

# NGWMN Meeting

Dec. 5-8<sup>th</sup> 2016

Oklahoma Water Resources Board

Water Quality Programs Division

Mark Belden, Groundwater Monitoring  
Section Manager

# Monitoring Goal

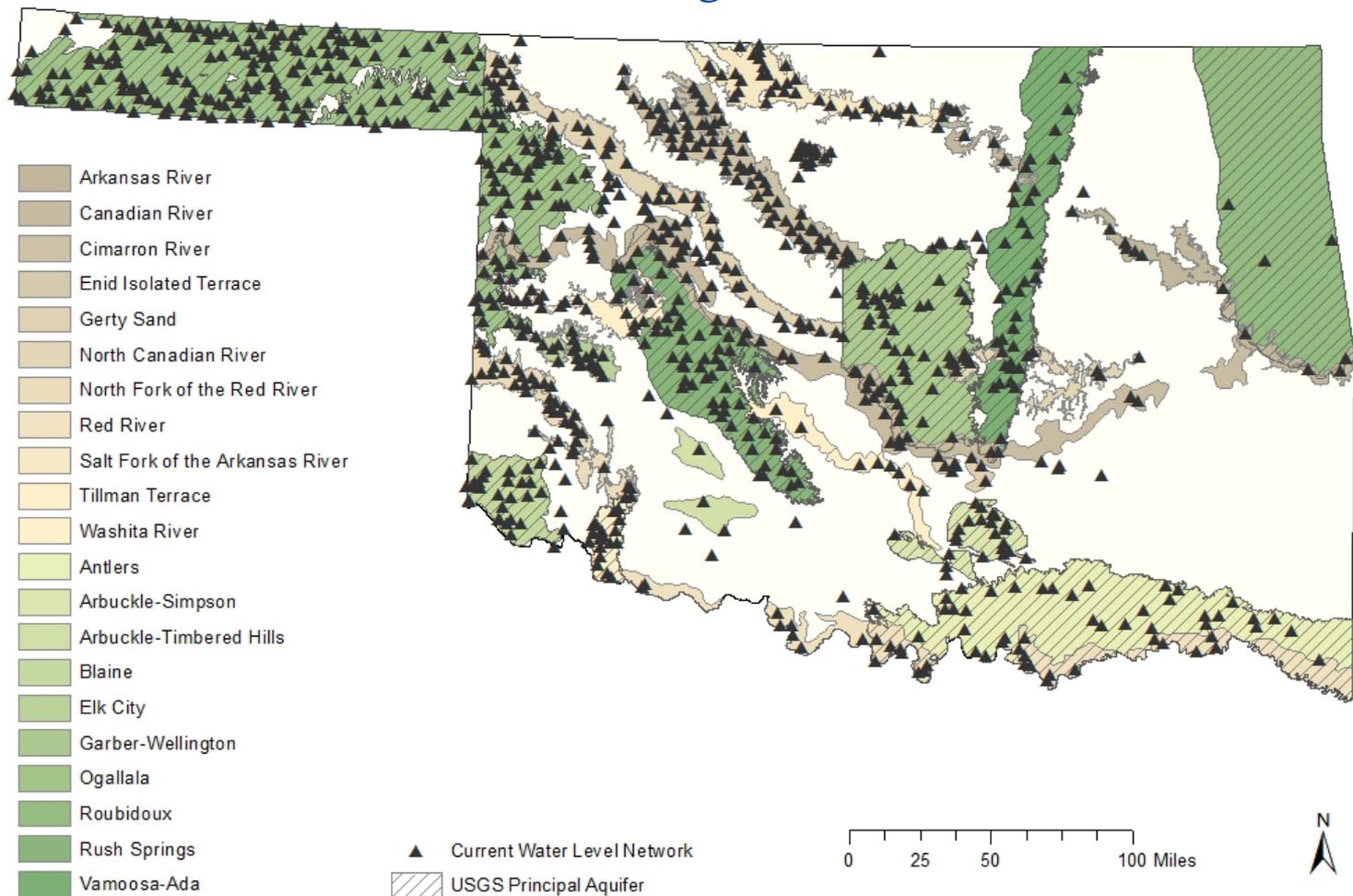
Provide technical data to support Oklahoma's water planning and management decisions to develop, maintain and secure a long-term future supply of water for the citizens of Oklahoma.

# OKs GW Monitoring Networks

- Groundwater level network sites
  - Trend-annual 900+ wells
  - Trend-seasonal 450+ wells (3 measurement periods)
  - Trend Continuous Recorders 25 wells (3 download periods)
- Groundwater quality network sites
  - Baseline 650+ wells (phased in since 2013) with one more round scheduled for 2017
  - Trend Network (implementation planned for the Fall of 2018) with 125 to 150 wells anticipated to compose this network.
- The baseline results will inform site and parameter selection for the trend network.

