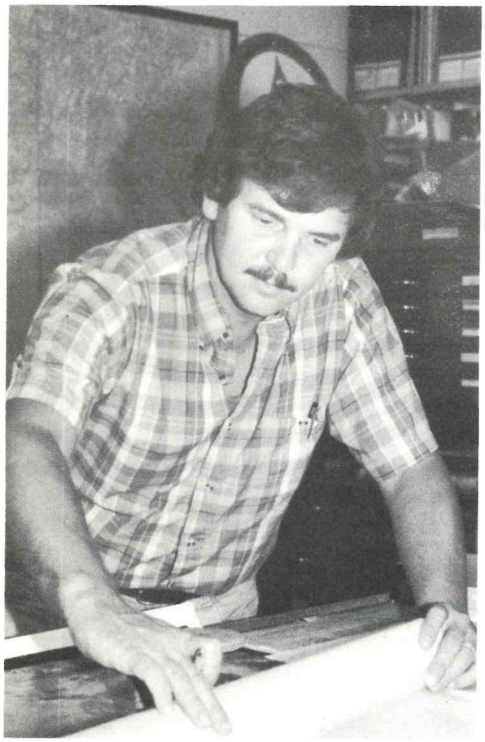
divining rod

Vol. X No. 3 **New Mexico Water Resources Research Institute** August 1987

Shorelines give clues to desert lakes



Stephen Wells

Researchers from New Mexico, Arizona and Colorado are examining the ancient shorelines of California's Lake Mojave for clues to the creation, disappearance and rebirth of desert lakes.

"We know so little about our hydrologic system and we are so dependent upon it," said Stephen Wells, a University of New Mexico paleohydrologist heading the study. The team is linking climate and hydrology to understand what causes an area to become desert and if ancient flooding patterns will be repeated.

Wells, along with a climatologist, two civil engineers and half a dozen students, spent spring vacation and part of the summer at Lake Mojave taking sediment samples.

Their field research, which is funded in part by the New Mexico Water Resources Research Institute, already is yielding information that can be applied to New Mexico, particularly ancient Lake Estancia southeast of Albuquerque. Lake Mojave, like most lakes in arid lands, was created from snow and rainfall runoff that immediately affected the lake level.

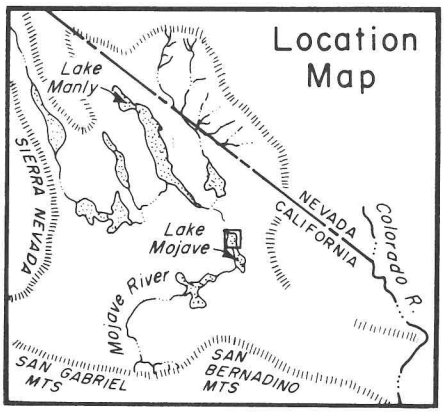
By radiocarbon dating the shorelines, the researchers are able to connect the rise in lake levels with vegetation and climatic patterns of the same time period to complete the hydrologic picture. "Shorelines form a timeline, just as tree rings reveal a tree's age," Wells explained.

Through shoreline dating, the researchers have learned that Lake Mojave, now a dry lakebed, was formed 15,000 years ago from snow and rainfall runoff from mountains 120 miles away. For the next 3,000 years, it was a large fresh water lake about 60 feet deep, 25 miles long and 10 miles wide. During that period the area supported juniper, pinon and Joshua tree woodlands.

Then 8,000 to 11,000 years ago, about the time man apeared in the area, the lake began to dry up and became more saline. The woodlands died out and the area became desert.

Computer models based on their findings are expected to show that modern floods have followed an ancient pattern in that they are caused by heavy winter precipitation. The models may also determine that increased runoff raised ground water levels, which in turn raised the water level in the lake bed. In fact, Wells said, the 1916 flood that filled Lake Mojave to a depth of 10 feet followed the pattern set by the predictive models.

Knowing that history repeats itself, for example, will help in determining the stability of nearby hazardous waste disposal sites. When the life of a waste material can be a thousand years, it is important to know the history of floods and infiltration the area for the past thousand years, Wells said.



