

Water Supply Management in a Variable Climate

**Ken Crawford, Director
Oklahoma Climatological Survey
State Climatologist for Oklahoma
Regents' Professor of Meteorology**

The University of Oklahoma

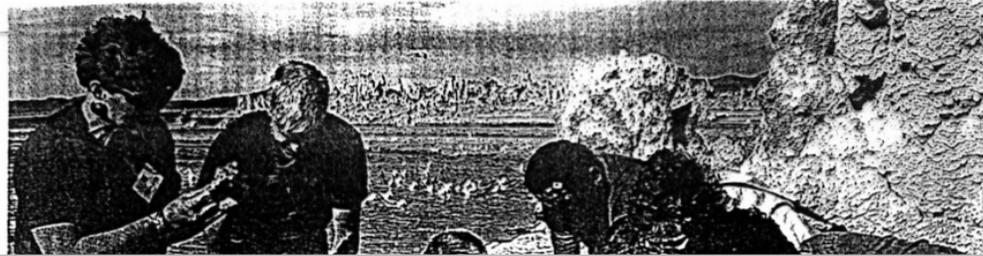
The Number One Societal Issue:Water.....



Why?

(The National Geographic - 1993)

Report from the President



“Unlike oil, there is no water alternative.”



LAUREN GREENFIELD

Water for Our Future: A New Society Initiative

Planet Earth faces a water crisis: Our freshwater supply is being used faster than nature can replenish it.

I am reminded of the great energy crisis of the early 1970s. Had we been prepared, that crunch might never have happened.

past decade from the High Plains Ogallala aquifer we have reduced reserves by an amount equal to the volume of Florida's 730-square-mile Lake Okeechobee.

The 30-foot limestone columns of northern California's Mono Lake are monuments to our unquenchable thirst, as teachers learned during a recent water workshop organized by the Society's Geography Education Program (above). The columns were uncovered as Los Angeles, 300 miles to the south, siphoned off Mono's water sources.

in November will focus on water use, quality, and conservation.

- A November Television Special on PBS will include sequences about the Colorado River, Great Lakes, Columbia River, and Everglades.
- EXPLORER TV program segments will address water issues.
- A new classroom film will teach students how to conserve water.
- WORLD and TRAVELER magazines will both feature freshwater themes.
- With support from the Seaver Institute we have granted \$360,000 for freshwater studies, which will

Surely This Problem is Decades Ahead?

Well...No, Its Not.

Consider Headlines Already Being Written

Barge operators can count their losses Script

11/15/92

in, Oklahoma

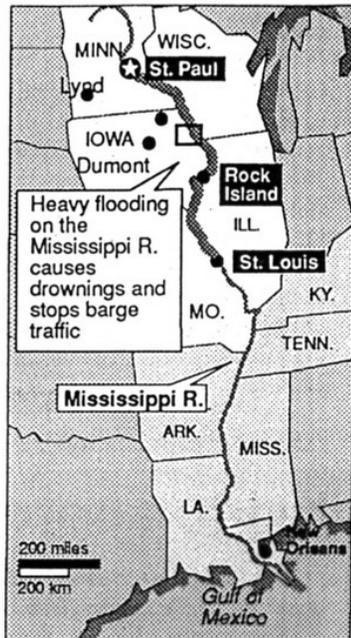
104th Year — No. 126 — Sunday 75¢

BUFFALO, Iowa (AP) — Bob Niemela stared dolefully at 160,000 tons of limestone that won't be going anywhere soon because of the rain-swollen Mississippi River.

"It's terrible. We're left out at our busiest time for the river," said Niemela, general manager of Linwood Mining and Minerals Corp.

Behind the small mountain of rock, the Mississippi surged beyond its banks, a rare summer flood that's halted commercial traffic along a 500-mile stretch of the river from St. Paul, Minn., to St. Louis, and inundated some Midwest towns and farms.

The shutdown has left barge operators counting their losses and companies scrambling to stay in business.



AP/Carl Fox

course of action could be a disaster emergency, offer loans to repay government. Governors of Minnesota, South Illinois are seeking assistance Wisconsin Governor Thompson estimates 30 million, including farm fields and crops.

Sally Fritz and her husband gave Espy a brief tour of their muddy 1,400 acre farm in southwestern Wisconsin.