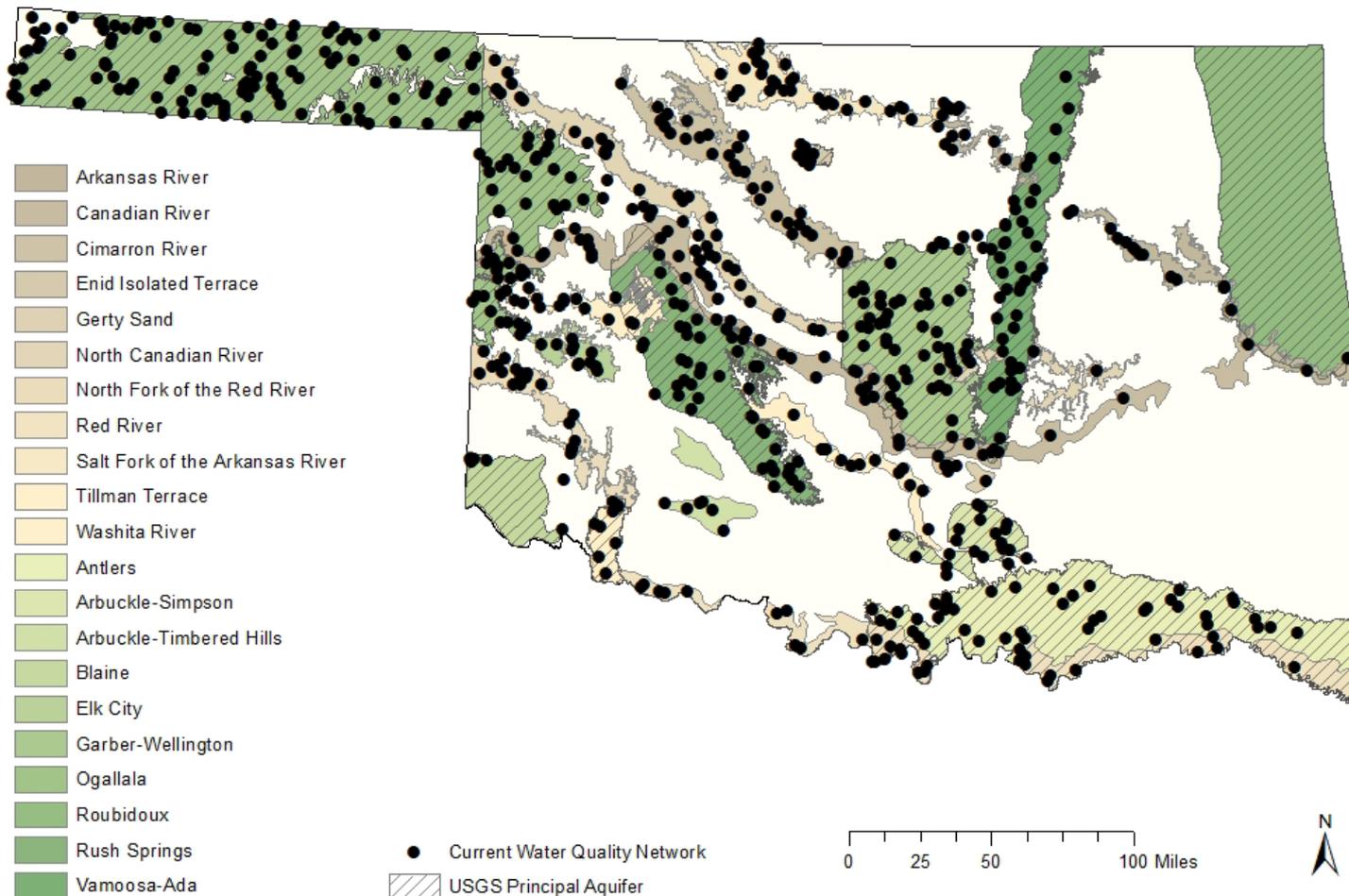
# Current Water Level Network

Trend water level sites for Groundwater Monitoring and Assessment Program (GMAP)



# Current Water Quality Network

Baseline water quality sites for Groundwater Monitoring and Assessment Program (GMAP)