Lake Mojave study area

The history of ground water recharge also could help predict modern recharge. "You don't think history is important in hydrology until you consider that Albuquerque depends upon ground water that was formed in an aquifer 10,000 years ago."

Other researchers working on the project are L. McFadden and R. Anderson from New Mexico, R. Balling from Arizona, and P. Lagasse and J. Schall from Colorado.

Mountain lakes susceptible to acid rain

When Tom Lynch first started talking about acid rain in New Mexico, no one took him seriously or funded him to research the problem. "Most people think that what New Mexico needs is more acid in its soils, not less. They also consider acid rain problems as confined to the eastern half of the United States," said Lynch, a biologist at the New Mexico Institute of Mining and Technology.

Then in 1986 with a small grant from the New Mexico Water Resources Research Institute (WRRI), he and Tech chemist Carl Popp and biologist Gerald Jacobi, from New Mexico Highlands University, began their acid rain studies. That year they sampled the waters of 10 New Mexico high mountain lakes. The results put six of those lakes near or below EPA standards for sensitivity to acid precipitation.

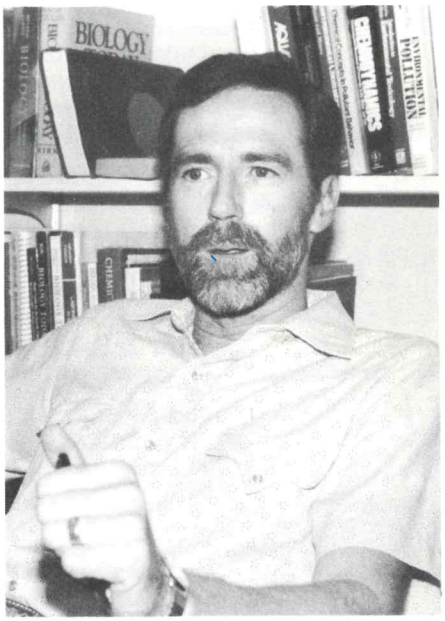
Their research attracted the attention of the U.S. Geological Survey, which along with the WRRI recently funded a larger additional study of New Mexico lakes. Also, the U.S. Forest Service is providing logistical support for the treks into the mountain lake areas.

Acid precipitation, which is rain or snow with a pH of less than 5.6, is associated with power and smelting plant emissions. Power plants in the state's Four Corners region, for example, produce 129,000 tons of sulfur dioxide a year with copper smelting in Grant County producing another 74,000 tons a year. "Even with additional pollution controls at the power plants, emissions are likely to increase as generating capacity increases," Lynch said. He said, for example, new smelting coming on line at Cananea and Nacozari, Mexico, just south of the Arizona-New Mexico border, will increase emissions.

Although some acids occur naturally and are beneficial to the environment, the increased levels deposited on a lake can change the water chemistry by lowering its pH. "Based on experiences in New England, lakes that become acidified can't support fish. The water also becomes more transparent because the algae decreases," Lynch said. This in turn affects the entire food chain of the lake.

Soil chemistry also can determine the effect of acid rain on lakes. "At lower elevations where the soil is more alkaline, soil and dust tend to neutralize acid precipitation," he said. Alkaline soils, which contain soluble mineral salts and have a high pH, are generally found in arid regions of the West.

The six lakes found to be most susceptible to acid precipitation were lakes Katherine, Santa Fe, Stewart, Spirit, Nambe and Williams. All were situated in granitic bed rock, which is low in buffering capacity. "These lakes also had a small watershed-to-lake surface area and rocky soils, so there was little chance for the precipitation to interact with the soils and become neutralized before entering the lake," he said.



Thomas Lynch

Truchas Lake, which is one of the nine lakes in the Santa Fe and Carson National forests that will be sampled in the upcoming year, is "practically distilled water," according to Lynch. "That is good for water purity, but the pH may swing wildly and it is difficult for aquatic organisms to tolerate sudden and radical changes."

