



# Divining Rod

Vol. XXXVI, No. 3 • August 2013

## NSF Grant Enables Statewide Sustainable Energy and Water Research in New Mexico

By Karen Wentworth, UNM Communications

A new \$20 million Experimental Program to Stimulate Competitive Research (EPSCoR) grant from the National Science Foundation will support key research into ways to make New Mexico an energy sufficient state. The research will focus on ways to improve efficiency of sustainable energy resource utilization while minimizing water and environmental impacts. Participating institutions and partners include University of New Mexico, New Mexico State University, New Mexico Tech, New Mexico Water Resources Research Institute, Eastern New Mexico University, New Mexico Highlands University, Santa Fe Community College, New Mexico Museum of Natural History and Science, The National Museum of Nuclear Science and History, Explora Museum, Los Alamos National Laboratory, Sandia National



Page 6 Bioalgal study part of EPSCoR research



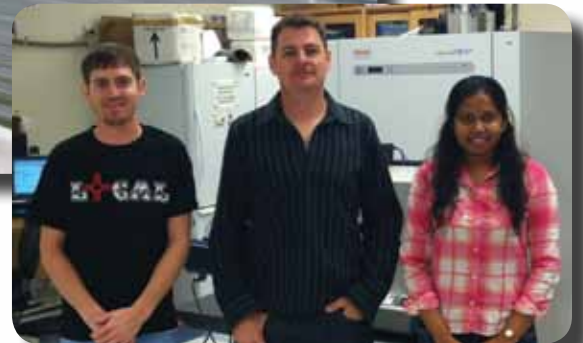
Page 7 EPSCoR project to develop statewide water budget



Page 9 Colorado River to be focus of Utton Memorial Water Lecture at annual NM WRRRI conference



Photo taken by Hamid Rad, NMSU Office of Research Development at the Fabian Garcia facility in Las Cruces.



From left: Barry Dungan, Tanner Schaub, and Nilusha Sudasinghe of the Chemical Analysis and Instrumentation Laboratory (CAIL) stand in front of the FT-ICR mass spectrometer, which will be used to look at the chemical composition of produced water as well as biofuels and other complex mixtures via the EPSCoR project. The CAIL lab is part of the Center for Animal Health and Food Safety in the NMSU ACES. Photo courtesy of Barry Dungan



# Divining-Rod

Published by  
The New Mexico Water  
Resources Research Institute

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Laboratories, Santa Fe Institute and the Global Center for Cultural Entrepreneurship.

William Michener, a professor with University Libraries at UNM, is the principal investigator along with UNM co-PI Mary Jo Daniel. Michener will coordinate research, education, and administration of the award. "The main idea of this award is to build our state research capacity to develop the state's potential for sustainable energy development through collaborations among academia, business and industry and the National Labs," Michener said.

"This new award builds on prior NM EPSCoR successes and will foster greater educational achievement in STEM fields and expand opportunities for employment in well-paid jobs for New Mexicans," Daniel said.

The research will attempt to answer three main questions:

1. How can we sustain extractive energy development with no minimal risk to water and environmental resources?
2. How can the efficiency of resource utilization or extractive technologies be increased?
3. How can New Mexico realize its energy development potential in a sustainable manner?

Research teams will explore questions in several specific areas, many of them including water resource issues.

- Bioalgal Energy Development Team led by Peter Lammers, NMSU and David Hanson, UNM. This effort supports the next generation of biofuel production while making use of abundant solar energy in the

Southwest as well as using produced and brackish groundwater for sustainable energy production in the desert where fresh water is limited.

- Social and Natural Science Nexus Team led by Sam Fernald, NMSU/ NM WRRI and Janie Chermak, UNM. This team will explore the sustainability of different energy technologies taking into account community economic choices and with particular attention to statewide water availability and interdependencies between water resources and energy sectors.
- Geothermal Energy Resources and Sustainability Team led by Mark Person, NM Tech and Laura Crossey, UNM. The geothermal energy team will develop a better understanding of factors that affect the viability and sustainability of New Mexico's underlying natural hydrothermal systems.
- Osmotic Power Development Team led by Frank Huang, NM Tech and Bruce Thomson, UNM. Waters produced by oil and gas industries are the focus of this team that will confront issues related to membrane properties and fouling that prevent osmotic pressure systems from becoming commercially viable sources of power.
- Uranium Transport and Site Remediation Team led by Dana Ulmer-Scholle, NM Tech and Steve Cabaniss, UNM. Water quality is the water emphasis for this team that seeks to improve understanding of the way uranium moves in the environment and developing tools for predicting and controlling the movement.