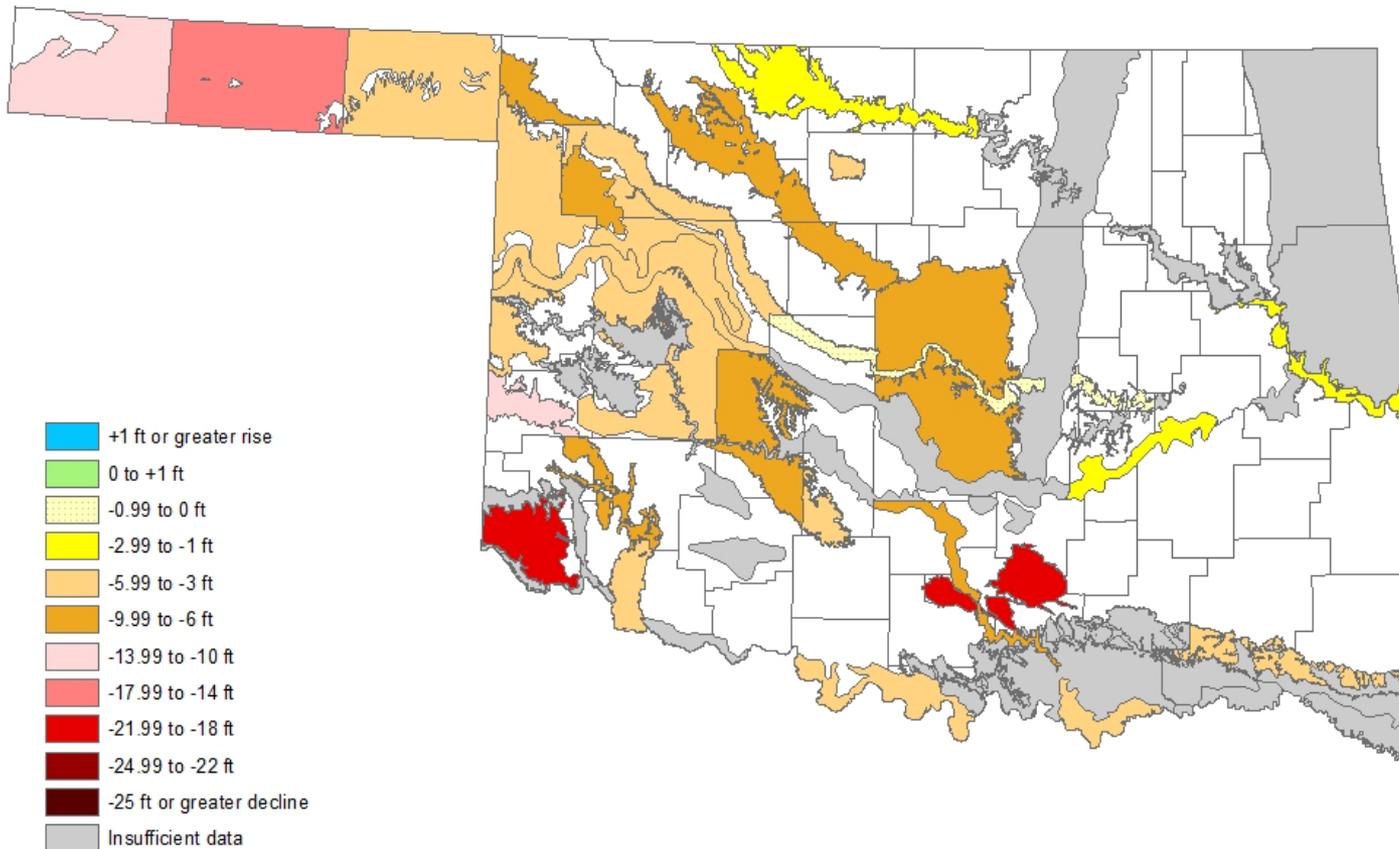
# Applications of Monitoring Data

- Capacity to meet future water supply demands
  - Quantity data collection
  - Application of quality data
- Capacity to meet assigned beneficial uses
- Accurate appropriation and allocation
- Improved water quality protection
- Drought contingencies/mitigation of drought

# Data Uses

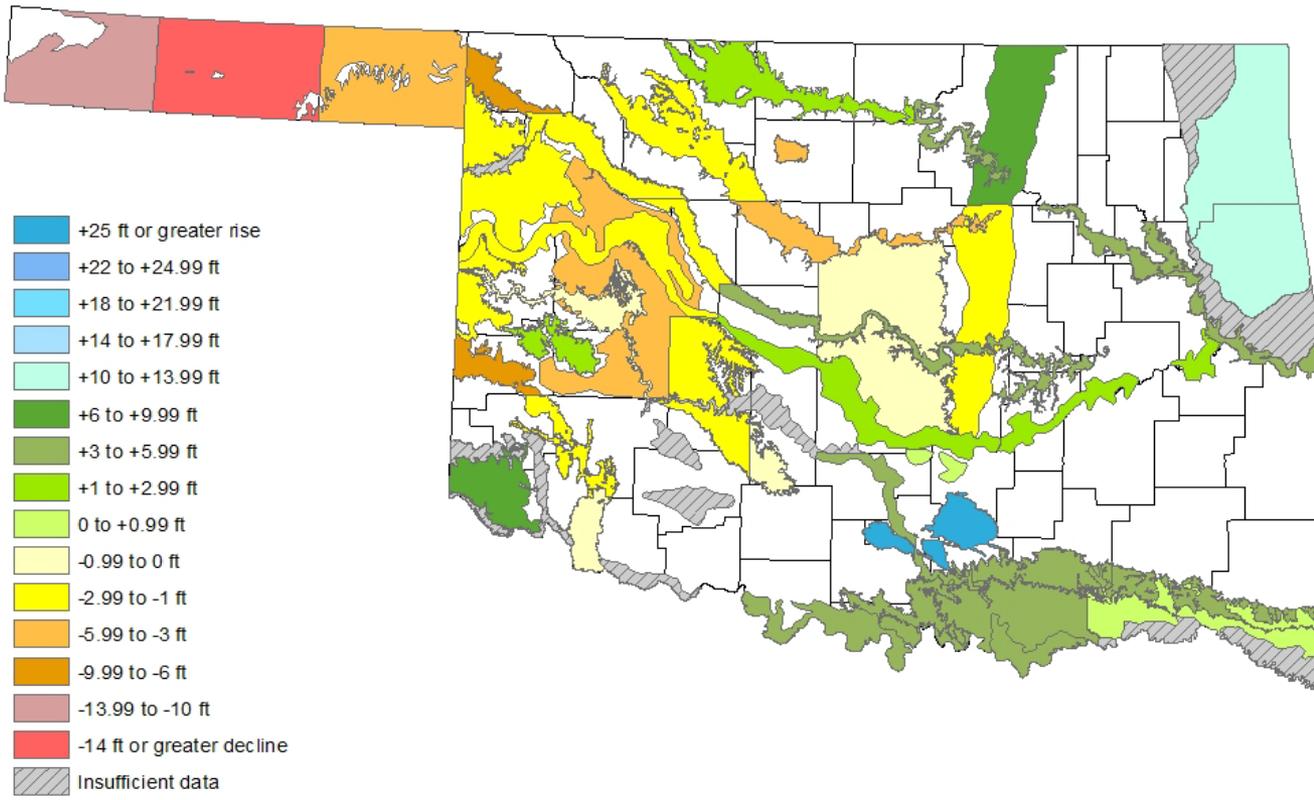
- Trends in groundwater levels related to drought/water use patterns.
- Hydrologic data for aquifer storage/yield studies.
- Beneficial use status/attainment.
- Characterization of groundwater quality.
- Water quality trends.
- Water supply forecasting.
- Inform decision making and technical research.
- Inform enhancements to GW quality standards.
  - Classification/Vulnerability/Criteria