"Other than the drought of 1988, this is probably the worst we've seen," Fritz said.

In Prairie du Chien, Wis., the

Water shortage looms for world

WASHINGTON (AP) — Water, water everywhere, but croplands, cities and some whole countries are drying up. Not just drought and global

triple since the 1950s, and 26 countries now have more people than their water supplies can adequately support, said Ms. Postel at a news conference. Ms.

Jerusalem.

But, despite water-saving drip irrigation systems pioneered in Israel and other efforts, the book points to a looming crisis in the

► PIPELINES

More water wars feared as the West goes dry

The recent move by Oklahoma City to raise its water rates to residential and commercial users and to surrounding cities that are also customers reflects the nation's

USA Today newspaper reports that more pipelines like the one proposed for Nevada are needed as the population shifts from rural areas to larger cities. The pipeline

Even More Headlines (The National Geographic)

Supply
CASE STUDY

California:

BY RICHARD CONNIFF
PHOTOGRAPHS BY RICK RICKMAN

■ Oasis Green was the color of choice when landscaper Les Robin painted this parched lawn in Santa Barbara during the state's six-year drought. Using a biodegradable dye, he supplies a touch-up kit

IT WAS AN AUTUMN MORNING before dawn, under a plum black [redacted] ducks and the *yack-yack-yacking* of mallards. As we passed, the birds seethed up off the water with a sound like waves breaking. I was here in the Sacramento Valley to consider the Nature Conservancy's unorthodox proposition that growing rice in California might not be such a dumb idea after all. Once maligned by environmental



ENJAMIN FRANKLIN quoted those prophetic words nearly two and a half centuries ago, when America's wells—both literally and figuratively—overflowed with water. Today those same wells are in danger of running dry, and along with the rest of the world we face a critical shortage of clean, fresh water. The problem is not the *supply* of water; earth has virtually the same amount today as it did when dinosaurs roamed the planet. Ninety-seven percent of that supply is in the form of salt water. Only 3 percent is fresh, and two-thirds of that is ice. The problem is simply people—our increasing numbers and our flagrant abuse of one of our most precious, and limited, resources.

“When the wells know the worth of water”

Introduction

Consider the Reservoir at Lake Mead, NV



“The lake ... has a 50% chance of becoming unusable by 2021 ... if demand for water remains unchanged and if human-induced climate change follows. ... ‘We have 90% of our water supply coming from Lake Mead’.”

*NY Times
February 13, 2008*

An Even More Ominous Headline...

“Nuclear reactors across the southeast could be forced to throttle back or temporarily shut down later this year because drought is drying up the rivers and lakes that supply power plants with the awesome amounts of cooling water they need to operate.” ... **“Water is the nuclear industry’s Achilles’ heel.”** ... “Lake Norman near Charlotte is down to 93.7 feet — less than a foot above the minimum set in the license for Duke Energy Corp.’s McGuire nuclear plant.” ... “It would cost 10 times that amount [\$5-7per megawatt hour] if you had to buy replacement power — especially during the summer.”

**Associated Press
January 24, 2008**

Recent CNN Headline

Thirsty World: Desperate Quest for Water

October 20, 2008

The price for our failure to provide universal safe water and sanitation will be paid by the poorest populations of the world in sickness, lost educational and employment opportunities, and, for a staggeringly large number of people, early death. This is morally unacceptable in a world that values equity and decency. But at present, it appears unavoidable unless we can muster the will and commitment to provide clean, safe water for all.

Why Now?

APRIL 3, 2006

www.time.com AOL Keyword: TIME

SPECIAL REPORT GLOBAL WARMING

TIME

**BE
WORRIED.
BE **VERY**
WORRIED.**

Climate change isn't some vague future problem—it's already damaging the planet at an alarming pace. Here's how it affects you, your kids and their kids as well

EARTH AT THE **TIPPING POINT**
HOW IT THREATENS YOUR **HEALTH**
HOW **CHINA & INDIA** CAN HELP
SAVE THE WORLD—OR DESTROY IT
THE CLIMATE **CRUSADERS**