- Solar Energy Development Team led by Michael Heagy, NM Tech and Marty Kirk, UNM. Including water in solar power processes, this team will explore solar-driven water oxidation that uses inexpensive catalysts to generate H<sub>2</sub>, a clean high-energy fuel and will also explore more efficient photovoltaic cells.

Additionally, the award supports education and outreach activities that will build the human capacity needed to realize New Mexico's potential in research, education and economic development.

These include:

- An after-school program for middle school students on computer modeling and simulation
- Summer research experiences for community college and tribal college students
- Professional development for community college faculty and for K-12 STEM teachers
- Museum exhibitions and a network of informal science education institutions
- An entrepreneurship institute to provide training in key enterprise functions to faculty

The research teams have already been designated and work began on the grant June 1, 2013. For more information, visit NM EPSCoR at <http://nmepscor.org>.

The *Divining Rod* will highlight each of the EPSCoR teams' activities periodically (see pages 6 and 7). 💧



## New Mexico EPSCoR Vision

*We envision New Mexico as a state that has achieved energy self-sufficiency in a sustainable manner through its research and development enterprise, that has a strong STEM pipeline between community colleges and the research universities, and that supports a culture of entrepreneurship that promotes innovation and new business and economic development.*

This workshop will be held in Ballroom C of the Student Union Building at the University of New Mexico on September 5, 2013. Workshop space is limited. To RSVP, contact [energy@acus.org](mailto:energy@acus.org) or 202-701-7727.



## TRANSFORMATIONAL SOLUTIONS FOR WATER IN THE WEST

September 5, 2013 • University of New Mexico Student Union Bldg, Albuquerque, New Mexico  
In collaboration with the New Mexico Water Resources Research Institute

**7:00 - 8:30 a.m. Poster Mounting and Continental Breakfast**

**8:30 - 9:00 a.m. Welcoming Remarks**

**Marianne Walck** or **Jill Hruby**, Sandia National Laboratories  
**John Lyman**, Director, Energy and Environment Program, Atlantic Council  
**Sam Fernald**, Director, New Mexico Water Resources Research Institute

Moderator:

**Marianne Walck**, Director, Geosciences, Climate and Consequence Effects Center & Deputy Director, Climate Security Program, Sandia National Laboratories

Framing the Discussion:

**Howard Passell**, Principal Member, Technical Staff, Sandia National Laboratories

**9:00 - 12:45 p.m. Session I: Transformational Solutions**

### Urban Solutions

Paradigm Shift: Rethinking Water Supplies in an Age of Scarcity  
**John Entsminger**, Senior Deputy General Manager, Southern Nevada Water Authority

The Role of Potable Reuse as a Sustainable Water Supply Alternative  
**Jeff Mosher**, Executive Director, National Water Research Institute

Integrated Water Management Strategies for the City of El Paso, Texas  
**Hector Gonzalez**, Government Affairs Manager, El Paso Water Utilities

Water Resource Management in the 21<sup>st</sup> Century  
**John Stomp**, Chief Operating Officer, Albuquerque/Bernalillo County Water Utility Authority

### Governance Solutions

The Train Wreck that Didn't Happen, and You Never Heard About: The Anatomy of a Shortage Sharing Agreement on the San Juan River  
**John Leeper**, Professional Engineer, AMEC Environment and Infrastructure, Inc.

Resilience in Water Governance: Building Adaptive Capacity within Socio-ecological Systems Facing Climate Change  
**Melinda Benson et al.**, Assistant Professor, Department of Geology and Environmental Studies, University of New Mexico

Sustainable Water Management Profile  
**Mike Myatt et al.**, California Water Foundation

The Traveler's Dilemma: Logic and Illogic in New Mexico's Water Laws  
**Max Yeh**, Principal Researcher, Percha/Animas Watershed Association

Challenges, Constraints and Opportunities Associated with the Development of a Watershed-Based Stormwater Permit in the Middle Rio Grande, New Mexico  
**Molly Blumhoefer et al.**, Geography Instructor, School of Math, Science and Engineering, Central New Mexico Community College

