance Aquatic Resources" presented by spokesman for the U.S. Bureau of Reclamation and U.S. Fish, Wildlife, and Parks.

Session topics are: Water Policy, Energy Impacts, Lake Mead, Oil Shale Development, two sessions on Reservoirs, Main Streams, Watersheds, Fisheries, and Salinity.

A special luncheon address will be given by James D. Webb, former Deputy Director of U.S. Fish and Wildlife Service, and now an Attorney in Tucson, Arizona, on "Colorado River Politics as a Factor in Aquatic Resource Management."

Phillip L. Fradkin, author of "A River No More, the Colorado River and the

Design Alternatives Tested For
Big Dam Problems In Pakistan

The 480-foot high Tarbela Dam on the upper Indus River in Pakistan has four outlet tunnels to carry the 6.6 million acre-feet of impounded water to users downstream. Two of the tunnels are for power generation; the other two for irrigation. Why waste the power potential of the two irrigation tunnels? Why not divert this water through a power house? The 300 feet of available head would have a power potential of almost 2000 mega watts.

Normally, one would build a power house and begin generating. At Tarbela, however, the technical problems are horrendous. The two outlet tunnels are 43 feet and 36 feet in diameter! The largest carries 25 million gallons per minute! How do you design a system to turn that much flow into a power house?

Well, that answer is easy—you give the problem to Paul Tullis and his staff at the UWRL to test design alternatives through the use of hydraulic models.

"There are a lot of problems associated with turning that much water at that high velocity. You get separation, cavitation, swirling flows, and lots of turbulence," says Tullis. "They may not be able to get the full 25 million gallons per minute (55,000 cfs) that they want; but when we're through, they will get the best design."

When the essential characteristics of the system are preserved in models (in this case 27 times as small as the actual tunnel), the problems can be examined in a laboratory setting, and design solutions can be tried for a relatively low cost. Tullis has been working for several months building the special pipe shapes needed to model the transitions, and there are several modifications to go yet.

Design alternatives are tested for the Tarbela Dam in Pakistan in these hydraulic models at the Utah Water Research Laboratory.
OWRT Situation

The Reagan Administration proposed elimination of funding for the Office of Water Research and Technology (OWRT). However, the House-Senate conference committee has designated $23,650,000 per year for three years for the water resources research and saline water programs currently directed by OWRT.

The way this money is to be used remains an issue. The Senate Committee acting on the Interior Appropriations Bill recommended that $6,210,000 of the $23,650,000 go to the Institutes.

This recommendation was accompanied by a direct statement that research conducted under OWRT should be continued in the new Office of Water Policy with the committee specifying “the state water institutes, water reuse, and conservation, and special research project accounts” for funding.

The House Committee, in contrast, recommended funding for research and development in the field of reuse and for saline water research. The House Bill specifically states that Interior should concentrate on special areas of research “rather than continuing the diffuse program of grants to numerous water research institutes.” The issue will be resolved by a House-Senate conference committee.

Cost Of Instream Water Use Studied

Appropriative water rights as defined in Utah permit a person needing water to purchase what he needs from a prior right holder. The water rights market works in this fashion to shift water over time from lower to higher valued uses.

One concern as these shifts occur is that as more water is consumed and return flows drop in quality, instream flow uses will suffer. Insufficient streamflow will be left to protect fish and wildlife, water quality, and recreational and aesthetic values. Little private capital is invested to purchase water rights to protect these values, and government is often asked to promote and develop them.

How much money would be required? The answer depends on the amount and timing of water needs for these uses, the competition for this water from off-stream uses, and the possibilities for diversion below the primary reaches of instream use. A new project with Bruce Bishop, Ranges Narayan, Jay Bagley, and Dean Larson will study instream uses to determine their needs and the cost of obtaining needed water from the least beneficial off-stream uses. The study will look at the present legal, institutional, and political structures and develop recommendations for providing for worthwhile instream water uses.

‘Common Hazards’

Almost as soon as technology produces new products, they appear as new waste substances in our environment. Often they threaten public health. Others harm the natural environment. Still others may cause initial concern but prove later to be relatively harmless.

These dangers cause new names and terms to appear in the newspaper and be heard on radio and television. As new products, processes, and materials are created and used, they are identified by names that become familiar to the technical and scientific world. These names are often used by the press with little explanation even though they are poorly understood by the public at large. Multiple acronyms and abbreviations complicate the situation.

The editors of Aquarius thought it was time for a glossary of definitions to help the nontechnical world understand what these names and terms mean.