APRIL 9, 2007

**Living with
Cancer**
The changing science



**Beyond
Baghdad: Where
The Enemy Has
Its Own Surge**



**The Sopranos'
Last Song:
What Exit Will
Tony Take?**

TIME

SPECIAL DOUBLE ISSUE



**The
Global Warming
Survival Guide**

51 Things You Can Do to Make a Difference

www.time.com

The Growing Consensus

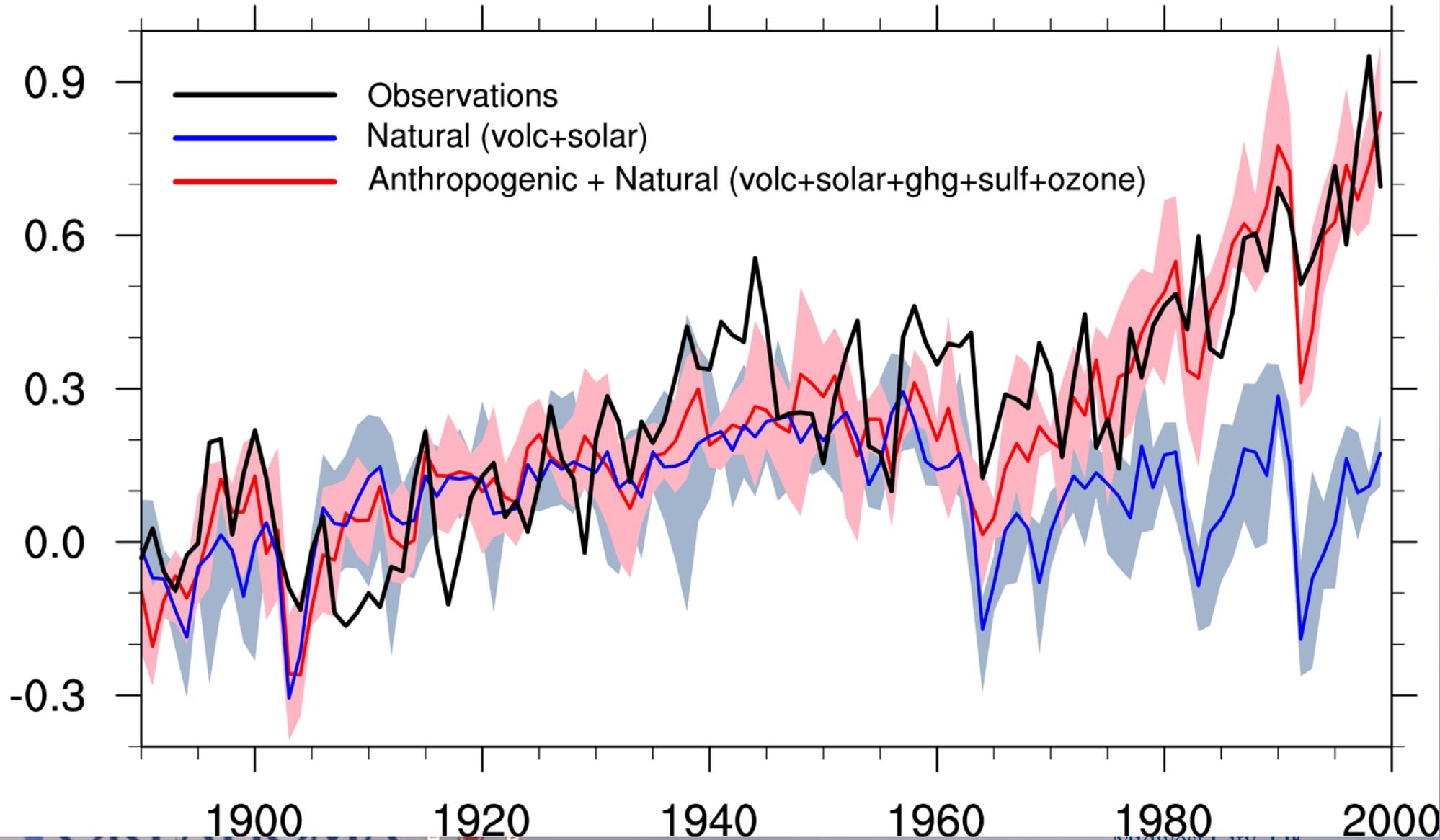
“warming of the climate system is unequivocal”

