

THE AQUAHOMAN

Volume XI, Issue I, February 2015

The newsletter of the

**OKLAHOMA
WATER RESOURCES CENTER**

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Garey Fox

**PROGRAM
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Jonathan Anthony



From the Director's Desk (by Garey Fox)

The Water Center is gearing up for a busy spring and summer with lots of water education activities!

We are organizing the **4th Annual Student Water Conference** held at Oklahoma State University on March 26-27, 2015. This conference consists entirely of undergraduate and graduate student presentations on water, but can be attended by those of us who have already graduated! Travel assistantships through the Buchanan Endowed Chair are provided to students not enrolled at Oklahoma State University. This year will be the largest event ever with 64 student presentations. More than 30 students will be visiting Oklahoma from 14 universities. We are very excited that JD Strong, Executive Director of the Oklahoma Water Resources Board will be presenting the annual Buchanan Keynote Lecture.

This summer the Center will be hosting seven undergraduate students as part of an **NSF Research Experience for Undergraduates** conducting research on streams. You can learn

more about the student water conference and NSF REU grant on our student water website, studentwater.okstate.edu.

We are excited about the **new Oklahoma research projects funded by the Water Center** through the USGS 104(b) grant program, which is part of our base funding from the Water Resources Research Act. We also recently awarded several new projects through funds provided by the Division of Agricultural Sciences and Natural Resources at Oklahoma State University. You can learn more about these projects [on page 6](#).

I want to especially thank the 22 current members of the [Water Resources Advisory Board](#) (WRAB), who invest their time and energy into reading and evaluating proposals, attending proposal meetings, and working diligently to fund critical research to support Oklahoma water resources through the USGS 104(b) program. The WRAB members have been a delight to work with during my tenure as Interim Director. Their insight and knowledge is so important to our grants program.



Dr. Garey Fox, Interim Director

The Water Center continues to document the impact of previous USGS 104(b) grants for researchers across Oklahoma. As in past editions of the newsletter, you can read about the [impact of another 2007-2008 grant awardee](#), Dr. Todd Halihan in Geology at Oklahoma State University.

I will have the pleasure of visiting with our Senators and Congressmen in Washington D.C. in early February at the National Institutes of Water Resources meeting to discuss the success of the Water Resources Research Act, the value of the WRAB, and the impact of the USGS grants. Our productive faculty make it an easy story to tell for Oklahoma!

THAT'S A WRAB: Introducing the People and Organizations Composing Our Water Research Advisory Board

(by Mr. Trey Lam, Executive Director, Oklahoma Conservation Commission)

The job of executive director of the Oklahoma Conservation Commission is the only job I would have ever taken other than the one I love as a farmer. I am a firm believer that voluntary programs are the best way to achieve conservation on small and large scales, so I am compelled to help those programs reach as many people as possible. Personally, I raise alfalfa, corn, soybeans, wheat, and cattle. I work closely with the USDA Natural Resources Conservation Service and OSU to develop farm plans for crop rotation and equipment usage on my farm. I have seen firsthand as a farmer and as a conservation district board member that, when programs are in place to provide technical assistance and knowledge-sharing, farmers and ranchers will make conservation a priority.

In the last seven years, the Conservation Commission has received over \$24 million dollars in federal funds from the Environmental Protection Agency (EPA) and leveraged those with matching funds into just under \$95 million dollars. All but 10% of the funds were paid directly to Oklahomans willing to install practices that protect soil and water quality, and we have documented the results.

