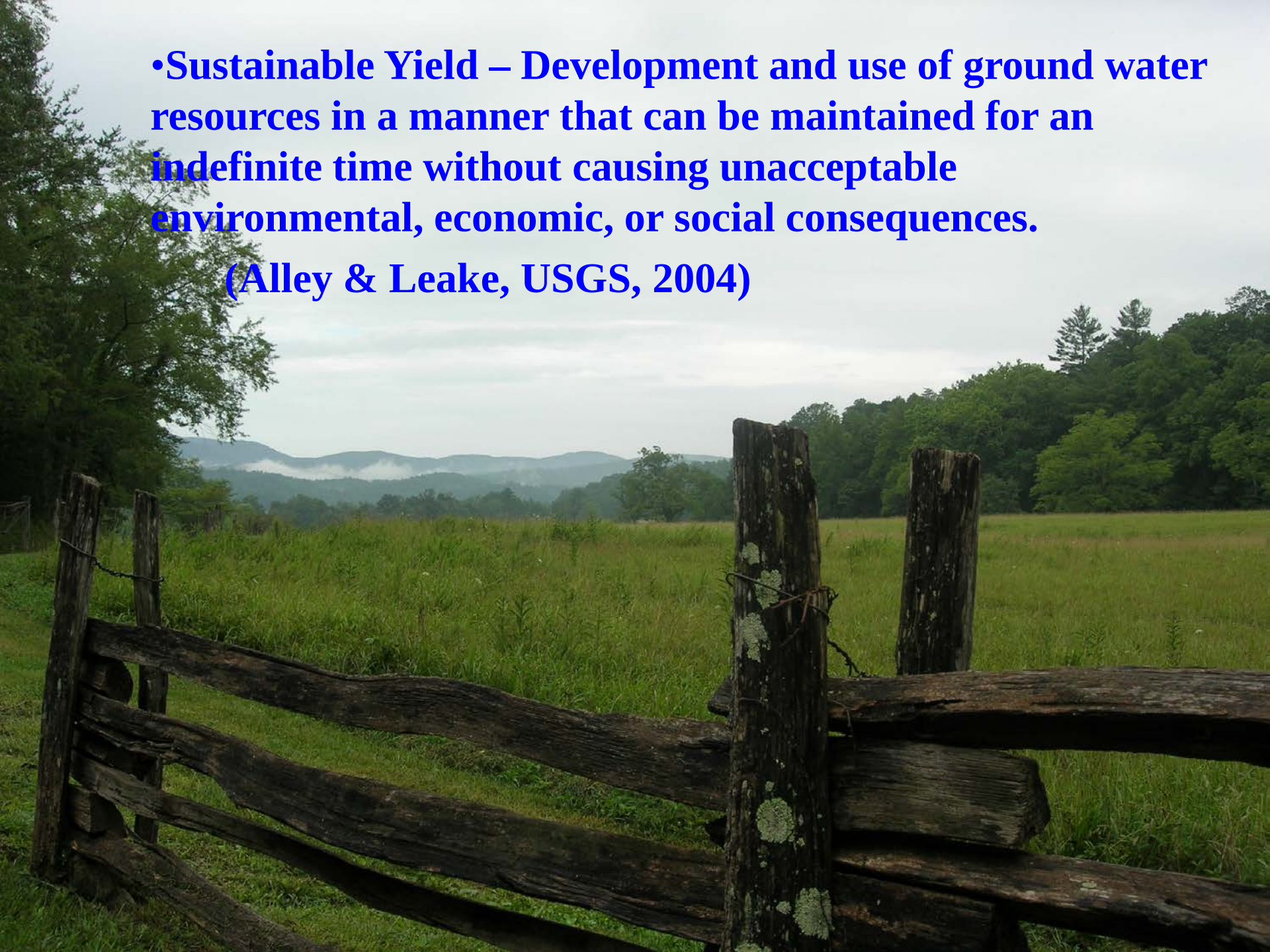
Comprehensive Update of the Arkansas Water Plan