and

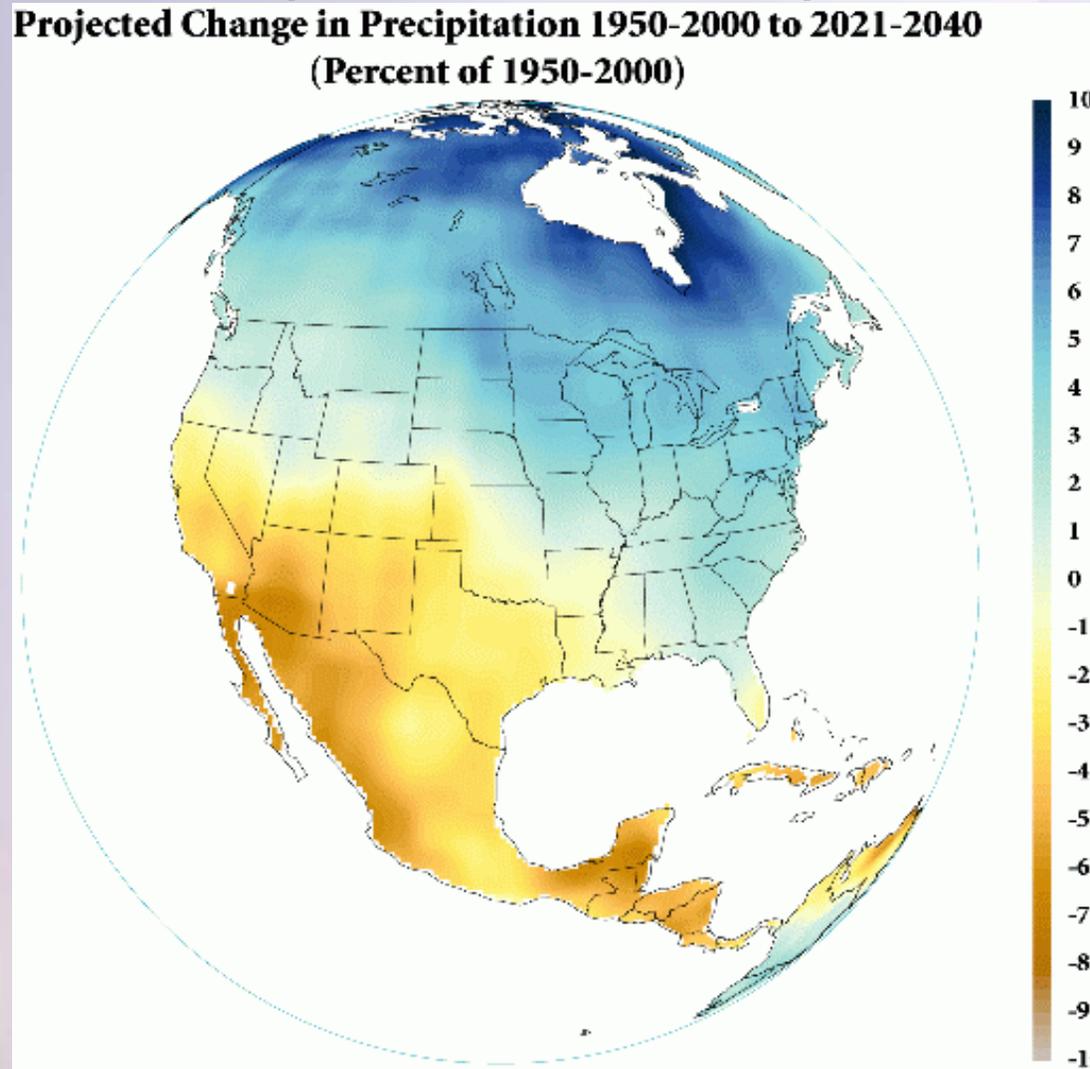
“very likely due to human activities”

Simulation of 20th Century Warming

Global Temperature Anomalies
from 1890-1919 average



Zoom to North American Precipitation ***(Valid 2021 – 2040)***



Average of 19 different climate models (2007)

The Bottom Line

***“Water is the delivery mechanism
of most climate change impacts”***

***Kathy Jacobs
Executive Director
Arizona Water Institute***

The Bottom Line

Fortunately in Oklahoma....