The fifth special issue of Aquarius is now off the press and ready for distribution. This issue defines in popular language terms related to common hazards and other things in our environment. Its title is “Common Hazards and Other Things—A Glossary of Terms” and may be ordered from UWRL for $1.50. Please request Aquarius Special Issue No. 5.

Water Research Needs Outlined In Publication

Last year OWRT requested the water research centers to inventory state water resources and water supply needs to identify water management problems and develop research programs that would contribute to solving those problems.

The hope was that the exercise would provide a logical framework for identifying, prioritizing, and planning water resources research. While the federal government has turned from following through with this process, the exercise was completed for Utah.

“We hope that it will help us do a better job of research management,” said Dr. Messer, one of the authors of the report entitled, “Water Resources Research Goals and Objectives for Utah FY 1982” by L. Douglas James and Jay J. Messer.

To obtain a copy of this report, please request UWRL/G-81/01. There is no charge, but there is an invitation to send in your ideas on research needs.

What To Do When The Floods Come

Few present residents of the Wasatch Front (from Brigham City to Provo) remember the mudflows of the late 1920s and early 1930s that crossed the highway near Willard, Utah. After 50 years, huge boulders still stand as monuments in the front yards of near-buried homes. Few now realize that water rushed off the slope above North Salt Lake many years ago, cut deep gullies, and deposited thousands of tons of material. But those who had to bail out basements and renew landscapes from recent flooding in Salt Lake County know that Utah does have a flood hazard.

A new project funded this year will enable Douglas James, Daniel Hoggan, and Eugene Israelson to review these events in history, and to determine from a study of the hydrology, topography, climatology, and cultural geography of the area, where the high risk places are and what can be done to mitigate (to make less harsh) the damage that might occur in future events.

Water coming out of the canyons and moving across the alluvial fans, before man's intervention, infiltrated into the ground and caused no damage. Man's occupation of the alluvial fans has reduced infiltration, diverted the flood flows (by means of roads, ditches and canals), and made flood risk delineation a complex and difficult job. The means of mitigating damages are not easy or inexpensive, but this study should contribute greatly to understanding the problem.

Aquarius

A newsletter for the Utah Center for Water Resources Research
Utah Water Research Laboratory
Utah State University

Utah State University is an equal opportunity employer. All programs are available to everyone regardless of race, color, religion, sex, age, or national origin.
NEWS NOTES

Research Project

Fingerprints To Foil Polluters

All that comes out of an oil well is not oil. The crude is mixed with and must be separated from groundwater before being sent to the refinery. The water that remains contains large amounts of dissolved solids and organic pollutants. The usual practice is to store this water in holding reservoirs where evaporation concentrates the salts. At some point, the brine must be hauled away and dumped into approved disposal areas which are safely isolated from ground and surface water sources.

Edward P. Fisk, a geologist-researcher at the Utah Water Research Laboratory, in a recent study (see article in next column) looked for sources of shallow groundwater contamination in eastern Utah. Fisk discovered that salt brines were being illegally dumped, that these dumps were contaminating the groundwater, and that there was no way to prove where they were coming from. This “midnight dumping” may save certain well operators money, but can make polluted groundwater unusable for culinary and irrigation uses.

Tracking down the sources is almost impossible, because the brine from all oil wells looks alike, right? Not so, says UWRRL researcher Jay Messer. It may be possible to “look” at brine extracts with an infrared spectroscope and detect a “fingerprint” which is characteristic of only one brine source. The fingerprint is really a graph of the amount of infrared energy absorbed by the brine in 21 different wavelength bands seen by the spectroscope.

Messer, with Fisk and Calvin Clyde, are now investigating such fingerprinting to see if it is possible to identify brines by this method. If so, the illegal spills could be traced back to the operators so that justice could take its course.

“If the fingerprinting doesn’t work, it may be possible to tag the brines with physical or chemical agents,” said Messer. “Our overall goal is to be able to trace illegal dumps back to their source.”

Hazards Found In Shallow Groundwater

“A Survey and Evaluation of Shallow Groundwater Contamination Hazards in the State of Utah” has been completed as a report by Edward P. Fisk and Calvin G. Clyde.

The survey was made to appraise current man-made contamination of shallow groundwater in Utah. The few published sources were used, but most of the information in the report was obtained by personal observation and through interviews of individuals concerned with water quality protection in Utah.