Funded through the EPA Nonpoint Source (NPS) Program, the Oklahoma Conservation Commission's Water Quality Division collects data from streams and estimates the combined results of conservation practices installed through the NPS Program, federal Farm Bill programs and the Locally-Led Conservation Cost-Share Program. As a result, Oklahoma is ranked number two in the nation for reducing nutrients from streams and rivers. 2014 was the fifth year in a row that we ranked in the top ten among states in reported NPS nutrient reductions. In 2013, **Oklahoma led the nation in phosphorus reduction for the third year in a row** with more than an estimated 1,036,393 pounds of phosphorus reduced due to voluntary practices. That number reflects over 30% of the overall reported reductions of phosphorus in surface water in the entire United States. Oklahoma also had an estimated sediment reduction of over 9,732 tons to streams. These numbers show that locally-led incentive-based programs work, and federal agencies continue to have the confidence in, and fund, Oklahoma's voluntary programs.

Our latest projects continue and expand our successful partnerships with federal, state, local and private partners and landowners. We are partnering on three USDA-funded Regional Conservation Partnership Projects (RCPP) and a Conservation Innovation Grant (CIG). The

Elk City Lake and Grand Lake watershed projects will combine RCPP funds with matching funds from partners including the City of Elk City, EPA, Grand River Dam Authority, Kansas State University, North Fork of Red River Conservation District, and multiple other conservation districts. The watershed projects aim to reduce excess nutrients that are causing algae blooms in the lakes and will help fund conservation practices such as alternative water supplies for livestock, stream bank fencing, and no-till farming. The two Soil Health projects, with OSU and Oklahoma Association of Conservation Districts in the lead, will establish between 10 and 20 on-farm demonstrations. Demonstrations allow producers, educators, and agency personnel to learn how an alternative management option, such as planting certain cover crops, will perform on local farms at the field scale. Once that is known, agencies can recommend practices with the greatest likelihood of protecting soil and water quality in a given area.

I am honored to work for an agency that is making a difference.



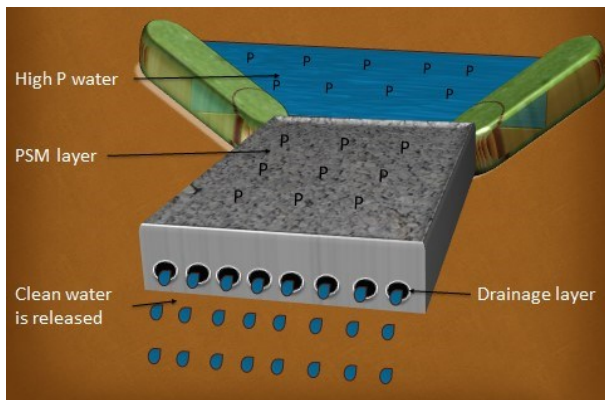
Trey Lam is the new executive director of the Oklahoma Conservation Commission. He is a lifelong conservationist who served on the Garvin County Conservation District board, following in the footsteps of his father and grandfather. His previous leadership positions include Oklahoma Soybean Association president, Oklahoma Soybean Checkoff board member, Oklahoma Crop Improvement Association president, Oklahoma Alfalfa Hay and Seed Association vice president, OSU Dean of Agriculture advisory council member, Oklahoma Association of Conservation Districts president, and National Association of Conservation Districts board member. He is a graduate of Yale University.

Research and Extension Collaboration: On a Land-Grant Mission to Improve Water Quality with a Unique and Versatile Structure (by Jonathan Anthony, OWRC staff writer)

To make research findings widespread and produce change at the state and national level, it is often beneficial for research and extension faculty to collaborate. One notable example of this at Oklahoma State University is the connection formed between Chad Penn, Associate Professor of Soil and Environmental Chemistry, and Josh Payne, Area Animal Waste Management Specialist. Together they develop and disseminate information on phosphorus removal structures.

Penn developed these structures to filter out dissolved phosphorus from flowing water before it reaches and pollutes nearby water bodies. "Some soils are built up with phosphorus to the point that a portion enters the environment through runoff," Penn said, "That dissolved phosphorus is primed to fertilize aquatic vegetation when it hits a water body, which is bad for recreation, drinking water treatment, the ecosystem, everything."

