

A RIZONA WATER RESOURCES NEWS BULLETIN

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BLACK MESA WATER-HARVESTING EXPERIMENT

With the generous cooperation of Peabody Coal Company, the financial support of the U.S. Bureau of Mines, and the ingenuity of two University of Arizona scientists, surface-mined land on northern Arizona's Black Mesa is being reclaimed using a unique water-harvesting and agriculture technique. Peabody annually mines about 200 acres for coal on Black Mesa to fuel the Mojave and Navajo power generating plants at Bullhead City and Page, Arizona, respectively.

During the past two years, an interdisciplinary water-harvesting "agrisystem" experiment has been conducted by the University of Arizona School of Renewable Natural Resources (SRNR) and Water Resources Research Center (WRRRC) on 30 acres of Peabody's leased land. The agrisystem originally was conceived eight years ago by John L. Thames, SRNR Watershed Management professor, and was designed by C. Brent Cluff, WRRRC associate hydrologist. From April 1978 to September 1980, Matts Myhrman, now a University of Arizona Mine Reclamation Center (MRC) staff member, supervised the project.

The aim of traditional surface-mine reclamation is to return the spoils to the area's original contour, to replace the topsoil and to establish drought-resistant vegetative cover. The water-harvesting approach attempts to optimize the earth-moving process of surface mining by recontouring and reshaping the land to increase and concentrate runoff to augment scarce rainfall for growing crops. Land contours that will give the maximum runoff with minimum erosion are predetermined by computer analysis of surface slope and texture, absorption rates of the soil, precipitation records, and erosion rates. Computer modeling has helped to determine how large a catchment surface is necessary to irrigate each acre planted.

The Black Mesa water-harvesting system consists of two large catchment areas, ditches to convey the harvested rainfall and snowmelt, three ponds for storing water, two level terraces for flood-furrow irrigated agriculture, and a small, combined orchard and catchment (Figure 1).

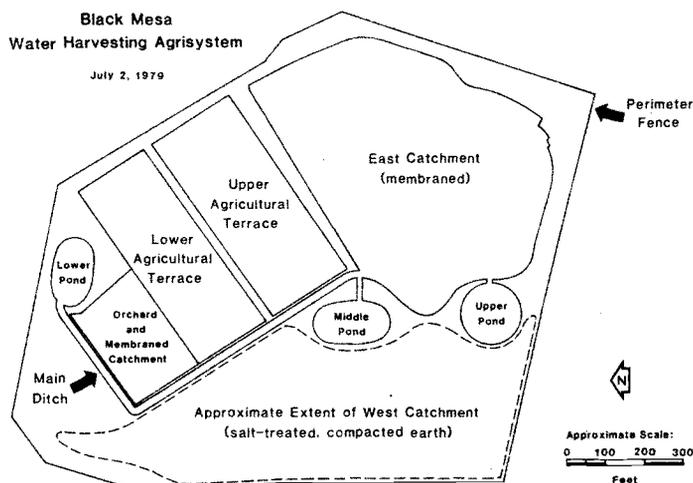


Figure 1. A schematic diagram of the water harvesting agrisystem.

To form one catchment, the spoils were treated with salt (to keep the slopes plant-free and to help harden the surface) and then compacted. That treatment provides a surface that collects about 45 percent of the annual precipitation that falls upon it. The larger of the two catchments also was salt-treated and compacted. A layer of fiberglass gauze then was rolled onto the area and sprayed with hot asphalt. A final layer of rock chips was used to protect the asphalt from the sun. That treatment provides a surface that collects 90 percent to 95 percent of the annual precipitation that falls upon it.

Three storage ponds were scooped out of mine spoils at different elevations. That was done with large earth-moving mining equipment and operators supplied by Peabody. Combined, the storage ponds will hold up to 2.5 million gallons of water. Evaporation from the ponds is reduced by polyurethane rafts that float on the surface of the water (Figure 2).