After presenting the relevant physiographic, geologic, and hydrologic characteristics of the various regions of Utah and discussing how these relate to groundwater contamination in general, representative groundwater quality hazards at 32 sites in Utah are presented. A wide range of hazards to groundwater quality was found and they should be watched for an effective shallow groundwater pollution control program.

The survey indicated shallow aquifers with the largest amounts of deleterious contaminants underlie cities and towns. Agricultural areas generate greater quantities of dissolved salts and possibly other contaminants, but the contamination is spread over considerably larger areas and thus is more dilute. Improper disposal of oil field brines is a serious problem in the state. Leaking disposal ponds, mining operations, and poorly managed solid waste dumps are serious hazards locally. Septic and other wastes from recreational activities are a small but increasing hazard.

To obtain a copy of the report, please request Hydraulics and Hydrology Series Report UWRRL/H-81/04. Cost is $3.00.

Obituaries

Noted hydrologist Ven Te Chow passed away in July. Dr. Chow was a professor of hydraulic engineering at the University of Illinois. He was an internationally recognized leader in the fields of hydrology and hydraulic engineering through his many years’ experience as a teacher, engineer, researcher, writer, lecturer, and consultant.

We also note with sadness the death in August of Murray B. McPherson who is remembered for his leadership in spearheading the American Society of Civil Engineers Urban Water Resources Program.
Irrigation Technologies And Their Impacts Reported

When a farmer expands his irrigated acreage and increases his profits through decreased consumptive use, downstream irrigators may see a consequent reduction in return flows, less water available to them and a violation of their water rights. On the other hand, upstream irrigators who install new sprinkler systems may reduce evapotranspiration losses from nonproductive vegetation and should be allowed to use the water saved.

What are water rights administrators to do? They have a responsibility to both users. They need to protect downstream water rights. In doing so, the policies should not deny those upstream who install new sprinkler systems the right to any water they really save from wasteful consumptive use. Perhaps they should not deny applications which benefit upstream users more than they harm those downstream, and estimation of downstream effects requires information on how downstream uses will change.

T. R. Fricke and Rangesan Narayanan have investigated this problem and report on it in a publication "Economic Impacts of Irrigation Technologies in the Sevier River Basin."

They developed a linear programming model and used it to evaluate the effect of changes in irrigation technology on cropping patterns and hence consumptive use and return flows to downstream users within the Sevier River Basin. The model was able to provide reasonable replication of the changes in cropping patterns, water use, and in-stream flows that have occurred in the basin. This success generates confidence in the model's ability to estimate the effects of adaptations of new irrigation technology and various basin water management policies on the cropping decisions made by basin farmers. The estimates made provide a valuable tool for equitable water rights administration, even though they are not refined to incorporate hydrologic routing, hydro-salinity effects, optimal irrigation levels, and year-to-year variation in water availability.

To get your copy of the report please request Water Resources Planning Series UWRL/P-81/02. Cost is $3.00.

Colorado River Ecosystem
(Continued from page 1)
within the Colorado River Basin on the river ecosystem and to provide for an exchange of ideas and information on what can be done to improve management to protect the aquatic resources of the Colorado River.

General chairman of the symposium are V. Dean Adams and Vincent Lamarra. They may be contacted for more information on the conference at the Utah Water Research Laboratory, UMC 82, Utah State University, Logan, Utah 84322 (phone 801-750-3185).

Groundwater Heat Pump Brochure #3 Ready

A new brochure "Groundwater Heat Pump: The Interaction of Flow Rate, Aquifer Temperature Changes, and Well Spacing" has been prepared under the Groundwater Resources Program at the UWRL by Calvin G. Clyde and Govindachari V. Madabhushi.

This third brochure in a series on groundwater heat pumps describes design considerations related to possible temperature changes in the aquifer. A groundwater heat pump system normally withdraws water from a production well and returns it to the aquifer through an injection well. The brochure presents spacing requirements between the two and design alternatives for minimizing them.

Copies are available on request.

Great Salt Lake Levels Forecast in 1981 Update

The one page 1981 forecast on Great Salt Lake levels has now been made and is available for distribution to interested persons. The forecast is updated each summer after the spring high to reflect current lake conditions. The analysis employs advanced stochastic hydrology to produce probability curves showing probable high and low levels of Great Salt Lake for future years. Your copy can be had by writing to Douglas James, UWRL-UMC 82, Utah State University, Logan, Utah 84322.
Water Management History To Be Compiled

Attempts to tell the story of water and its role in the development of the West are replete with simplistic statements of how "water is the life blood ..." and "water is this ... or that..." Thoughtful reflection, however, recognizes that the story is not really a water story, but a people story. Water didn't build the West, people did. Water didn't make the desert blossom, people did. It was many sorts of individuals; uneducated, highly trained, arrogant, innocent, greedy, selfish, benevolent, soft spoken, angry, proud, ambitious, hardworking people who put it all together. It was people collectively with their politics, religion, finances, laws, governments, customs, and institutions that fostered decisions and actions to put the water resource to work.