The researchers also will pay special attention to the lakes during the spring snowmelt when the greatest potential for "acid-shock" exists. Acid-shock occurs when rapidly melting acid snow causes a short-term, but ecologically damaging, drop in a lake's pH. In the 1986 study, Santa Fe, Stewart and Lost lakes indicated a potential for acid-shock.

Based on experiences in other regions with high mountain lakes, acid precipitation degrades lakes long before it visibly affects vegetation and soil. "The lakes may serve as an early warning system of the more devastating effects associated with declines in forests. Water and land managers, alerted early, could look for ways to remedy the problem," Lynch said.

Making preparations to sample Horseshoe Lake are (left to right) Carl Popp, Tom Lynch and Gerald Jacobi. The lake is at 12,000 feet and in the middle of July the snowbank still has not melted.

To order the following publications, write the New Mexico Water Resources Research Institute, Box 30001, Las Cruces, NM 88003-0001.

#M 17 — *Predicting Chemical Movement is Soils* — O'Connor, G.A. and F. Khorsandi
#204 — *The Ecophysiological Bases of Salt Tolerance in Distichlis Spicata, Background for Domestication* — Allen. A. et al.
#214 — *Use of Saline Water for Buffalo Gourd Production in New Mexico* — Whittier, J.
#215 — *A Study of Runoff and Erosion Processes Using Large and Small Area Rainfall Simulators* — Ward, T.
#216 — *Modeling Impacts of Grazing Animals on Nutrient Mobilization into Small Reservoirs* — Cole, R. et al.
#218 — *Evaluation of Available Saline Water Resources for the Construction of Large Scale Microalgae Production Facilities in New Mexico* — Lansford, R.
#219 — *Proceedings of the 31st Annual New Mexico Water Conference: Managing the River* — Harris, L. ($5)
#220 — *Quantification of Groundwater Recharge Rates in New Mexico Using Bomb 36CL, Bomb 3H, and Chloride as Soil-Water Tracer* — Mattick, J.L. and Duval, T.A.
#221 — *Somatic Cell Selection Criteria for Water Use Efficiency Using Genetically Differential Alfalfas* — Phillips, G.C.
#222 — *Evaluation of the Potential to Improve Alfalfa for Production Under Less than Optimum Moisture Conditions* — Currier, C.G.; Melton, B.A. and Wilson, M.L.
#223 — *A Model for Optimization of Socio-Economic Fishery Values on the Rio Grande in New Mexico* — Cole, R. et al.
#225 — *Development of a Drip Irrigation Scheduling Model* — Sammis, T.; Williams, S. and Jernigan D.

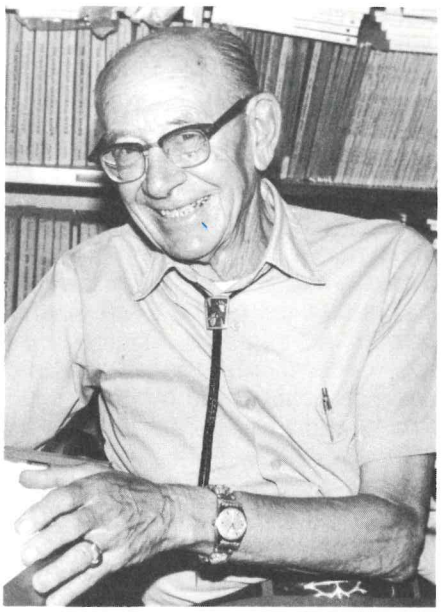
State water history published

When Ira Clark began writing the history of water in New Mexico, he never dreamed it would take him 25 years. His was not a case of prolonged writer's block, just tenacious attention to detail.

His book, "Water in New Mexico: A History of Its Management and Use," begins with New Mexico's ancient irrigators 1,000 years ago and ends 24 chapters later with the El Paso suit. In between is the chronicle of the events, laws and institutions that shaped the state's water history.

Clark, professor emeritus in history from New Mexico State University, said he wrote the book simply because no one else had. "Most of them were scared off when they found out how complex the subject was," he said.

The book is packed with information. The chapter on ground water, for example, traces the evolution of New Mexico's model ground water law. Clark writes that the effects of pumping on the artesian wells in the Pecos Valley were so bad that by 1917 the land bank was refusing farm loans in the area.