# Data Use



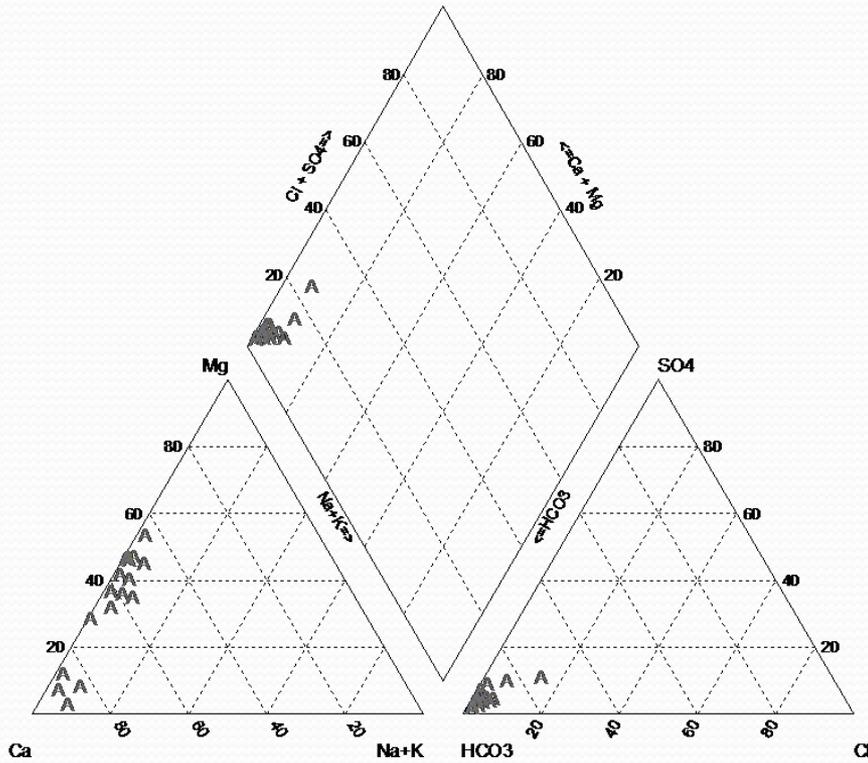
Statewide ten-year changes in water level by aquifer and climate region, 2005-2015

# Data Use

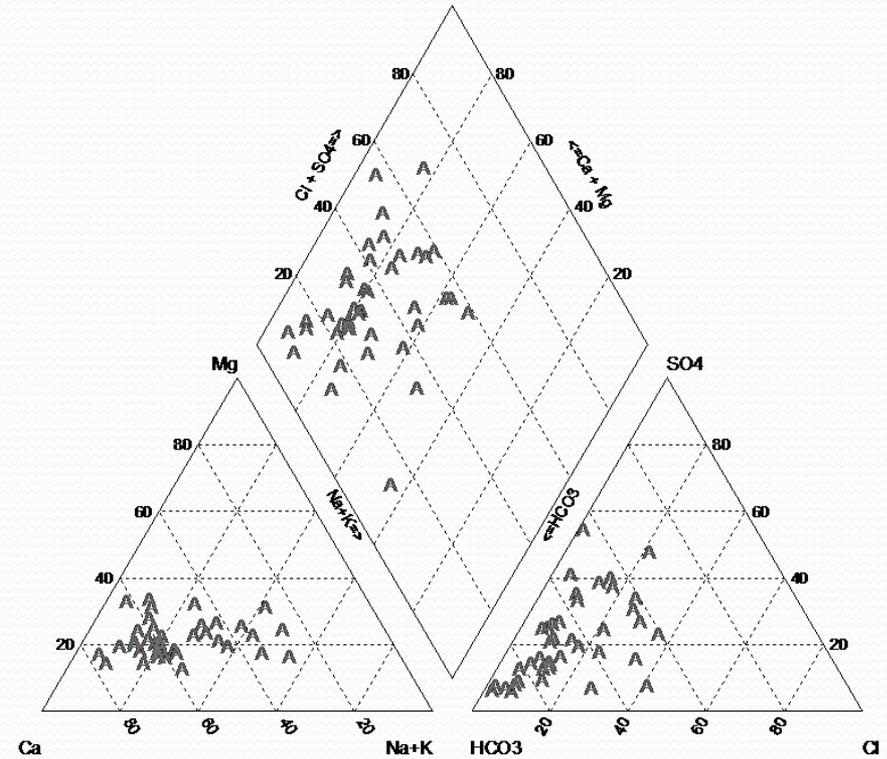


Statewide ten-year changes in water level by aquifer and climate region, 2006-2016