**12:45 - 1:30 p.m. Lunch and Poster Session**

**1:30 - 2:00 p.m. Keynote Speaker: Senator Tom Udall**

Introduction: **Paul Hommert**, Director, Sandia National Laboratories

**2:00 - 3:00 p.m. Session II: Transforming New Ideas into Policy: Challenges and Opportunities**

Moderator: **Senator Tom Udall**

Strong Medicine: Considering a Greater Federal Role in Water Management  
**Reed Benson**, Chair, Natural Resources Committee, University of New Mexico Law School

Where Will the Water Come From? Review of Water Availability in the West  
**Vincent Tidwell et al.**, Distinguished Member, Technical Staff, Sandia National Laboratories

Water Resource Impacts Embedded in the Western U.S. Electrical Energy Trade; Current Patterns and Adaptation to Future Drought  
**Benjamin Rudell**, Assistant Professor, CTI Department of Engineering & Senior Sustainability Scientist, GIOS, Arizona State University

Responding to Projected Water Resource Scarcity in the Upper Rio Grande Basin  
**Jesse Roach**, Hydrologist, Earth Systems Analysis, Sandia National Laboratories

**3:00 - 4:40 p.m. Session III: Transformational Solutions (continued)**

**Management and Research Solutions**

Water Transfers in the West: Projects, Trends, and Leading Practices in Voluntary Water Trading  
**Carlee Brown**, Policy Associate, Western Governors' Association

Responding to Projected Water Resource Scarcity in the Upper Rio Grande Basin  
**Jesse Roach et al.**, Hydrologist, Earth Systems Analysis, Sandia National Laboratories

Transformational Management of Forest Ecosystems to Improve Water Availability and Ecological Resilience in the West  
**Michael Hightower et al.**, Distinguished Member, Technical Staff, Sandia National Laboratories

Computational Model for Water Governance Reform  
**Michael Agar**, Professor Emeritus, University of Maryland

Role of Research in Developing and Implementing Transformational Solutions for Water Sustainability  
**Arnim Wiek et al.**, Associate Professor, Decision Center for a Desert City, Arizona State Univ.

**4:40 - 5:15 p.m. Session IV: Summary Discussion/Next Steps**

**5:15 - 5:30 p.m. Closing Remarks**



## New Mexico EPSCoR Team

### Bioalgal Energy Development

By Hamid Mansouri Rad, Office of Research Development, NMSU

Having a better understanding about algal biology and how to scale up algal biofuels production from cells and populations to large reactors will help grow the bio-algae industry that has recently begun in the desert Southwest. The EPSCoR Bioalgal Energy Team includes researchers from Eastern New Mexico University, New Mexico State University, the University of New Mexico. They will investigate three overarching questions:

1. Can inexpensive, scalable, closed bioreactor designs maximize biomass productivities with heat tolerant algae in summer and cold-tolerant strains in winter with minimal water consumption and cultivation costs while achieving a net positive energy balance?
2. What species/community characteristics and cultivation conditions best promote stable, reproducible, large-scale production of algal biomass and also harmonize with design specifications for algal cultivation; extraction and conversion processes for high-, mid-, and low-value products; and QA/QC specifications for fuels and co-products?
3. Can wastewater sources safely offset nutrient requirements at large scales, and how do associated scale-up logistics, reactor design and operation affect output water quality to meet process recycling and discharge requirements?

A key consideration for algae cultivation at large scales is the scarcity of water in New Mexico. However, the team has been successful in taking advantage of non-potable brackish water, which is not suitable for municipal or agricultural uses without desalination. The team will examine techno-economic synergies between energy-positive, wastewater treatment using water-efficient algal cultivation systems and the emerging algal-biofuel industry in the desert Southwest. Development of energy-positive treatment processes that utilize dairy wastewater and municipal wastewater are priorities for the program. The team will face challenges in developing efficient integrated processes that conserve nutrients and water resources to enhance competitiveness of New Mexico agriculture.

One of the goals of this project is to reduce the environmental impact of the future algal biofuels industry in New Mexico. “The NM EPSCoR award has provided us with a significant opportunity” says NMSU Team Co-Leader Peter Lammers. “We are looking closely at every step in this process, from algae cultivation, and CO<sub>2</sub> supply, to algal oil extraction, and fuel conversion; all with an eye toward optimizing yields and utilizing wastes. By returning derivatives to the algae production cycle and avoiding waste generation, we will have a minimal environmental footprint.”