Groundwater in Arkansas

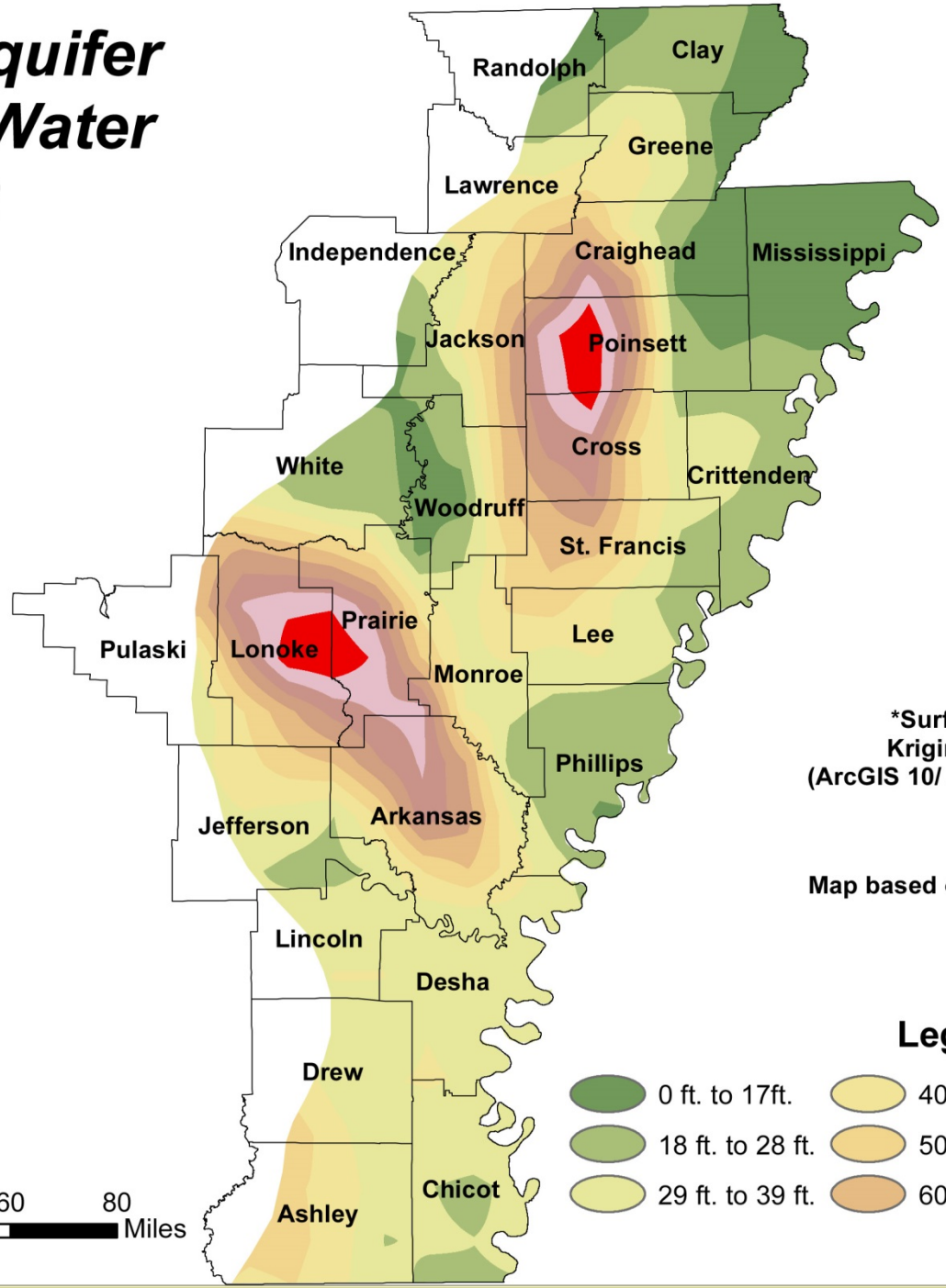
February 18, 2014



•Sustainable Yield – Development and use of ground water resources in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences.

(Alley & Leake, USGS, 2004)

Alluvial Aquifer Depth to Water 2012



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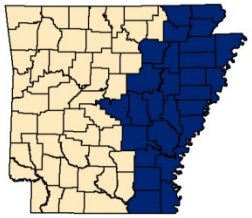
*Surface Created by
Kriging Interpolation
(ArcGIS 10/ 3D Analyst Extension)