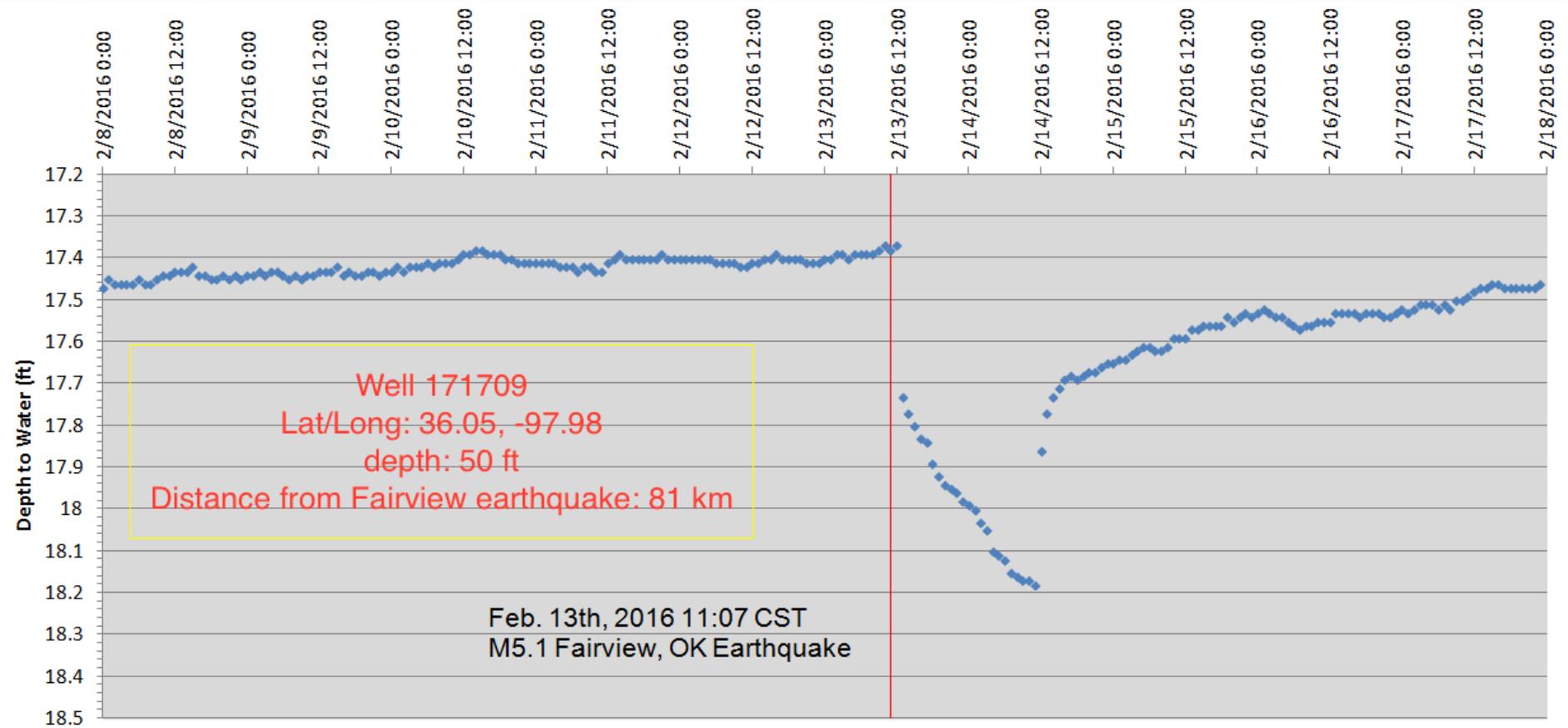
# Data Use



Piper plot of the Arbuckle-Simpson aquifer (sampled 2015)



Piper plot of the North Canadian alluvial & terrace aquifer (sampled 2015)



# “Potential” Earth Quake Signature Captured by CREC

(provided by Chi-Yuen Wang, University California at Berkley), November 2017



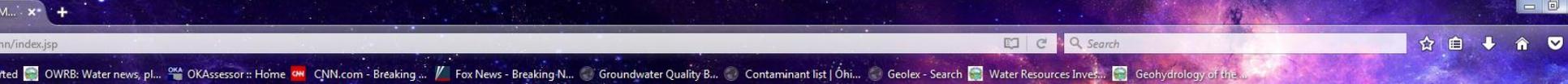
# OK's Current NGWM Project

- Includes 10 wells in 2 federal principal aquifers
  - Rush Springs - 5 wells
    - SubCats: 2 Suspected Change, 1 Background, 2 N/A
  - Central Oklahoma - 5 wells
    - Subcats: 4 Suspected Change, 1 N/A
- All wells constitute “back bone” wells
- Wells are equipped with continuous monitoring pressure transducers logging/recording hourly

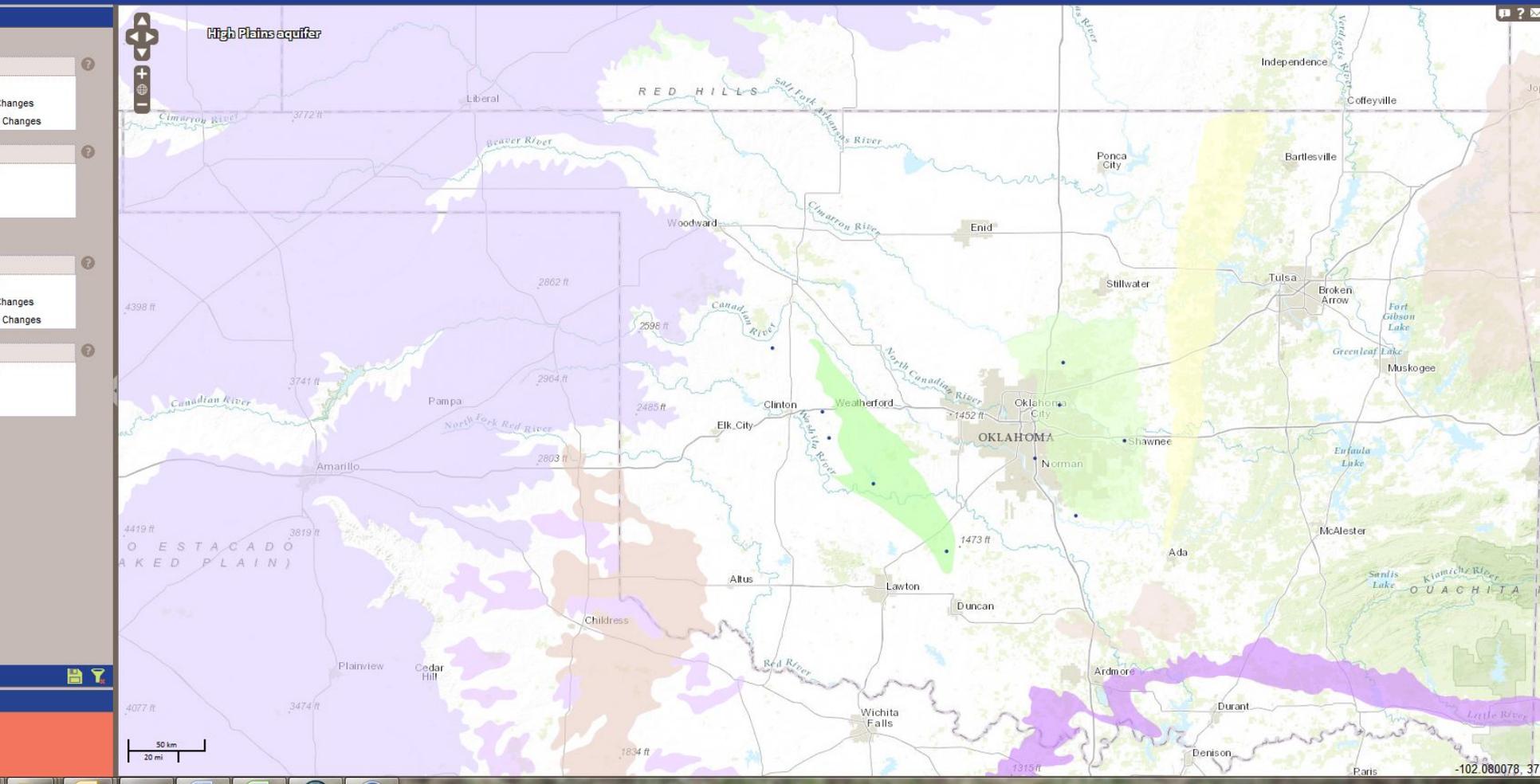
# Oklahoma's Current Project cont.