The innovative technologies that result from NM EPSCoR investments and research should help overcome the challenges of developing algal biomass in a desert environment where fresh water is precious. The goal is to make the use of algal biomass a sustainable, economically viable component of a renewable energy portfolio in New Mexico.

In addition to building new facilities for growing and processing algae, the team will collaborate with industry and national laboratories to provide interdisciplinary training for undergraduate and graduate students so they can continue and expand this research field. ♦



*NMSU students in the greenhouse conducting algae research. (Photo courtesy of Wiebke Boeing)*

## New Mexico EPSCoR Team Social and Natural Science Nexus

By Hamid Mansouri Rad, Office of Research Development, NMSU



*The Rio Hondo meets the Rio Grande near Taos, New Mexico. Photo courtesy of Natalie Willoughby, Public Information & Outreach Representative, New Mexico EPSCoR, UNM, [www.nmepscor.org](http://www.nmepscor.org)*

New Mexico EPSCoR's Social and Natural Science Nexus team goals are to better understand the trade-offs that occur between different energy and economic development choices while considering the potential for sustainable socioeconomics, environment, and water use.

This project is co-led by Sam Fernald, Director of the NM WRRI, who is also an NMSU professor of watershed management in the Department of Animal and Range Sciences and also by Janie Chermak, department chair and professor of natural resource economics at UNM. The team also includes NMSU's Steve Guldan, Thomas Schmugge, Caitriana Steele, and Ursula Smedly. New Mexico Tech is represented by Mike Pullin, UNM by Jennifer Thacher and Bruce Thomson, Vince Tidwell from Sandia National

Laboratories, and Bob Parmenter, from the Valles Caldera National Preserve.

One major goal is to construct a dynamic statewide water budget based on hydrologic science. Fernald points out, "We have access to information about water usage across the state, but that information is static. In reality, water usage is dynamic and constantly changing. In this project, we are going to obtain information about the water budget, both physical and hydrological, and our model is going to simulate different scenarios regarding water use in various temperatures, including during drought." The plan is to make the statewide water budget available to researchers to support water research above and beyond EPSCoR efforts. The statewide water budget will kick off with an innovation working group in fall 2013 to bring in experts in regional

hydrologic assessments including top New Mexico water managers. In a hydrology roundtable, the group will extract lessons learned from other large-scale water assessments to help kick-start this effort.

Another major product of the Social and Natural Science Nexus team is a cutting-edge multidisciplinary model that links natural and human systems, which will be used to develop a decision-support tool for energy development in New Mexico.

The team will use system dynamics modeling to simulate the links between energy, water, built infrastructure, environment, and human perceptions. This team will integrate results from energy sector studies throughout the broader EPSCoR project. 💧



## Reports and Links Available

### USGS

The Novarupta-Katmai Eruption of 1912 – Largest Eruption of the Twentieth Century: Centennial Perspectives, Professional Paper 1791 <http://pubs.usgs.gov/pp/1791>

New Maps Provide Crucial Information for Water Managers: Long-Term U.S. Evapotranspiration Rates Mapped for the First Time <http://onlinelibrary.wiley.com/doi/10.1111/jawr.12010/abstract>

Stay Current on Your Rivers with USGS WaterNow <http://water.usgs.gov/waternow/>

An Economic Value of Remote-Sensing Information—Application to Agricultural Production and Maintaining Groundwater Quality, Professional Paper 1796 <http://pubs.usgs.gov/pp/1796/pp1796.pdf>

Atlas of Relations Between Climatic Parameters and Distributions of Important Trees and Shrubs in North America—Modern Data for Climatic Estimation from Vegetation Inventories, Professional Paper 1650-F <http://pubs.usgs.gov/pp/p1650-f>

Baseline and Projected Future Carbon Storage and Greenhouse-Gas Fluxes in Ecosystems of the Western United States, Professional Paper 1797 <http://pubs.usgs.gov/pp1797/>

### Bureau of Reclamation

Major supply shortages loom in 7-state basin <http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/index.html>

### Rio Grande Compact Commission

2011 Report of the Rio Grande Compact Commission to the Governors of Colorado, New Mexico and Texas was released in late February 2013. The report is available on the Office of the State Engineer website at: [http://www.ose.state.nm.us/isc\\_rio\\_grande\\_tech\\_compact\\_reports.html](http://www.ose.state.nm.us/isc_rio_grande_tech_compact_reports.html)