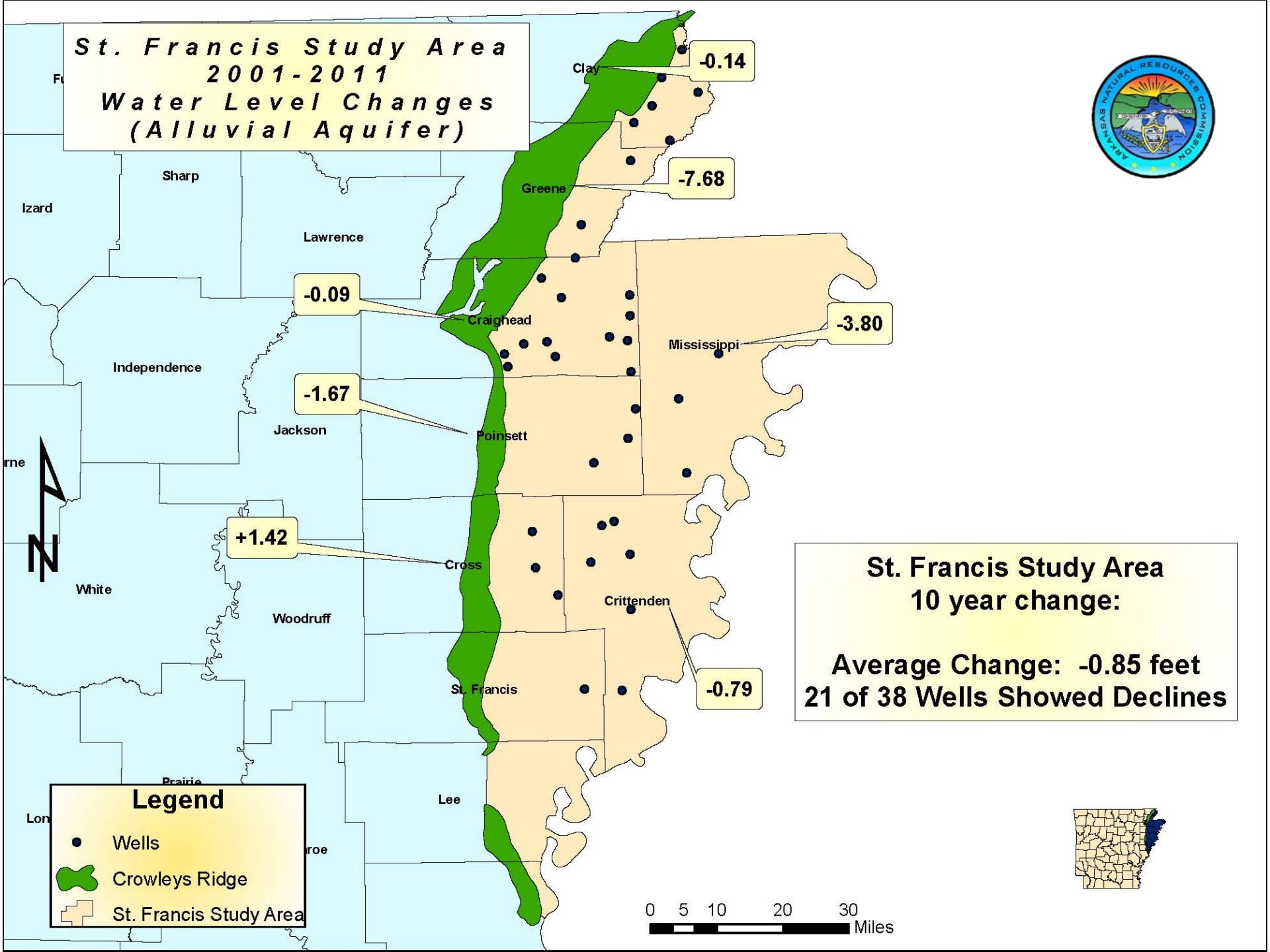
Map based on 593 data points

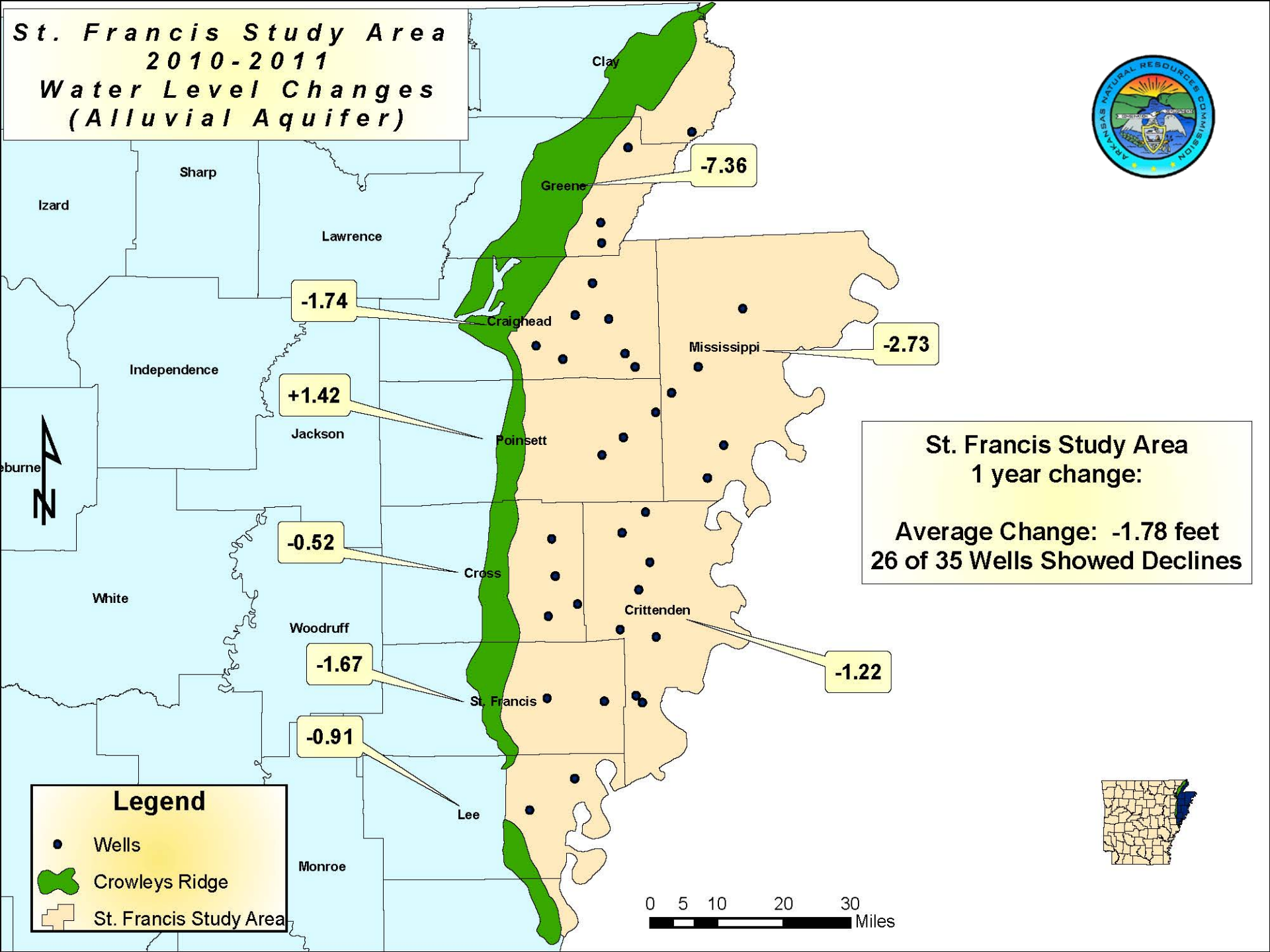


0 10 20 40 60 80 Miles

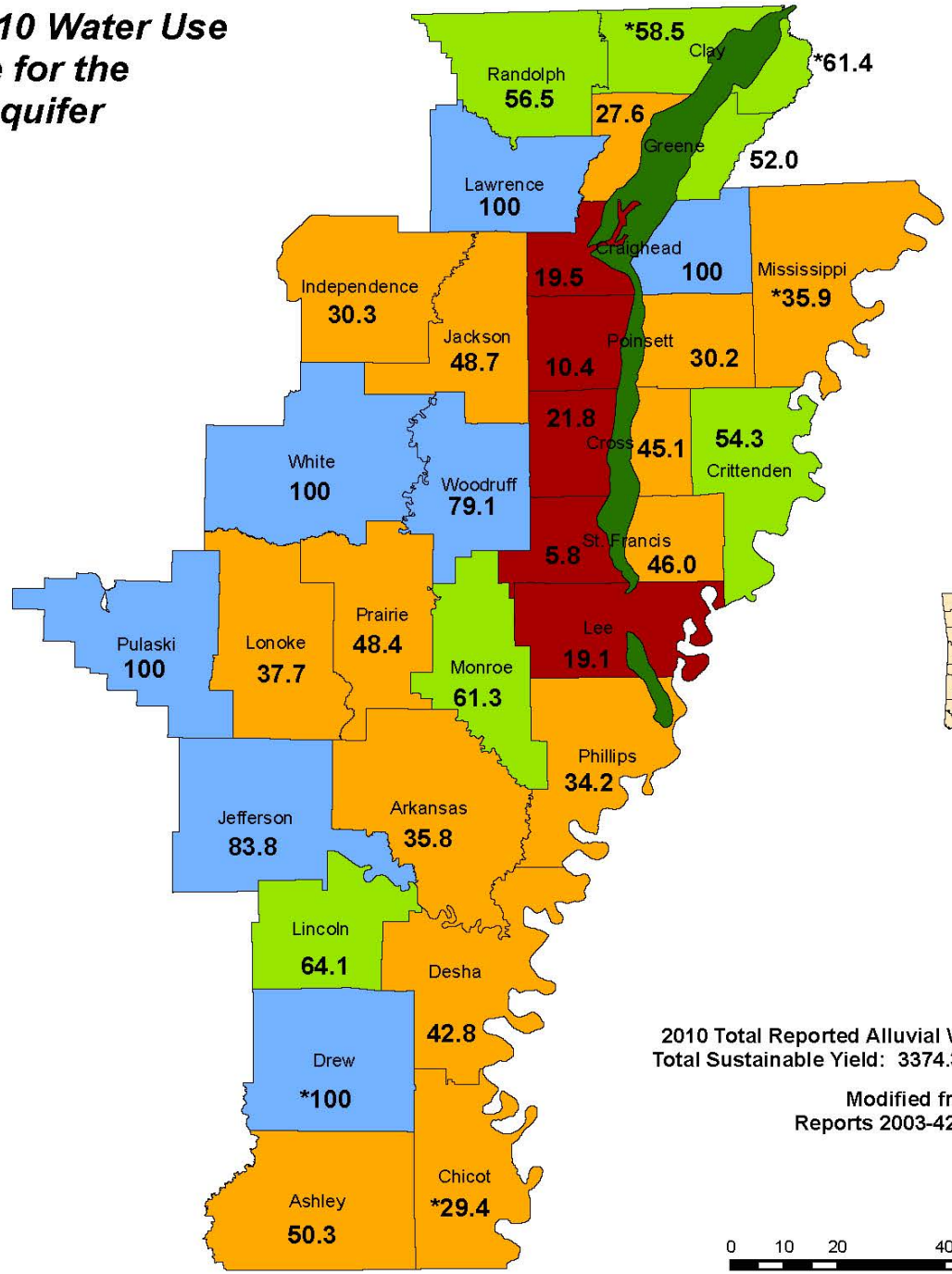
Legend

- 0 ft. to 17ft.
- 18 ft. to 28 ft.
- 29 ft. to 39 ft.
- 40 ft. to 49 ft.
- 50 ft. to 59 ft.
- 60 ft. to 70 ft.
- 71ft. to 81 ft.
- 82 ft. to 92 ft.
- 93 ft. to 103 ft.
- 104 ft. - 115 ft.


St. Francis Study Area
2001-2011
Water Level Changes
(Alluvial Aquifer)
Clay
-0.14
Greene
-7.68
Sharp
Izard
Lawrence
-0.09
Craighead
-3.80
Mississippi
Independence
-1.67
Jackson
Poinsett
+1.42
Cross
White
Woodruff
Crittenden
-0.79
St. Francis
Lee
Prairie
Legend
Wells
Crowleys Ridge
St. Francis Study Area
0 5 10 20 30
Miles
St. Francis Study Area
10 year change:
Average Change: -0.85 feet
21 of 38 Wells Showed Declines


St. Francis Study Area
2010-2011
Water Level Changes
(Alluvial Aquifer)
Clay
Sharp
Izard
Lawrence
Greene
-7.36
-1.74
Craighead
Mississippi
-2.73
Independence
+1.42
Jackson
Poinsett
-0.52
Cross
White
Crittenden
Woodruff
-1.67
-1.22
St. Francis
-0.91
Lee
Monroe
St. Francis Study Area
1 year change:
Average Change: -1.78 feet
26 of 35 Wells Showed Declines
Legend
Wells
Crowleys Ridge
St. Francis Study Area
0 5 10 20 30
Miles

Percentage of 2010 Water Use Sustainable for the Alluvial Aquifer



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* USGS model allowed 100% of 1997 pumping rate. Percent Sustainable may be greater