Phosphorus removal structures adsorb dissolved phosphorus from runoff like a filter, preventing water contamination in streams and rivers. "To build a structure," Penn said, "you need three things: an effective sorption material, a site with phosphorus-rich water to flow through the material, and the ability to retain and replace the material." With all three conditions met, a structure can be built in any shape to filter out dissolved phosphorus.



Find more information on phosphorus structures [here](#).

Though Penn has published several articles and installed structures in multiple locations, word of this technology needs to be publicized to investors. "Commercialization is key to getting this out," Penn said, "We're patenting all of this so someone can take it and build them nationwide." Penn's solution to effective public outreach is

partnering with Extension faculty member, Josh Payne.

Penn and Payne have been working together since 2006. Payne extends Penn's findings beyond academic journals to a broader audience at public demonstrations and conferences. "When OSU researchers conduct experiments and team with the Oklahoma Cooperative Extension Service to disseminate their findings, this illustrates an excellent example of effective teamwork between research and extension," Payne said.

Payne also helps connect Penn to other organizations for opportunities to inform the public, including the Poultry Waste Management Education Program, a poultry farm research and demonstration site, the Illinois River Watershed Partnership (IRWP), and other university researchers. "For example Dr. Bob Nairn, an expert in treating acid mine drainage, is providing acid mine residuals as a demonstration material at the IRWP's educational facility," Penn said.

Both Penn and Payne agree the collaboration between research and extension was necessary to get this information out to the public. "Simply publishing a peer-reviewed scientific journal article is not enough to get the word out to our constituents," Payne said. "We need another avenue to share results in order for agricultural producers and environmental professionals to benefit from our work, and Cooperative Extension serves as that conduit of information by transferring research-based information to the public."

Through their collaboration, the future is bright for making the phosphorus structures more widespread. "We have people in Florida set to purchase the first license, and the Natural Resources Conservation Service is very interested in cost sharing this best management practice at the national and state level," Penn said. "We're also currently working with them to build a large filter near western Lake Erie."

For faculty members interested in forming their own collaboration between research and extension, Payne offered some advice from his experience: "It requires open communication and a desire to answer a question through research and share it through Extension. These opportunities don't always present themselves and often must be sought out." The Oklahoma Water Resources Center is eager to help you form a research-extension team. Contact us at water@okstate.edu.

BRACE FOR IMPACTS:**Water Center Grant Recipient Positively Impacting the “City of Pure Spring Water” and its Neighbors**

(by Jonathan Anthony, OWRC staff writer)

Funded through the Water Resources Research Act, the USGS 104(b) grant program provides the seed money for research breakthroughs and collaborations in order to address Oklahoma’s current and future water resource issues. To ensure the results have a lasting impact on the state, the grant program also promotes the dissemination of findings to the public and encourages regional coordination. An exceptional example of a grant recipient supporting Oklahoma’s water future is Dr. Todd Halihan, Hydrogeophysics Professor and Hydrogeology of Fractured and Karstic Aquifers Specialist at Oklahoma State University.

In 2007-2008, Halihan conducted a study titled *Determination of Fracture Density in the Arbuckle-Simpson Aquifer from Ground Penetrating Radar (GPR) and Resistivity Data* in order to **map out and better understand groundwater flow paths within the aquifer**. Investigating the Arbuckle-Simpson is particularly important because it underlies over 500 square miles in south-central Oklahoma, providing the primary water source for Ada, Sulphur, and other residents in the region. It is also the source for several springs, including the Byrds Mill Spring and those in the Chickasaw National Recreation Area.

The importance of this aquifer also extends statewide with many traits not found elsewhere in Oklahoma. “For example, it’s the only designated sole source aquifer in Oklahoma, meaning it’s the only legal place where water underneath the ground interacts with water on the surface,” Halihan said, “**So it’s a test case for understanding surface-groundwater interactions on a legal basis.**”

Despite being such a crucial aquifer, there was little knowledge of the Arbuckle-Simpson’s geology and hydrology. Dr. Halihan’s team helped water managers and lawmakers **understand the formation’s freshwater availability, water storage capacity, spring and stream response to groundwater withdrawals, and hydrogeology** controlling the interactions between groundwater levels and springflows. With the help of the USGS 104(b) grant, Halihan’s research in the Arbuckle-Simpson resulted in significant progress for understanding the aquifer’s unique flow mechanics.