The history of how all this happened and the lessons our past experiences provide in better meeting present needs tend to be forgotten. Perhaps our memory can be improved. A modest effort has begun, and water engineers and historians at the UWRL and USU have high hopes for its continuation and growth. Jay M. Bagley is the force behind this effort and will begin the program by recording "living histories" of men with long involvement in Utah water development and vivid memories of the past; men who are willing to document and preserve their part in history. Other information can be found in the records of men who have passed on. Recently the files of E.O. Larsen, longtime water development leader, were offered to USU. It is hoped that others might also contribute. Anyone with photos, files, diaries, or other documents that could be loaned or donated can help.

Bagley envisions the program "catching on" and for USU to become a center for Water Development History, a multidisciplinary effort of recording water history and interpreting "dry" facts from the past through the understanding found in agriculture, economics, engineering, and natural resources; an effort building the understanding required for people to manage our water more effectively in the future.

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New Research

UWRL Contributes to Salinity Study

A treaty between the United States and Mexico obligates the federal government to deliver Colorado River water at the Mexican border without the salt content exceeding certain specified limits. One way to reduce the salt content is to reduce natural and man caused salt loading.

Congress has appropriated money to study and implement ways of reducing salt load coming from manmade activities on many of the upper tributaries. The Bureau of Reclamation was assigned the task of making the studies and implementing their recommendations.

The Price River and the adjacent San Rafael River in Utah are two river basins which contribute significant amounts of salt to the Colorado River system. To find out how much salt and where it is specifically coming from, the Bureau of Reclamation recently contracted with CH2M Hill, a national firm of consulting engineers with headquarters in Oregon, to study the area. The UWRL has been awarded a subcontract with CH2M Hill to assist with the study. The UWRL thus has the opportunity to use its considerable experience in the Price River area in modeling and analysis in search of effective salinity control measures.

Heading the work for UWRL is C. Earl Israelson with assistance from Eugene Israelson, Paul Riley, and Pete Hawkins. Another subcontractor working with CH2M Hill is Vaughn Hansen Associates. Hansen is a USU graduate and the first director of the UWRL. His assistant, George Chadwick, is also a USU graduate and former UWRL employee. USU and the UWRL are further represented by a former student, Bruce Johnson who is the project manager for CH2M Hill.
**Study Concerns**

**How To Measure Salt In Soil**

A little salt in your morning oatmeal can make eating a pleasure, but too much salt and even the cat won't touch it. Too much salt in irrigation water can also be a problem. Many agricultural crops are sensitive to salt. Production can be reduced by irrigation water that is too salty or by the accumulation of salts in the soil. Salinity management is becoming more important as water resources committed to agricultural production become increasingly saline. In fact, the reduction of salt damage to crops, soils, and water is recognized as a national research priority by the U.S. Department of Agriculture.

Effective salinity management requires that the amount of salt in the soil be measured. Quantitative information is required to know whether soil salts are a problem and what is best to do if they are. Existing measurement techniques are cumbersome because the soil has to be disturbed, samples collected and transported to the laboratory, where solutes are prepared and analyzed. No one, in all the years since irrigation began, has devised a practical method of measuring salt in place without disturbing the soil by physically removing a soil sample. A breakthrough providing such a measuring technique would greatly enhance salinity management and agricultural production.

A study proposed by UWRL researcher Duane G. Chadwick may be the beginning of such a breakthrough. Chadwick proposes to build an instrument which will radiate electromagnetic waves into the soil. These waves will induce secondary fields whose magnitude will be proportional to the soil conductivity. Since conductivity is a product of both salinity and water content, Chadwick will also measure the water with a neutron probe. The conductivity and water content measurements can then be used to estimate soil salinity.

It sounds complicated, but Chadwick is known for solving complex electronic problems. He has built devices to telemeter water content of snow, to pump water with solar energy, and to use an instrument to measure the “doneness” of a boiled egg.