A floating, solar-powered electric pump transfers water between ponds. Water then can be concentrated in one area to minimize the surface area and to reduce losses by evaporation. Power is delivered to the pump by an innovative device designed by Cluff. A floating, tracking



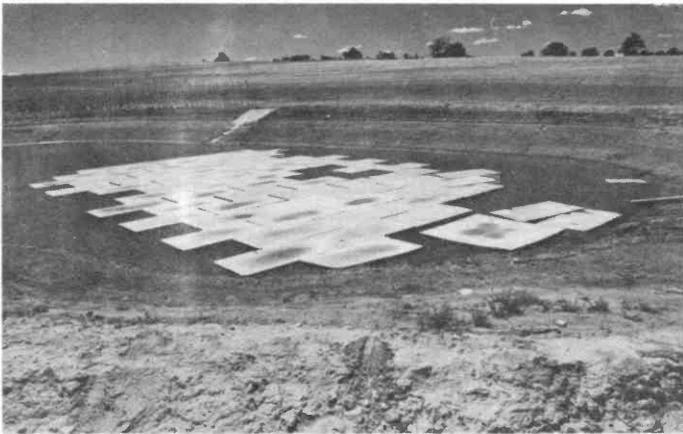


Figure 2. Compartmented pond reservoirs at Black Mesa are outfitted with floating polyurethane rafts to cut evaporation.

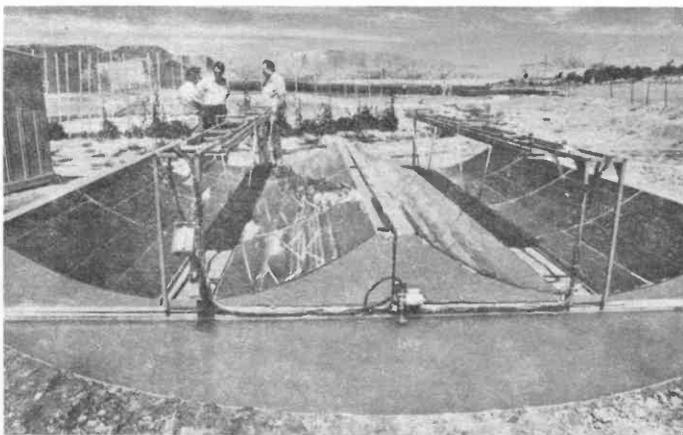


Figure 3. A floating photovoltaic concentrator converts solar radiation to electricity used to operate water-moving pumps.

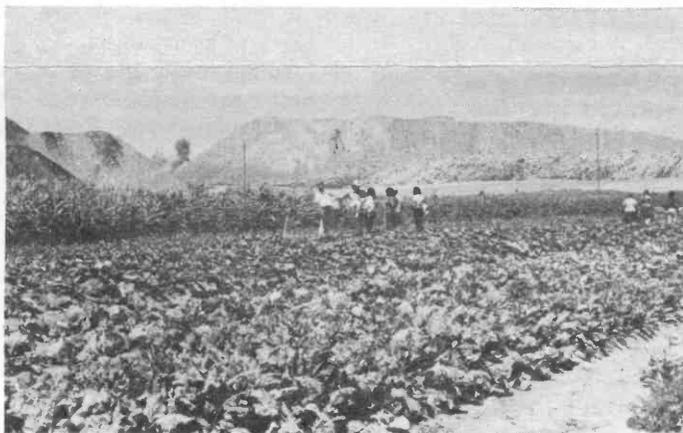


Figure 4. Northern Arizona Indians visit the prototype family farm that produced beets, corn, cabbage, carrots, beans, potatoes and squash.

Photos by Lori Stiles, University of Arizona Information Services.

photovoltaic concentrator converts solar radiation to electrical energy that is stored in batteries. The batteries, in turn, provide the energy to operate the pump motor. (See Figure 3).

Farming activities during the summer of 1980 were supervised by David Powelson, a SRNR graduate student. Oliver Whitehair, a Monument Valley High School vocational agriculture teacher, and several of Whitehair's students assisted Powelson. Vegetables have been produced quite successfully in both spoils and sandy loam that were irrigated with harvested water. Beets, corn and squash have done especially well (See Figure 4). Next summer various soil amendments, used to improve the water infiltration rate and structure of the spoil material, will be tested.