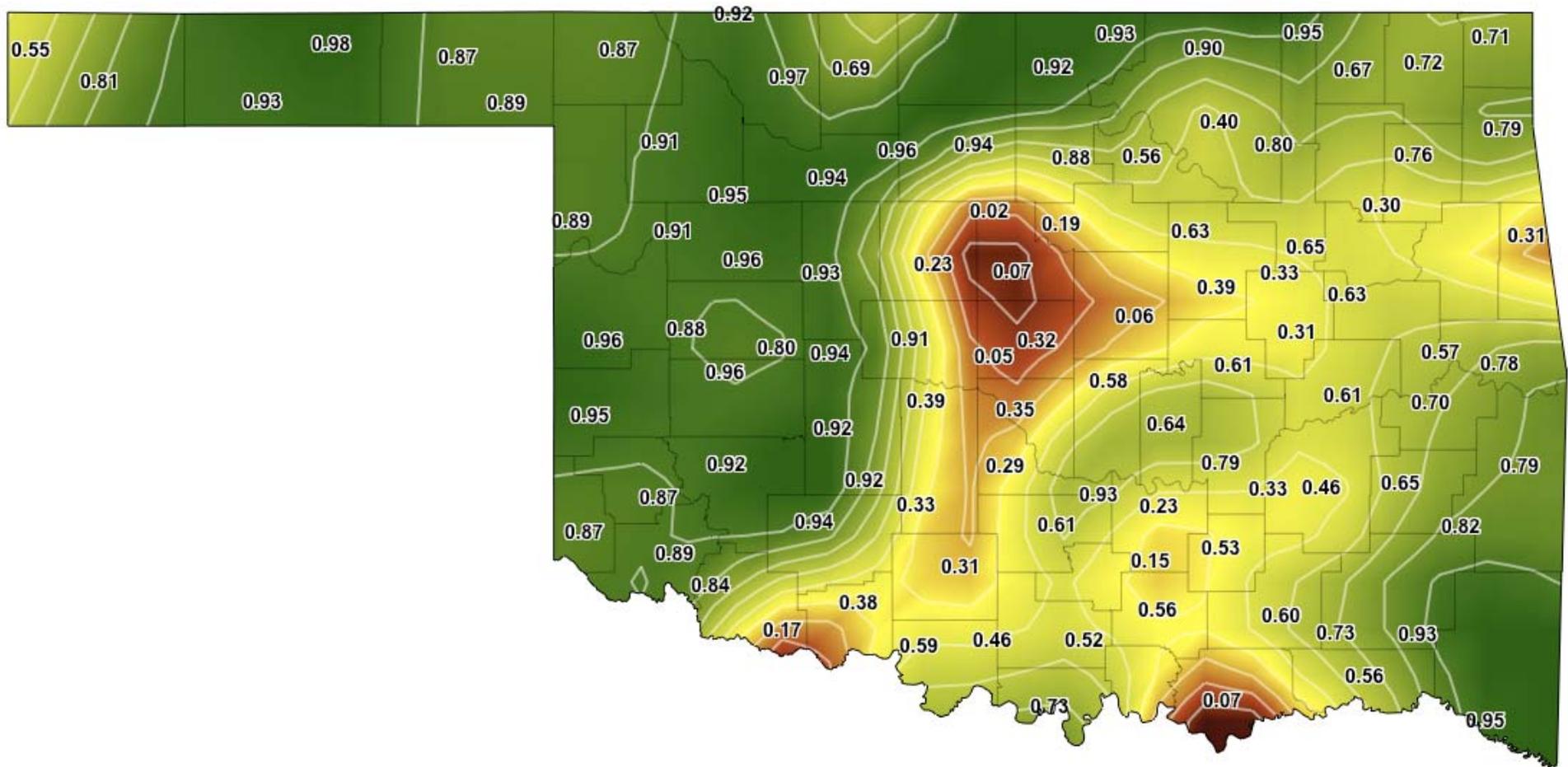
We Have The Oklahoma Mesonet!