- Field data is downloaded 3 times a year.
- Data is uploaded to Aquarius time-series data base
- Post processing in Aquarius prior to approval to the portal will include:
  - Apply corrections to time-series related instrument drift
    - Confirm that drift is “normal” and not indicator of instrument malfunction.
  - Review the yet to be established QA flags (based on historical knowledge of the aquifer)
  - Assign an overall grade to the time series (definition of grade(s) has not been established.
- IT is currently working on connection between Aquarius and the USGS portal
- Data Availability –Pending? May have something to report Thur.
- Only water level data will be available (for now)
  - Lithologic/well construction data housed in a separate database

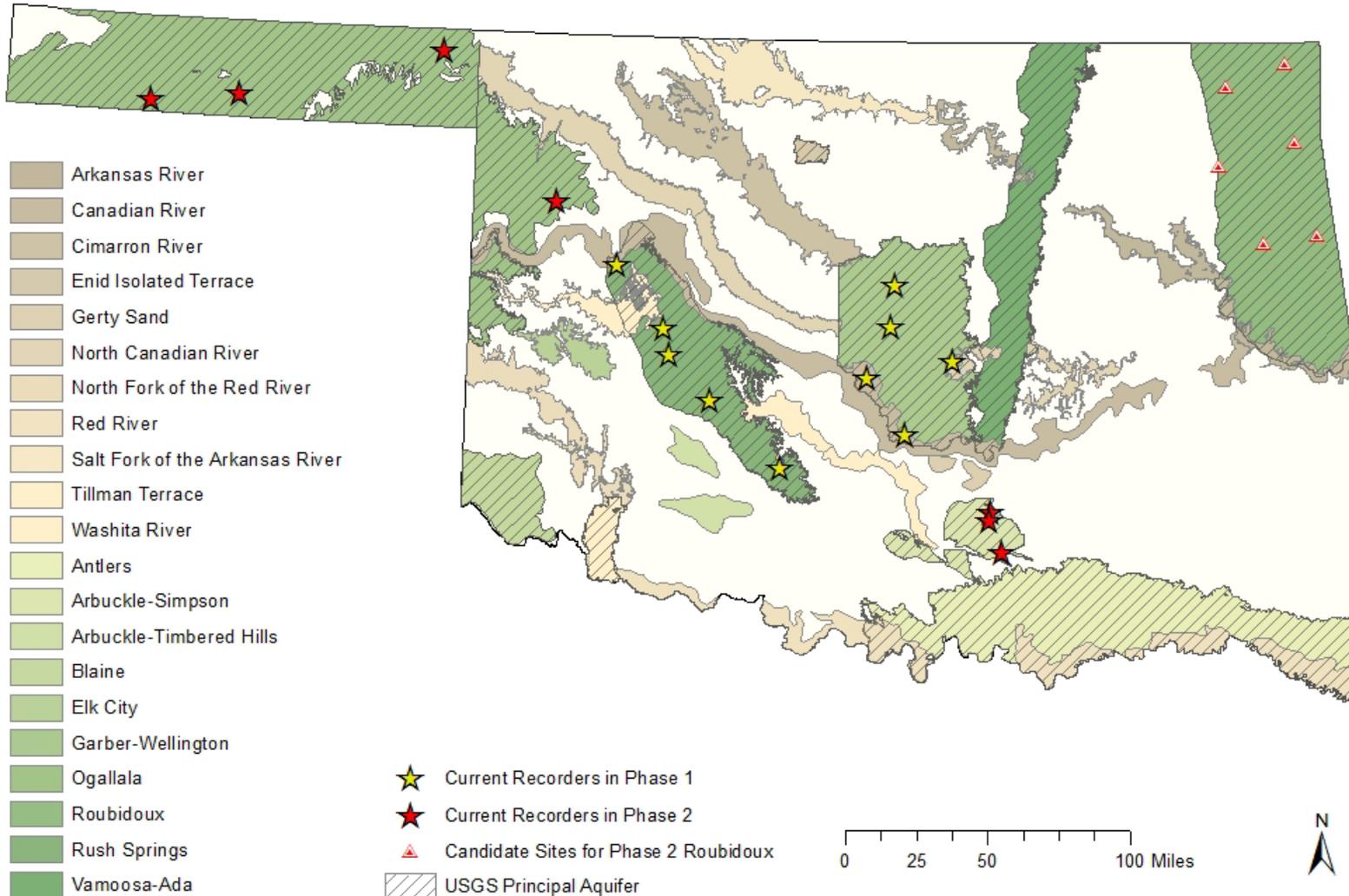
# USGS Portal – Rush Springs & Central OK Aquifers