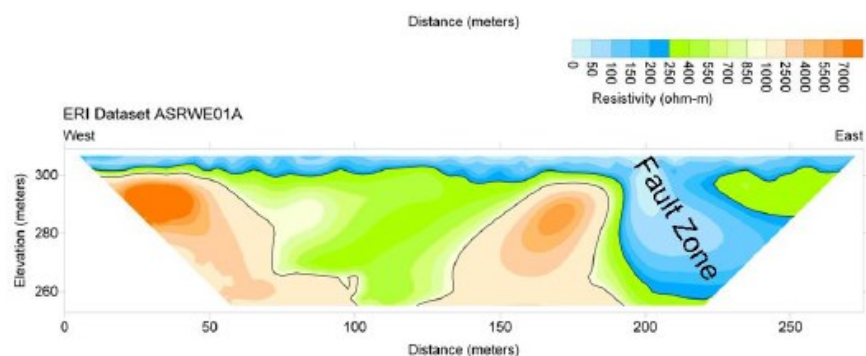
“The amount of knowledge we have of the aquifer is now way ahead of what it was before the project started,” Halihan said. “We understand the basic framework, and now we’re looking at how we can tie the pieces together to really understand what’s happening. For example, we’re not just trying to evaluate where the flow paths might be in Ada’s system; we’re imaging them to determine how they’re moving and evaluate their water quality.”

Halihan noted that progress is not exclusively found in the field. “For a land-grant university, there are a lot of questions to answer and outreach/education to be done, and the USGS 104(b) grant program helped to build communication between researchers and stakeholders,” Halihan said, “This communication grew and established a lot of important connections for our students.”

Through collaboration with The Nature Conservancy, the US Environmental Protection Agency, and the City of Ada, Halihan **established a student research center** that is invaluable for learning about the aquifer. At the Arbuckle-Simpson research station, dozens of students have completed undergraduate, Master’s, and Ph.D. degrees, and Halihan himself has published a similar number of journal articles covering his work on aquifer properties and imaging.

Between gathering a wealth of information on Oklahoma’s most unique aquifer, sharing his findings with the public and residents of the city of Ada, and training students in geologic research, Halihan has applied the USGS 104(b) grant to benefit the state as a whole.

More information about this and other USGS 104(b) grants is at water.okstate.edu/programs/owrri/project-reports.



STUDENT SECTION:

2015 Student Water Conference

The Oklahoma Water Resources Center will be hosting an Student Water Conference March 26-27, 2015 on the campus of Oklahoma State University in Stillwater, Oklahoma.

This year will be the largest event ever with 64 student presentations. More than 30 students will be visiting Oklahoma from 14 universities.

Learn more at studentwater.okstate.edu.

This year's **Buchanan Lecture** will be given by *J.D. Strong*, Executive Director of the Oklahoma Water Resources Board, and previously Oklahoma's Secretary of the Environment. He received a Bachelor of Science degree from Oklahoma State University and started working with OWRB as an environmental specialist.
March 26th at 7 PM
in French Lounge of
Student Union



Water Career Perceptions Lecture

We are pleased to welcome back to campus, Dr. Maria Chu, Assistant Professor, University of Illinois to discuss her experiences as a graduate student, post-doctoral researcher, consultant, and now a faculty member.
March 27th at 6 PM in French Lounge of
Student Union

Are You an Undergraduate Interested in Research?

The Oklahoma Water Resources Center will be hosting an NSF-REU (Research Experiences for Undergraduates) on Stream Restoration/Rehabilitation this summer 2015 in Stillwater, Oklahoma.