Soil Water in the Bank

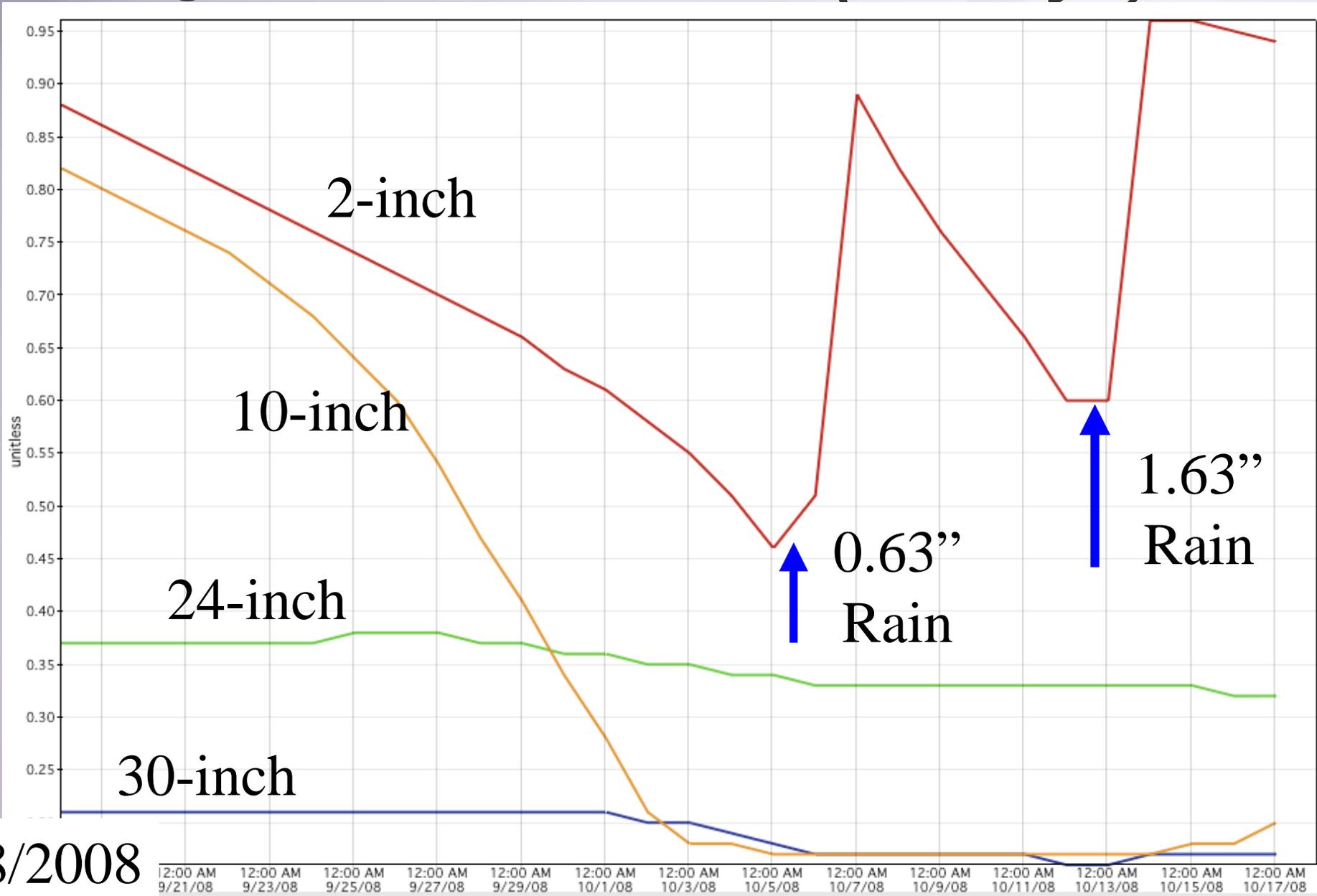
October 18, 2008 — 25 cm or 10 inches

10-in. Soil Moisture (25cm)

Sat, 10/18/2008



Kingfisher Soil Moisture (30 days)