## National Ground-Water Monitoring Network



# NGWMN Project Wells



# NGWMN Site Selection Criteria

- State program wells (most w/3 or more years of data)
- Spatiality and aquifer boundaries
- Landowner permission
- Unused with no plans for use in near future
- Secure from public
- NGWMN sites are chosen from these dedicated recorder sites
- Meets USGS 1/1000 mi<sup>2</sup> density requirements (that's what is great about CRECs!)
- Metadata for most sites are complete

# NGWMN Well Classification

1. Period of Record for the site; when a recorder was installed (less than 5 yrs, sub-cat not classified)
2. Visualized using GIS, aerial maps, & site field notes
3. Within a 3 mile radius:
  - Land use
  - Major landmarks
  - Surface waters
  - Proximity to cities
  - Potential sources of contamination (O&G; Ag; etc)
  - # reported well logs
  - # permits for groundwater usage
  - # permits for stream water diversion

# Differences in Protocol

- Field visits on recorders are every 12-16 weeks - not 6-8 weeks.
- Catching up meta data for sites maintained by another department in agency.

# Plans to Enhance the NGWMN

## Plans

drilling of observation wells in Ozark Plateaus Aquifer

Connectivity to the Oklahoma Climate Surveys Mesonet to capture/provide real-time data (through the Mesonet web site)

Spring/Summer of 2017 (Project Costs 95K)

## Status

pending landowner permissions

pending bid solicitations - commercial driller with experience drilling in the aquifer

## Methods

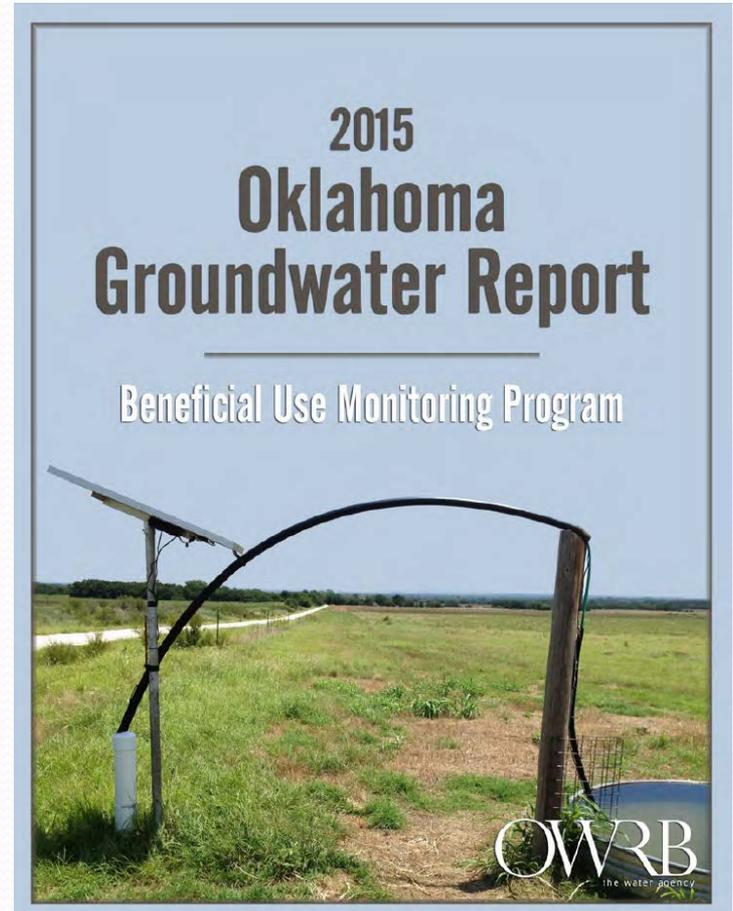
Air rotary; drilling depths from 950-1,250 feet.

Isolation of Ozark aquifer from Spring field aquifer with casing/annular seal

Geophysical logging?

# Where to Find OWRB Data

- <http://www.owrb.ok.gov/gmap>
- Report for GMAP 2015 sampling activities
  - Archived reports available on GMAP map viewer
- Aquifer summaries
- Resources for private citizens
- Links to state and federal technical studies, compliance monitoring programs, etc.



# Where to Find Data

The screenshot shows the OWRB website interface. On the left is a dark blue navigation menu with the following items: Water Use Permitting, Financial Assistance, Well Drilling, Water Quality Standards, Monitoring & Assessment, Groundwater Studies, Surface Water Studies, Dam Safety, Floodplain Management, Drought Monitoring, and Data & Maps. The main content area is titled 'Interactive Maps & GIS Data' and contains several map preview cards. Each card includes a small map thumbnail, a title, a brief description, and a link to the 'GIS Data'. The cards are: 1. 'OWRB General Viewer' (description: 'This map includes layers from the old WIMS viewer.'). 2. 'Dam Inventory of Oklahoma' (description: 'Dam Inventory GIS Data'). 3. 'Floodplains in Oklahoma' (description: 'Floodplain GIS Data (FEMA)'). 4. 'Garber-Wellington Groundwater Wells with Maximum Trace Metal Concentrations' (description: 'Groundwater GIS Data'). 5. 'Groundwater Level Monitoring Wells in Oklahoma' (description: 'Groundwater GIS Data'). 6. 'Groundwater Monitoring & Assessment Program (GMAP)' (description: 'Groundwater GIS Data'). To the right of these cards is a 'Frequently Requested Maps' section with a list of links: Lakes of Oklahoma, Rural Water Systems, National Wetlands Inventory (NWI) Mapping Project, Historic Flood Maps, Bathymetric (Contour) Lake Maps, Arbuckle-Simpson Hydrology Study GIS Data, Viewing GIS Data, Cooperative Water Planning Tool (DEQ) [NEW], Spatial Data Sets for Water (USGS), Center for Spatial Analysis (OU), Oklahoma GIS Council, USGS Oklahoma District GIS, and South Central Arc Use Group. Two red arrows point from the right side of the image towards the 'Groundwater Level Monitoring Wells in Oklahoma' and 'Groundwater Monitoring & Assessment Program (GMAP)' cards.