The Black Mesa water-harvesting agrisystem has provided an opportunity to test various strategies for surface treatment; water conservation and production of vegetables, fruit, grains and forage crops using only harvested precipitation and snowmelt runoff; and a basis for examining commercially oriented ventures based on water harvesting. Part of the Black Mesa experiment, a prototype family farm, could help broaden the economic base for Navajo families who now concentrate more heavily on livestock production.

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RESEARCH PROPOSALS SOLICITED

Notice has been received from the Office of Water Research and Technology (OWRT), U.S. Department of the Interior, regarding FY 1982 Matching Grant proposals, according to Sol Resnick, Director of the University of Arizona Water Resources Research Center.

Persons interested in submitting Matching Grant proposals should have nine copies in Director Resnick's office by 5 p.m., January 16, 1981. Instructions, budget forms, and examples of approved Matching Grant proposals are available in that office, and at the offices of Dr. Richard Packard, Provost, Northern Arizona University, Dean C.O. Minor, Northern Arizona University, and Dean H.B. Hunnicutt, Arizona State University.

OWRT's Matching grant program in FY 1982 will be primarily directed toward solving the most critical state and regional water-related problems identified by water experts of the individual states. Five-year plans for water resources research are being developed for Arizona and the Colorado River Basin. The five-year plan for Arizona, which will be available soon at the above listed offices, should be referred to in your research proposal.

The matching fund program will also support research aimed at meeting the nation's future water needs, under the following principal topics:

1. Water Quality Protection
2. Water Shortages
3. Flooding and Storm Runoff Damage
4. Instream Flow Management
5. Barriers to Intergovernmental Water Planning and Management
6. Wetlands Protection

Numbers 1 through 6 are of equal importance.

It is recommended that persons intending to submit a proposal contact Director Resnick at 626-1172 before starting work on it.

An announcement for the Annual Cooperative Program proposals (formerly, Allotment Grant program) should be forthcoming in the near future.

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CONDENSATION

Treated Municipal Wastewater to Cool Palo Verde

The three 1,270-megawatt electric power units at the Palo Verde Nuclear Generating Station about 37 miles southwest of Phoenix will be cooled with treated sewage effluent from the Phoenix metropolitan area.

"Because river and (underground) waters are scarce and mostly needed for agriculture and to meet other Arizona water needs, we sought an alternative source of water," said Edwin E. Van Brunt Jr., Arizona Public Service Company vice president for nuclear projects management.

"Following consultants' recommendation, Palo Verde participants decided that sewage effluent was the best source to meet our large cooling water requirements," Van Brunt added.

Each of the three power units at the Station will require 30 million gallons of water daily to cool condensers during peak operating times. The 91st Avenue Wastewater Treatment Plant in Phoenix processes 90 million gallons of wastewater daily from Phoenix, Mesa, Tempe, Scottsdale, Glendale, Sun City and Youngtown. Effluent will be carried from the Plant to the Station through 36.5 miles of buried pipelines.

New BLM Policy for Small Water Sources

In the U.S. Southwest, water always has been important. The importance generally has been related to the quantity of the water available. In the past, small water sources have not been subject to a water rights policy. These small water sources, while of minor significance in statewide or river basin water resource planning, are vitally important to the users of public land. The benefits of a water rights policy are the allocation of water for many uses and the protection of the water used by Bureau of Land Management (BLM) permittees. Overall administration and allocation of water should be facilitated by clarifying conflicting claims and eliminating disparities over water rights. As the uses of the public lands expand, the need for a water policy increases.

In light of the scarcity of water on public land, the well-worn phrase of controlling land by controlling water still has validity on the public lands today. On the average, there is one water source for every 4,000 acres of public land in the Phoenix District. Thus, water is not only limited in abundance but also in distribution; thereby, water becomes a limiting factor in resource management.

Some public land uses common to the Phoenix District include livestock grazing, wildlife consumption and habitat, mineral extraction and processing, recreation and domestic use. These activities are all dependent on water. The new water policy of protecting and securing water rights in the name of the BLM will secure the use of water resources for our grazing permittees as well as for other resource users.