## Upcoming 2013 Conferences

September 5, 2013 Transformational Solutions for Water in the West, workshop sponsored by Sandia National Laboratories and the Atlantic Council of the United States and co-sponsored by NM WRRI, Sandia National Laboratories, Albuquerque, NM [energy@acus.org](mailto:energy@acus.org)

September 23-24 New Mexico Water Law, La Fonda, Santa Fe, NM [http://www.cle.com/product.php?proid=1409&src=Featured&page=New\\_Mexico\\_Water\\_Law](http://www.cle.com/product.php?proid=1409&src=Featured&page=New_Mexico_Water_Law)

October 2-4, 2013 WaterSmart Innovations 2013 Conference and Exposition, Las Vegas, NV [www.WaterSmartInnovations.com](http://www.WaterSmartInnovations.com)

October 23-24 24<sup>th</sup> Annual South Platte Forum, The Ins and Outs of the South Platte Basin, Longmont Plaza Hotel, CO [www.southplatteforum.org](http://www.southplatteforum.org)

November 4-7 AWRA Annual Water Resources Conference, Red Lion Hotel on the River-Jantzen Beach, Portland, OR <http://www.awra.org/meetings/Portland2013>

November 5-7 Nevada Water Resources Association, 2013 River Symposium, Ramada Reno Hotel & Casino, Reno, NV [www.nvwra.org](http://www.nvwra.org)

**Nov 21-22, NM WRRI New Water Realities: Proposals for Meaningful Change, Embassy Suites Albuquerque, NM** <http://2013.wrri.nmsu.edu>

December 9-13 American Geophysical Union, Fall Meeting includes session on “Climate Variability and Water Resources Management: Integrating Paleoclimate, Observations and Physical Models” San Francisco, CA <https://fallmeeting.agu.org/2013>

## **NM WRRI's 57<sup>th</sup> Annual New Mexico Water Conference**

### **Poster Abstracts Due October 4, 2013**

<http://2013.wrri.nmsu.edu>



Albert E. Utton Memorial Water Lecture  
featuring  
Tanya Trujillo



Executive Director, Colorado River Board of California,  
formerly with the  
New Mexico Interstate Stream Commission

November 21, 2013 12:00 – 1:45 p.m.  
58<sup>th</sup> Annual New Mexico Water Conference  
Embassy Suites Albuquerque

The Albert E. Utton Memorial Water Lecture honors the memory of a lifelong friend of the New Mexico Water Community. Al Utton served New Mexico for over 35 years as a distinguished member of the University of New Mexico School of Law, a twenty-year member of the New Mexico Interstate Stream Commission, a valued advisor to the New Mexico Water Resources Research Institute, a worldwide authority on transboundary issues, and a recognized leader in conflict resolution.

Tanya Trujillo is the sixth recipient of the Albert E. Utton Memorial Water Lecture. Previous honorees include Dan Tarlock, Mexico Ambassador Albert Székely, Charles DuMars, Em Hall, John Hernandez, and Joe Stell.



Colorado River photo courtesy of Benjamin Edelstein

**Colorado  
River Basin  
focus of  
Utton Lecture**

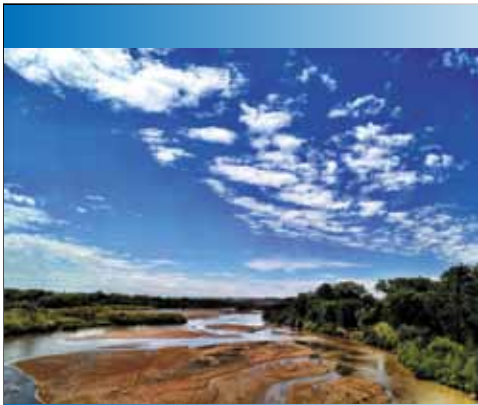
Register at: <http://2013/wrri.nmsu.edu/>

58<sup>th</sup> ANNUAL NEW MEXICO WATER CONFERENCE

# New Water Realities

— PROPOSALS FOR MEANINGFUL CHANGE —

Embassy Suites Albuquerque - November 21-22, 2013



## Preliminary Program

Thursday Morning, November 21, 2013

- 8:30 Welcome  
[Sam Fernald](#), NM WRRRI Director
- 8:45 Opening Address  
[Lowell Catlett](#), New Mexico State University
- 9:15 Setting the Stage  
[John Shomaker](#), John Shomaker and Associates, Inc.
- 9:30 Changing Precipitation, Temperature,  
and Stream Flow Conditions  
[Dave Dubois](#), New Mexico State Climatologist  
[Greg Pederson](#), U.S. Geological Survey,  
Northern Rocky Mountain Science Center
- 10:30 Break
- 10:45 Western Perspectives  
Water Transfers in the West, [Tony Willardson](#),  
Western States Water Council  
The Importance of Agriculture, [Dan Keppen](#),  
Family Farm Alliance
- 11:35 New Mexico State Engineer Update, [Scott Verhines](#)
- 12:00 Luncheon  
2013 Albert E. Utton Memorial Water Lecture  
Collaborative Efforts in the Colorado River Basin  
[Tanya Trujillo](#), Colorado River Board of California