The REU pays for student housing, meals, research supplies, travel to a future conference, and also provides a stipend during the 10-week program this summer.

You can learn more about the projects and faculty mentors at <http://studentwater.okstate.edu/content/nsf-reu-streams>.

If you have questions about the REU, please don't hesitate to contact water@okstate.edu about this opportunity.



Application deadline is 2/15/2015.

**OKLAHOMA
WATER RESOURCES CENTER**

USGS 104(b) State Grant Recipients Selected for 2015

Threats to the Lugert-Altus Irrigation District: Untangling the Effects of Drought, Land Use Change, and Groundwater Pumping

(Tyson E. Ochsner, Yohannes Tadesse Yimam, and Erik S. Kruger)

As of October 1, 2014, Lake Altus-Lugert, the primary water supply for the Lugert-Altus Irrigation District in southwest Oklahoma, was only 10% full, was recovering from a golden algae bloom, which killed all fish in the lake, and has not contained enough water to produce an irrigated cotton crop since 2010. Dr. Ochsner's team will investigate the relative importance of these various contributing factors (drought, upstream land use change, changing climate, and groundwater development) to better understand the drivers of change in this regionally-significant watershed.



Quantifying Streambank Erosion and Phosphorus Load for Watershed Assessment and Planning **(Dan Storm and Aaron Mittelstet)**

Sediment and nutrients are two primary pollutants to surface waters. In some watersheds streambank erosion is the main source of sediment. Excess sediment affects the water chemistry, aquatic organisms and the water clarity in our streams and reservoirs. A summary of the benefits from the proposed research include: 1) Provide local, state and federal agencies with accurate estimates of streambank erosion and phosphorus contributions for the Barren Fork Creek watershed, 2) Improve TMDLs and watershed based plans, 3) Test and assess a model that will be applicable to other watersheds throughout the world, and 4) Provide recommendations to watershed modelers and managers.

Optimizing the Economic Value of Water from the Ogallala used for Irrigation

(Jason Warren, Rick Kochenower, Jody Campiche, Rodney Jones, and Art Stoecker)

The Ogallala aquifer is a vital resource for the entire economy of the Oklahoma Panhandle. Agricultural irrigation is the primary use (86%) of water in the region overlaying the Ogallala aquifer. This water is used to produce a variety of crops, primarily corn. The objectives are to evaluate the yield and water use efficiency of corn, sorghum and wheat under a range of irrigation capacities and evaluate the profitability and production risks of these crops such that producers can make sound decisions on the utilization of their water resources.



DASNR Water Program Award Recipients Selected



Jason Warren



R. Scott Frazier



Saleh Taghvaeian



Sergio Abit

Drip, Sprinkler, and Sub-Surface Irrigation: Effects on Crop Yield, Aquifer Sustainability, and Salt Movement

The Oklahoma Onsite Wastewater Treatment Professional Education Program

OSU Stream Trailers Teach Vital Lessons about Streams and Rivers

(by Jonathan Anthony, DWRC staff writer)

How do rivers and streams behave over a stretch of time? What is the point of vegetation on the banks? How do activities upstream or downstream of my property affect the stream running through my land?

What if there was a reliable way to show the answers to these questions and more?

Marley Beem, pond extension specialist at Oklahoma State University (OSU), and Garey Fox, interim director of the Oklahoma Water Resources Center, recommend the OSU stream trailers. Stream trailers demonstrate the features and processes found in rivers and streams, including channeling and stream bank sloughing by using a recirculating water flow system and light-weight plastic grit (in place of soil).



As overseer of the stream trailer program, Beem has developed five major lessons that educators can teach with this simple tool.

1. *Why do streams curve and wind?*

The educator begins the demonstration by pumping water onto the bed and channels begin forming in the plastic grit. Water takes the path of least resistance, winding around obstacles in a phenomenon known as meandering. Even with a straight channel for the water to flow down, the trailer is effective in showing how creative water is at finding new pathways.