**Interactive Maps & GIS Data**

**OWRB General Viewer**  
This map includes layers from the old WIMS viewer.  
[OWRB GIS Data](#)

**Dam Inventory of Oklahoma**  
[Dam Inventory GIS Data](#)

**Floodplains in Oklahoma**  
[Floodplain GIS Data \(FEMA\)](#)

**Garber-Wellington Groundwater Wells with Maximum Trace Metal Concentrations**  
[Groundwater GIS Data](#)

**Groundwater Level Monitoring Wells in Oklahoma**  
[Groundwater GIS Data](#)

**Groundwater Monitoring & Assessment Program (GMAP)**  
[Groundwater GIS Data](#)

**Frequently Requested Maps**

- Lakes of Oklahoma
- Rural Water Systems
- National Wetlands Inventory (NWI) Mapping Project
- Historic Flood Maps
- Bathymetric (Contour) Lake Maps
- Arbuckle-Simpson Hydrology Study GIS Data
- Viewing GIS Data
- Cooperative Water Planning Tool (DEQ) **NEW**
- Spatial Data Sets for Water (USGS)
- Center for Spatial Analysis (OU)
- Oklahoma GIS Council
- USGS Oklahoma District GIS
- South Central Arc Use Group

<http://www.owrb.ok.gov/maps>

# Where to Find Data

Technical Reports | Oklaho... x +

www.owrb.ok.gov/studies/reports/reports.php

theoklahomawaterresourcesboard

thewateragency

| Skip Nav | Rules | Forms | FAQ | Board Meetings | Reports | OCWP | About Us | News |

Water Use Permitting

Financial Assistance

Well Drilling

Water Quality Standards

Monitoring & Assessment

Groundwater Studies

Surface Water Studies

Dam Safety

Floodplain Management

Drought Monitoring

Data & Maps

## Technical Reports & Publications

OWRB technical reports and publications are listed by topic and publication date below. Out of print publications may be available for loan from your public library.

Groundwater | Stream Water Availability | Water Quality Monitoring | Lake Restoration | Water Quality Standards  
Bathymetric Surveys | Oklahoma Comprehensive Water Plan | Drought | OWRB Annual/Status Reports | Out of Print Publications

Groundwater	Date
Hydrogeological Framework, Numerical Simulation of Groundwater Flow, and Effects of Projected Water Use and Drought for the Beaver-North Canadian River Alluvial Aquifer, Northwestern Oklahoma	2015
Hydrogeology and Simulation of Groundwater Flow in the Garber-Wellington Aquifer	2013
Hydrogeology and Simulation of Groundwater Flow in the Arbuckle-Simpson Aquifer	2011
Arbuckle-Simpson Hydrology Study Final Report to the US Bureau of Reclamation	2009
Hydroclimatic Reconstruction of the Arbuckle-Simpson Aquifer using Tree Rings	2009
Arbuckle-Simpson (FFY 2007) Hydrology Study Annual Report	2008
Arbuckle-Simpson (FFY 2006) Hydrology Study Annual Report	2007
Arbuckle-Simpson (FFY 2005) Hydrology Study Annual Report	2006
Hydrogeologic Investigation of the Ogallala Aquifer in Roger Mills & Beckham Counties, Western Oklahoma	2002
Update of the Hydrologic Survey of the Tillman Terrace Groundwater Basin, Southwest Oklahoma	2002
Impact of Concentrated Animal Feeding Operations on Oklahoma City's Water Supplies	2002
Hydrogeologic Investigation Report of the Boone Groundwater Basin, Northeast Oklahoma	2001
Hydrogeologic Investigation Report of the Kiamichi, Potato Hills, Broken Bow, Pine Mountain, and Holly Creek Minor Groundwater Basins in Southeast Oklahoma	2001
Groundwater Levels in Observation Wells in Oklahoma, 1998-2000	2001
Hydrologic Report of the El Reno, Fairview, Isabella and Loyal Minor Groundwater Basins in Central Oklahoma	2000
Rapid Recharge of Parts of the High Plains Aquifer Indicated by a Reconnaissance Study in Oklahoma (OWRB/USGS)	2000
Water Flow in the High Plains Aquifer in Northwestern Oklahoma (OWRB/USGS)	2000
Groundwater Level Changes in Oklahoma, 1978-1998	1999
Hydrologic Report of the Woodbine, Marietta, and Texoma Minor Bedrock Groundwater Basins and the Haworth Terrace and Utile River Alluvial and Terrace Minor Groundwater Basins	1998
Statewide Groundwater Vulnerability Map of Oklahoma	1999
Vulnerability Assessment of Twelve Major Aquifers in Oklahoma	1998
Hydrologic Report of the Southwest Oklahoma Groundwater Basin in Caddo, Kiowa and Jackson Counties	1998

<http://www.owrb.ok.gov/reports>