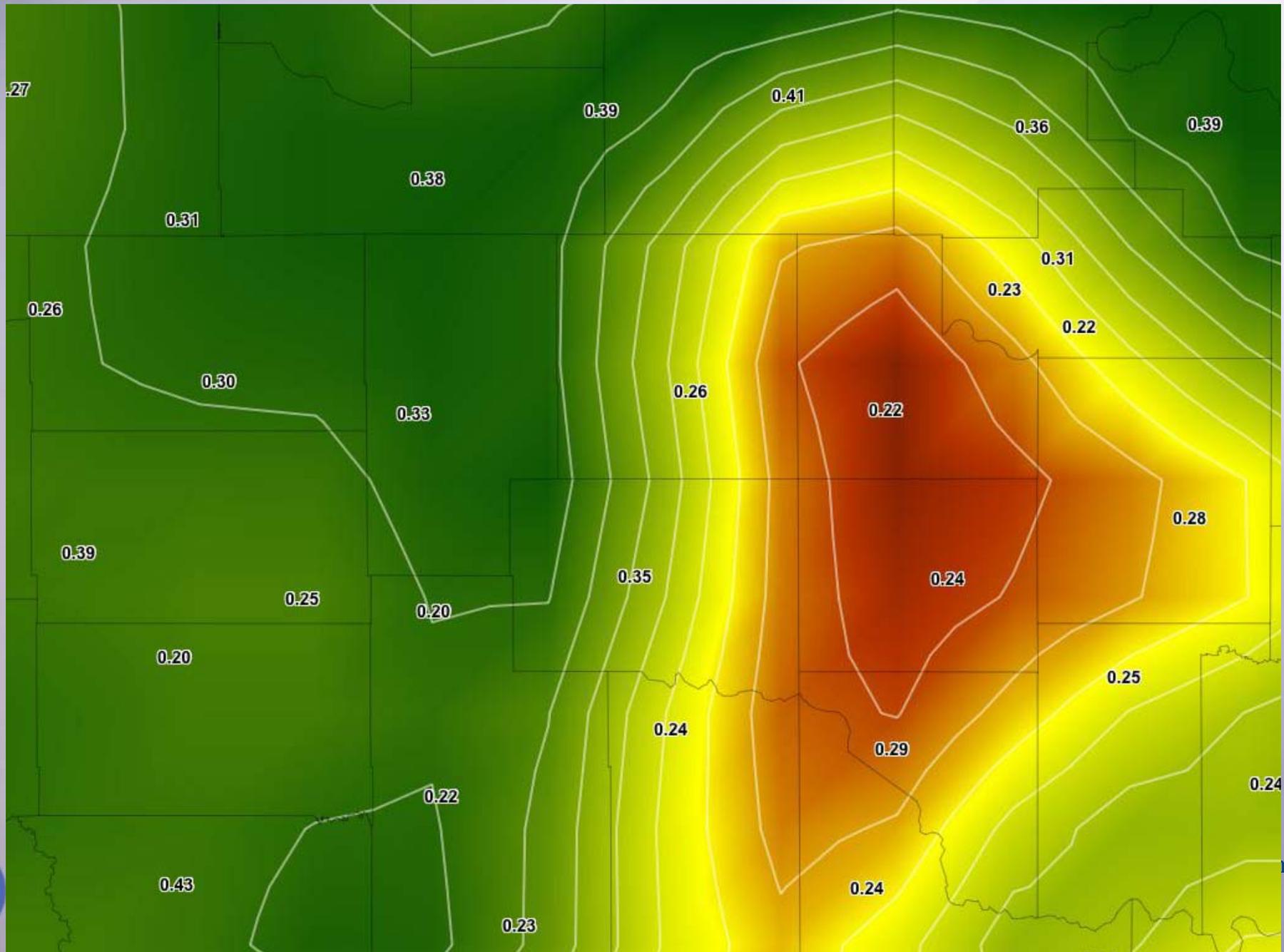


9/18/2008

12:00 AM 9/21/08 12:00 AM 9/23/08 12:00 AM 9/25/08 12:00 AM 9/27/08 12:00 AM 9/29/08 12:00 AM 10/1/08 12:00 AM 10/3/08 12:00 AM 10/5/08 12:00 AM 10/7/08 12:00 AM 10/9/08 12:00 AM 10/11/08 12:00 AM 10/13/08 12:00 AM 10/15/08 12:00 AM 10/17/08

Soil Water in the Bank

October 26, 2008 — 25 cm or 10 inches



The New Oil — WATER



Thank You