2. *Why does flooding happen and is it natural?*

By simulating a large rainfall event, stream trailers can replicate the flooding that results. Dr. Garey Fox explained, “the trailers are great at showing how flooding and erosion are natural. Streams are like living organisms and can’t be held in place.” Educators can also use this opportunity to show

how urban development can increase stormwater runoff and flooding. With small houses set up in the stream trailer’s floodplain, the viewer can see increased runoff impacting both the simulated stream and the downstream residences.

3. *Is streambank vegetation valuable?*

Small tree figurines and mesh fabric are used to show the viewers how plant life next to the stream can reduce streambank erosion. As water flows through the stream channel, this root network reinforces the bank like rebar in concrete. Marley Beem highlighted this as his favorite feature and uses it to demonstrate the value of streambank vegetation to landowners. “The erosion process is so gradual in the natural setting,” Beem said, “that we otherwise have a hard time seeing the vegetation is doing a job for us and often what we see as normal is not desirable.”

4. *What happens when streambank soil is eroded?*

Despite the help from streambank vegetation, portions of streambanks erode and fall into the river constantly. This mixture of soil and rock polluting the water is called sediment. It can be harmful to water quality by reducing the available sunlight and oxygen. Dr. Fox notes in his presentations, “this sediment is the biggest expense in water treatment. All of it has to be filtered out before the water is potable.”

5. *Can I play with the stream trailer to see what will happen if ...?*

Yes! Viewers are encouraged to manipulate the stream trailer features in creative ways. For example, Dr. Fox challenges his engineering students to try new experiments and install structures. When students build a bridge pier or abutment, the stream trailer is realistic enough to mirror the different holes formed when water flows around these structures. Even stream channels can be altered if students build structures to divert flow away from eroding banks and around a landowner’s property.

Outside the classroom, stream trailers are also effective for teaching the public. Dr. Fox is invited to bring a trailer to the annual FFA Convention to help recruit students into science, technology, engineering, and mathematics; ~2500 students, parents, and teachers see it annually. He also takes a trailer to a local elementary school’s outdoor day helping the students understand terms they learned in class, such as floodplains, deltas, erosion, or the mouth of the river.”

If you are interested in using a stream trailer to learn or teach, you can learn more at [here](#) or find your nearest source at <http://streamtrailer.okstate.edu>. If interested in having one constructed for yourself, [contact Marley Beem](#).

Conservation Conversation

(by Dr. Garey Fox, OWRC Interim Director)

As of the end of January 2015, [the US Drought Monitor](#) continues to show almost the entire state of Oklahoma in drought conditions. The impact of drought can be persistent. During drought conditions, soil moisture is depleted, which decreases the storage of water within the soil profile. Therefore, except during heavy rainstorms, the water that falls during rainfall events that would have produced runoff to refill our ponds, lakes, and reservoirs must first replenish this soil moisture. The drought monitor and our water information network available through Mesonet and USGS, for example, point to the immediate and long-term need to conserve water.

Our playlists, [Foundations of Oklahoma Water](#) and [Rangeland Drought](#) are excellent resources for learning more about the basics of hydrology and the need to conserve water. The Oklahoma Water Resources Center's website has a wealth of information available on its [Water Conservation page](#). There's also a link to a newly developed Think Water website (<http://water.okstate.edu/thinkwater>) on outdoor water conservation developed by Dr. Justin Moss.

Recently I attended an Oklahoma Cooperative Extension Service Youth Water Education In-Service in Ada. The event was organized by Cheryl Newberry, Southeast District 4-H Program Specialist, and Claude Bess, District Director of Extension for southeast Oklahoma. I am a strong believer in the need to empower our youth with information on water conservation similar to recent programs on solid waste reuse and recycling.