Ira G. Clark sorts through his bibliography note card file. He filled about 20 such files in researching his book.

After some prodding from local leaders, the state legislature agreed to fund a study of the area's ground water. The outcome was "an extremely advanced ground water code," said Clark. Today, he said the ground water laws of 16 states reflect New Mexico's influence.

"Water in New Mexico" is available from the University of New Mexico Press and sells for $50.

Ground water is conference topic

"Ground Water Management" will be the topic of the 32nd Annual New Mexico Water Conference Nov. 5-6, 1987. The conference will be held at the Holiday Inn Pyramid in Albuquerque.

Talks the morning of Nov. 5 will cover ground water quality. Speakers will talk about the EPA ground water protection program, water quality problems in Albuquerque's South Valley, and pollution from agricultural chemicals and oil fields.

The afternoon session will cover natural and artificial recharge. Representatives from Arizona, Alamogordo and El Paso will discuss their artificial recharge projects. Results of two natural recharge research projects also will be presented.

The Nov. 6 session will cover ground water law, management and planning. Speakers from New Mexico will discuss interstate ground water transfers and the state water plan. Federal cost sharing also will be discussed. The conference will close with a discussion of the effects of the Clean Water Act on Indian reservation lands.

The conference fee of $50, ($15 for students) includes lunch and the proceedings. Registration information will be mailed in September. For more information call the institute at 646-4337.

El Paso hearings end; ruling to come

The El Paso hearing ended Aug. 12, not with impassioned speeches, but with a collective sigh of relief. "I'm very grateful we completed the Hueco Basin hearing without any spilled blood — yours or mine," New Mexico State Engineer Steve Reynolds told the hearing participants. "I'll try to give you a reasonably early decision after all the briefs are in. Then we'll know whose water we'll spill."

Reynolds, who presided over the 9-month-old hearing, gave lawyers 70 days to file briefs. Each side is allowed 60-pages to outline their arguments in the case. Reynold's decision could come by Christmas. The hearing on El Paso's applications to drill 266 wells in the Lower Rio Grande Basin is set for Jan. 5.

His ruling will test a 1983 New Mexico law that permits ground water export under certain conditions. That law replaced New Mexico's embargo statute, which was ruled unconstitutional because it violated the interstate commerce clause.

The 1983 law allows ground water export as long as it is not "contrary to the conservation of water" in New Mexico or "detrimental to the public welfare" of its citizens.

The El Paso hearings ended as they began — with Lee Wilson on the stand. Wilson, a Santa Fe hydrologist, was the chief witness for El Paso. He was one of 35 witnesses to testify during the 58-day hearing.

Witnesses for New Mexico focused on that criteria during the last stages of the hearing.

Charles Howe, a Colorado economist, said water administrators should distinguish between the economic and social costs of using a non-renewable ground water supply. He questioned whether the likely future benefits of conservation were sufficient to warrant the undertaking of these costs.

He also said the criteria for conservation should include the efficiency of water use, timeliness of development and the risk of that development on future generations. El Paso is seeking a 100-year water supply, while New Mexico holds the limit to 40 years.

Helen Ingram, an economist specializing in water policy said, "Water is a 'different' resource with a special meaning linked to survival and security that transcends its commodity value." When people lose control over their water, she said they view it as "losing the opportunity to shape the destiny of the area."

Throughout the hearing, however, El Paso has contended that New Mexico's objection to water export is purely economic.

The hearing was recessed two days in honor of Bill Saad, who died of a heart attack July 29. Saad was treasurer-manager of Elephant Butte Irrigation District and a key witness for the district in its case against El Paso. He was 52.

Note new address

Bob J. Creel, acting director, New Mexico Water Resources Research Institute
Linda G. Harris, editor

the divining rod
New Mexico Water Resources Research Institute
Box 30001, NMSU, Dept. 3167
Las Cruces, NM 88003-0001
(Address correction requested)

Non-Profit Org.
U.S. Postage
PAID
Las Cruces, N.M. 88003
Permit No. 162