## Thursday Afternoon

- 1:30 Legal Realities and Solutions  
Health of Settlements, [Steven L. Hernandez](#), P.C.  
Priority Administration, [Dudley Jones](#), Carlsbad Irrigation District  
Is Prior Appropriation Dead? [Em Hall](#), University of New Mexico School of Law
- 2:30 Forgotten Rivers  
Clean and Healthy Rivers, [Chris Canavan](#), NM Environment Department  
Healthy Watersheds and Water Quality, [Steve Wilmeth](#), Doña Ana County Soil and Water  
Riparian Areas, [Steve Harris](#), Rio Grande Restoration
- 3:30 Break
- 3:45 Stakeholders Panel: Proposals for Meaningful Change moderated by [Jose Rivera](#), UNM  
[Frank Chaves](#), Sandia Pueblo  
[Juan Garcia](#), El Rito Regional Water and Wastewater Association  
[Dan Guevara](#), NM Environment Department  
[Steve Guldan](#), NMSU Sustainable Agriculture Center, Alcalde  
[Matt Holmes](#), NM Rural Water Association

## Friday Morning, November 22, 2013

- 8:15 Legislative Perspectives, introduced and moderated by [John Fleck](#), *Albuquerque Journal*  
Federal View, [Kris Polly](#), editor-in-chief, *Irrigation Leader*  
State View, NM Senator [Peter Wirth](#), NM Senator [Joseph Cervantes](#), (invited)  
NM Senator [Steven Neville](#), and NM Representative [Don Tripp](#)
- 10:00 Break and Poster Viewing
- 10:45 Economic Impact of New Water Realities  
The Relationship Between Energy and Water, [Scott Backhaus](#), Los Alamos National Laboratory  
Economic Impact of Western Agriculture: Focus on New Mexico, [Darryll Olsen](#), Washington State
- 11:25 Urban Solutions, the El Paso Example, [John Balliew](#), El Paso Water Utilities
- 11:45 Conjunctive Use of Surface and Groundwater on the Pecos,  
[Greg Lewis](#), NM Interstate Stream Commission, Pecos River Basin
- 12:05 Implementation of Restoration Sites on the Lower Rio Grande,  
[Elizabeth Verdecchia](#), International Boundary and Water Commission
- 12:30 Water Data on the Web  
[David R. Maidment](#), University of Texas at Austin
- 1:00 Luncheon  
Reflections from Water Careers in the Ivory Tower  
Retiring faculty [Bruce Thomson](#), University of New Mexico  
and [Adrian Hanson](#), New Mexico State University

NM WRI 58<sup>th</sup> Annual New Mexico Water Conference  
*New Water Realities: Proposals for Meaningful Change*

## Call for POSTER ABSTRACTS

Deadline for Poster Abstracts  
**October 4, 2013**

The 2013 New Mexico water conference includes a Call for Poster Abstracts on any water research or management topic. Posters will be displayed at the conference on Friday morning, Nov 22, 2013. *New Water Realities: Proposals for Meaningful Change* will take place at the Embassy Suites Albuquerque, November 21-22.



### Poster Abstract Guidelines

Poster abstracts should not exceed 250 words and must be submitted online. Posters must be mounted on a hard poster backing appropriate for use with an easel, which will be provided. Abstracts will be reviewed by a committee and a notice of poster acceptance will be emailed by October 11.

Poster abstract guidelines are online at  
<http://2013.wrri.nmsu.edu/posters>

### Registration

All poster presenters must register for the conference. The registration fee will be waived for students who present a poster.

Registration online at <http://2013.wrri.nmsu.edu/>

***The 58<sup>th</sup> Annual New Mexico Water Conference has been approved for 9.0 credits by the New Mexico Minimum Continuing Legal Education Board.***