The Cooperative Extension Service is planning to organize a series of Oklahoma 4-H₂O Water Fairs, aimed at elementary students in grades two through five, in at least 10-20 schools across southeast and southwestern Oklahoma. The program builds upon success with Water Fairs as organized by Texas AgriLife in Guadalupe County, Texas. Extension educators, working with volunteers in the area, will organize the water fair around specific stations to educate students on the water cycle, indoor and outdoor water conservation, aquifers, and non-point source pollution.

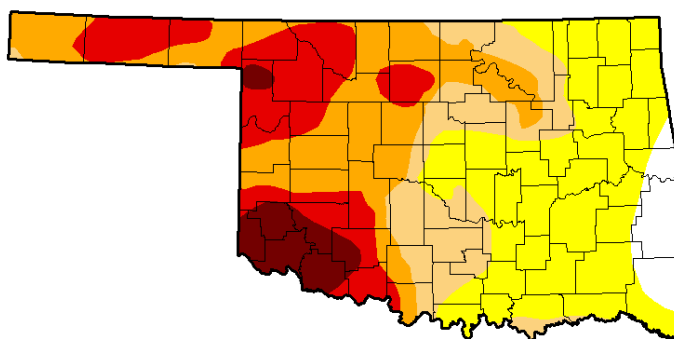
I am confident that this youth education program will be critical for helping the state of Oklahoma reach its goal of using no more freshwater in 2060 than it used in 2012 (from the Water for 2060 Act). The Cooperative Extension Service is uniquely positioned to carry out such youth water education programs through the work of our Extension educators! To learn more about the program, contact the [Water Center](#) or [Claude Bess/Cheryl Newberry](#) directly. And I am sure that the Extension educators would be extremely pleased to have volunteers help lead stations during the Water Fairs.



January 27, 2015
(Released Thursday January 29, 2015)
Valid 7 a.m. EST

Intensity:

- | | |
|-----------------------|--------------------------|
| D0 - Abnormally Dry | D3 - Extreme Drought |
| D1 - Moderate Drought | D4 - Exceptional Drought |
| D2 - Severe Drought | |



New & Noteworthy

Conferences/Seminars (water.okstate.edu)

- **Plasticulture Conference** (Okmulgee, 2/7@ 9:00 AM to 2/8 @ 3:00 PM)
- **Natural Resource Conference** (AFS/TWS meeting; Hyatt Regency, Tulsa, 2/11-13)
- **Financial Management for Small Water Systems workshop** (Tulsa, 3/5)
- **Seminar:** Richard Lowrance, EPA-Kerr Lab Director (Stillwater, 3/11)
- **Water Appreciation Day** (State Capitol, 3/11)
- **Student Water Conference** (Stillwater, 3/26-27/2015)

Job openings (water.okstate.edu/opportunities/employment)

- **Postdoctoral Research Associate** (USDA-ARS) in Stillwater, Oklahoma.
- **NSF-REU** (Research Experiences for Undergraduates), application deadline is 2/15/2015
- **Project Management/Research Internship** with Keep Oklahoma Beautiful
- **Water Supply Systems Manager**, City of Tulsa

Funding opportunities (<http://water.okstate.edu/opportunities/funding>):

- **NIWR-USGS National Competitive Grants (104G) Program** (application deadline is February 19, 2015)
- **NRCS Conservation Innovation Grants** (application deadline is February 24, 2015)

[WWWeb Updates]

- ◇ A "Dates & Deadlines" table on the [Home page](#) lists various cut-off dates so you don't miss out.
- ◇ Brace for Impacts: We are producing a series of articles in which researchers tell how Water Center grants impacted their research and career. Find them [here](#).
- ◇ We have a new video [about us](#) from the interim director, Dr. Garey Fox.
- ◇ A table with the most recent videos has been added near the top of the [video page](#). Now you never have to miss the latest release!
- ◇ Be the first to know about the latest additions! [Subscribe to the RSS feed](#).

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