**Leachates May Pollute Groundwater**

As part of the copper mining operations in western Salt Lake County, a leaching process is used to recover copper and associated metals from the overburden dumps and sub-commercial portions of the ore body. Water, percolated down through these materials, oxidizes pyrite to form sulfuric acid, which then removes metallic minerals. Copper and other metals are recovered from the acidic waters drained from these areas. However, not all of these waters are captured. Some are known to have entered the shallow groundwater and moved into the west side of Salt Lake Valley.

Local water management agencies in Salt Lake County and the U.S. Geological Survey are embarking on an extensive study to delineate the extent of this problem. A coordinated effort directed by Calvin G. Clyde will help assess the present hazard to groundwater quality and the future impact upon the subsurface environment. Remedial action may be suggested to alleviate the hazards to downstream groundwater users.

**Protection Of Recharge Areas Studied**

Rapid urbanization can create a variety of problems associated with water. As land is occupied with buildings, paved streets, and parking lots, surface drainage networks used to carry away storm water reduce the opportunity for water to infiltrate into the soil and replenish the groundwater supply. Instead of recharging the groundwater basin, the water runs into surface streams, bypassing the base of the mountains in much of Utah, to be evaporated in terminal lakes.

The same urbanization increases the demand for the domestic quality water, which can be obtained through greater groundwater development. In order to prevent the growing dependence on groundwater supply from requiring withdrawals that exceed the recharge, areas of potential recharge need to be identified and protected. If critical recharge areas become covered with cultural features, costly artificial recharge or surface storage may be the only substitute.

Recharge areas for some of the major groundwater basins in Utah will be identified under a new study headed by Calvin G. Clyde of the UWRL. After identification, management alternatives will be compared to find those systems which will permit both use and recharge. Both structural and nonstructural alternatives will be considered; and if new legislation is needed, that will also be suggested.

**Groundwater—To Use Or Not To Use**

In Utah, groundwater has been moderately developed in some areas but remains relatively undeveloped in other areas. State water laws and policies govern the extent of groundwater use in the face of an increasing scarcity of surface supplies and growing agricultural and urban demands. Unrestrictive policies encourage greater groundwater extraction and sometimes an excessive mining of the resource. Overly protective policies lead to lesser utilization and sometimes unfulfilled needs.

A new UWRL study headed by A. Bruce Bishop and Rangasan Narayanan will attempt to produce general guidelines for optimal groundwater withdrawal between these two extremes based on economic efficiency principles. Specific quantitative prescriptions will be based on site-specific hydrology. It is hoped that a management decision model can be developed that will aid the state engineer in his administrative control of groundwater basins in Utah.
Groundwater Contamination Report


Many Utah towns are built upon alluvial fans or upon lake deposits along the shoreline of old Lake Bonneville. The objective of the study was to assess the potential impact of man's activities upon groundwater quality within these geologic features. Emphasis was placed on shallow groundwater quality after it was determined that deep groundwater is rarely contaminated at such sites.

A reconnaissance of Utah and Nevada identified and collected field notes on 28 towns built on these features. Four sites underlain by alluvial fans (Willard, Mantle, Elsinore, and Spring City) and four sites underlain by lake shore deposits (Hyde Park, Fielding, Providence, and Richmond) were selected for more detailed geologic, hydrologic and water quality studies.

The data showed that septic effluents, agricultural wastes, and other sources of man-made contamination can be hazards to shallow groundwater quality in alluvial fans and lake shore sediments. Mercury was found in concentrations exceeding the EPA drinking water standards at a few of the sites, but its source was probably natural. Nitrates and phosphates were the most common observable indicators of shallow groundwater contamination at the sites investigated. Coliform bacteria evidently are not transported appreciable distances underground and made poor indicators.

The conclusions reached in the report are believed to be applicable to other areas of the arid west where similar geologic features and basin margin sediments occur. Copies are available for $5.00 each. Please request Hydraulics and Hydrology Series UWRL/H-81/05.

Report Completed On Rotating Contactors

A report on "The Kinetics of Rotating Biological Contactors Treating Domestic Wastewater" has been completed by Abraham Panco, E. J. Middlebrooks, and J. H. Reynolds.

For this study, four four-stage laboratory scale rotating biological contactor (RBC) units were used to develop steady-state kinetic models for the RBC process when treating domestic wastewater. Kinetic constants were determined for COD and ammonia nitrogen removal. The kinetic constants were determined as a function of temperature to provide a rational design approach for the RBC process treating domestic wastewater. Biomass yield, biomass stabilization, and ammonia nitrogen removal were also evaluated.

To obtain a copy of the report, please request Water Quality Series UWRL/Q-81/04. Cost is $4.00.