How is the new policy affecting BLM grazing permittees? In Arizona, BLM has filed application with the State of Arizona under the Stockpond Registration Act of 1974 and the Arizona Water Rights Registration Act of 1974. Even though BLM permittees previously may have filed on waters they use within their allotments, a filing was made routinely on all water on public land to record BLM interest in water on the land it administers. BLM has no intent to interfere with valid existing water rights. When new water filings are made by private parties on public land, BLM has adopted a policy of protesting those filings in order to secure the use of the water for multiple resource management. Implementing the water policy will assure users of public land that water for many purposes will be available now and in the future.

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CALL FOR PAPERS

A joint session of the Arizona Section, American Water Resources Association, and the Hydrology Section, Arizona-Nevada Academy of Science will be held May 1-2, 1981, at the University of Arizona, Tucson. Papers on all aspects of hydrology and water resources are invited. Topics may range from physical systems and analytical techniques, to legal and institutional problems in water resources management.

Abstracts of 200 words or less should be submitted to Gerald Harwood, School of Renewable Natural Resources, 204 Biological Sciences East, University of Arizona, Tucson 85721; telephone, (602) 626-4406. The deadline for submitting abstracts is January 1, 1981. Instructions are available from Harwood or K. J. DeCook, Water Resources Research Center, Douglass Building Room 102, University of Arizona, Tucson 85721; telephone, (602) 626-1009 or 626-2144.

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ANNOUNCEMENTS

Environmental Measurements Short Course

A special Environmental Measurements Short Course will be held at the University of Arizona, January 12-16, 1981, under the direction of Lloyd W. Gay, professor of watershed management in the School of Renewable Natural Resources, and Leo J. Fritschen, professor of forest meteorology, University of Washington, Seattle.

The course will present the basic theory of environmental sensors, emphasizing proper measurement techniques and reporting on methodology and use. Topics include radiation, temperature, humidity and moisture, precipitation, and wind speed and direction. Laboratory exercises make use of available equipment.

The course fee is \$225. It is anticipated that funds for tuition and expenses will be available to a number of advanced graduate students in the environmental and biological sciences. Course participants will receive a copy of the new text *Environmental Instrumentation* (Springer) by Fritschen and Gay. For further information, contact Dr. Gay at the University of Arizona (602-626-2313).

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MEETINGS

December Meetings on State Urban Lands

The Governor's Commission on Arizona Environment is planning a series of meetings to provide the public with an opportunity to discuss the issues concerning the use and disposal of state urban lands.

With the public input from these meetings it is hoped to achieve a fresh look at the recommendations developed by the State Urban Lands Task Force as well as to identify modifications or additions and hopefully to find a new approach to resolving some of the issues that emerged during the last legislative session.

These three meetings will be held Tuesday, December 2, Little America, Flagstaff; Thursday, December 4, Sheraton Pueblo, Tucson; and Saturday, December 6, Sheraton Greenway, Phoenix. Each meeting will be attended by a local panel of experts in the fields of public policy, finance, development, planning and marketing. In a day-long workshop issues will be identified, discussed and, with input from local public, the conclusions reached will be summarized. A statewide panel then will put these summarizations into a final set of recommendations or report.

For reservations and information, please contact Alicia Ray, Executive Director, Governor's Commission on Arizona Environment, 206 S. 17th Ave., Phoenix, Arizona 85007, 261-7803 or 261-7804.

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PUBLICATIONS

The proceedings of the symposium on **Flood Monitoring and Management** co-sponsored by the Arizona Section, American Water Resources Association, are available for \$7 per copy.

The symposium was designed for participants to discuss and disseminate information on the need for flood monitoring and management. Papers were presented by

representatives of federal, state and local governments, the private sector and the general public.

Topics addressed include flood-control problem areas in Arizona, practices and goals for floodplain management in Pima County, flash-flood management problems, Salt River Project emergency storm operations system for the Salt River and Verde River watersheds, early flood warning system for the Tucson Basin, storm-flow management and industrial development, the small watershed program (PL-566), the Golder Dam experience, floodplain management in Sonora, and the Central Arizona Water Control Study.

Copies of the 96-page publication can be ordered from K. J. DeCook, Water Resources Research Center, Douglass Building 102, University of Arizona, Tucson, Arizona 85721.

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Please address your news item or comments on the News Bulletin to any of the editors:

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Dick Haney, Office of Arid Lands Studies, University of Arizona, Tucson, Arizona 85721.