NEWS NOTES

Cathy Richards has joined the UWRL staff as a lab aid in the water quality area.

We also welcome Ronald Sims to the UWRL staff as a research assistant professor of Civil and Environmental Engineering. He comes here as an environmental engineer just completing his doctoral degree from North Carolina State University, Raleigh, North Carolina.

Does Your Home Water Purifier Really Work?

Logan City used to maintain a sign at Dewitt Spring in Logan Canyon—the source of Logan City's drinking water—which said the water was "98.48% pure." Today, citizens in Logan, and all across America, are asking the question, "is any water pure enough to drink?" A new consciousness of water quality has flooded the nation, and people worry about the long term health hazards of drinking water that isn't absolutely pure. This "mania," if such it is, has created a market for home water purifiers with sales exceeding a million units a year.

The question to be asked now is, "do these units really work?" Manufacturers make convincing claims about their products, but these claims are rarely documented.

So here comes UWRL to the rescue. Alberta Seierstad, research chemist, has a new project to test home purifiers, and she has promised to make the facts available in an extension service publication as soon as all the tests are complete. "Most units," Bert says, "operate by filtration or adsorption; many utilize activated carbon, but the media may consist of silver impregnated carbon, submicron filters, reverse osmosis membranes, ion exchange resins, magnetic devices, or some combination of the above."

Seierstad says different kinds of units will be tested for their ability to remove bacteria, organics (total organic carbons, trihalomethanes), metals, anions, and cations. Since the devices are often installed to reduce or remove offensive odors, tastes, and particulates, these things will also be evaluated.
Report Features

Model Choice in Stochastic Hydrology

The rapid development of stochastic or operational hydrology over the past 10 years has led to the need for comparative analyses of currently available long-term persistence models. A report "Model Choice: An Operational Comparison of Stochastic Streamflow Models for Droughts," by W. Robert James, David S. Bowles, and Nath T. Kottekoda, compares five annual stochastic streamflow generation models on their ability to preserve historical time series properties and annual statistics of the flows recorded on four Utah streams. The models compared are autoregressive, autoregressive-moving-average (ARMA), ARMA-Markov, fast fractional Gaussian noise, and broken line.

A disaggregation model is applied to each of the annual models for each of four study streams at a monthly disaggregation level. The results present the water resources engineer with a choice strategy to select an annual stochastic streamflow model based on values of historic time series' lag-one serial correlations and Hurst coefficient. Procedures are presented for annual and seasonal model parameter estimation, calibration, and application. Techniques to ensure a consistent matrix for successful matrix decomposition are included, and user oriented model parameter estimation techniques that are easy and efficient to use are presented.

The ARMA-Markov and ARMA models are judged to be the best in terms of preserving the short and long-term persistence statistics for the four historic time series studies. The broken line model is judged to be the best in terms of minimizing the economic regret as determined by an agricultural crop production function.

To obtain a copy of the report please request Water Resources Planning Series UWRL/P-81/03. Price is $5.00.

1981 Annual Report

The 1981 Annual Report of the Utah Water Research Laboratory and Center for Water Resources Research, combined with Agricultural and Irrigation Engineering, is now available for distribution.

The report contains the director's report, a sentence outline of each project in the total research program, and an one or two page description of each of the research projects active during fiscal year 1981.

A Summary Annual Report is also available. It contains the sentence descriptions of the active research projects along with the director's report.

Both Summary Annual Report and Annual Report are available from the Utah Center for Water Resources Research, UMC 82, Utah State University, Logan, Utah 84322. There is no charge.

Energy Siting

Because power plants require water and emit air and water pollutants, an evaluation of trade offs among water use, air quality, and economic costs is an important consideration in selecting the best sites for power plants.

As an evaluation tool, a report on "Energy Siting in Utah: A Programming Model" has been completed by Donald L. Snyder, John E. Keith, Terrence F. Glover, and Gene L. Wooldridge.

A linear programming model was developed to determine the optimal allocation of water between agriculture and coal-fired electrical generating entities as well as the trade offs which could occur if electrical generation were increased. Other areas of potential regulation such as coal source and air quality restrictions were also examined.

In the model, few trade offs between electrical power generation and irrigated agriculture were noted. However, substantial changes within the energy sector were predicted should coal capacities and air quality standards be changed. Net revenues declined sharply as air quality control costs increased or coal capacity restrictions were imposed. Substantial changes in regional economic activity and water use would occur as a result of these restrictions.

The report is Water Resources Planning Series UWRL/P-81/04, and is available for $3.00.