Legend

- 0 - 25%
- 26 - 50%
- 51 - 75%
- 76 - 100%
- Crowleys Ridge

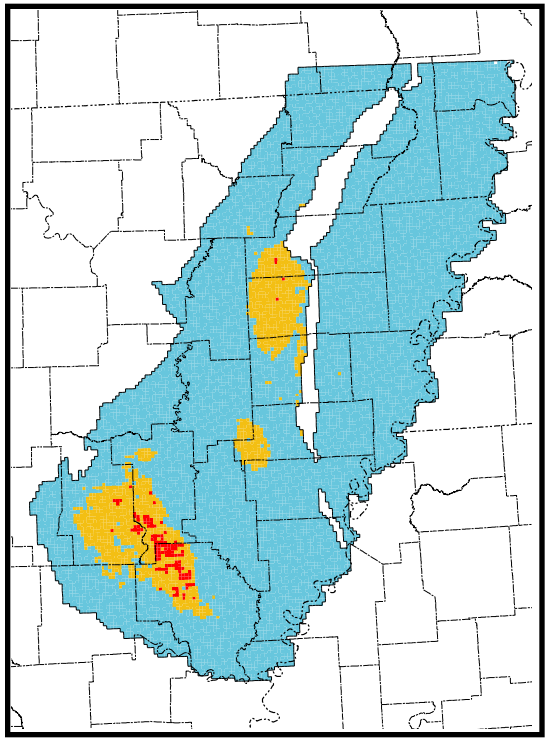
2010 Total Reported Alluvial Water Use: 7592.33 Mgal/day
Total Sustainable Yield: 3374.33 Mgal/d (44.4%) of 2010 Use

Modified from USGS Reports 2003-4230 &2007-5241

0 10 20 40 60 80 Miles

What happens if pumping continues at 1997 rates?

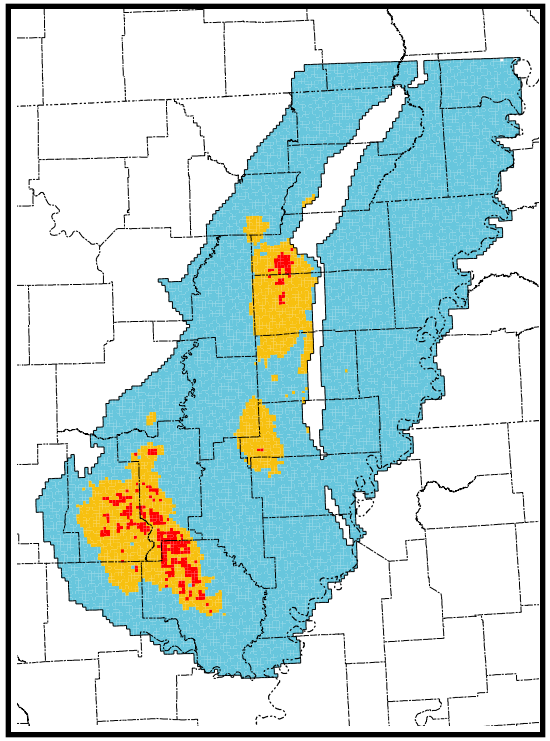
2009



118 dry cells

1,481 cells half depleted

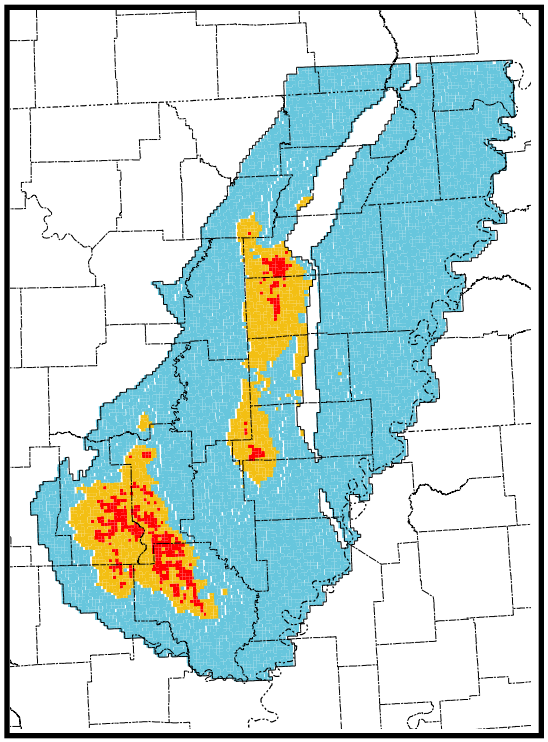
2029



273 dry cells

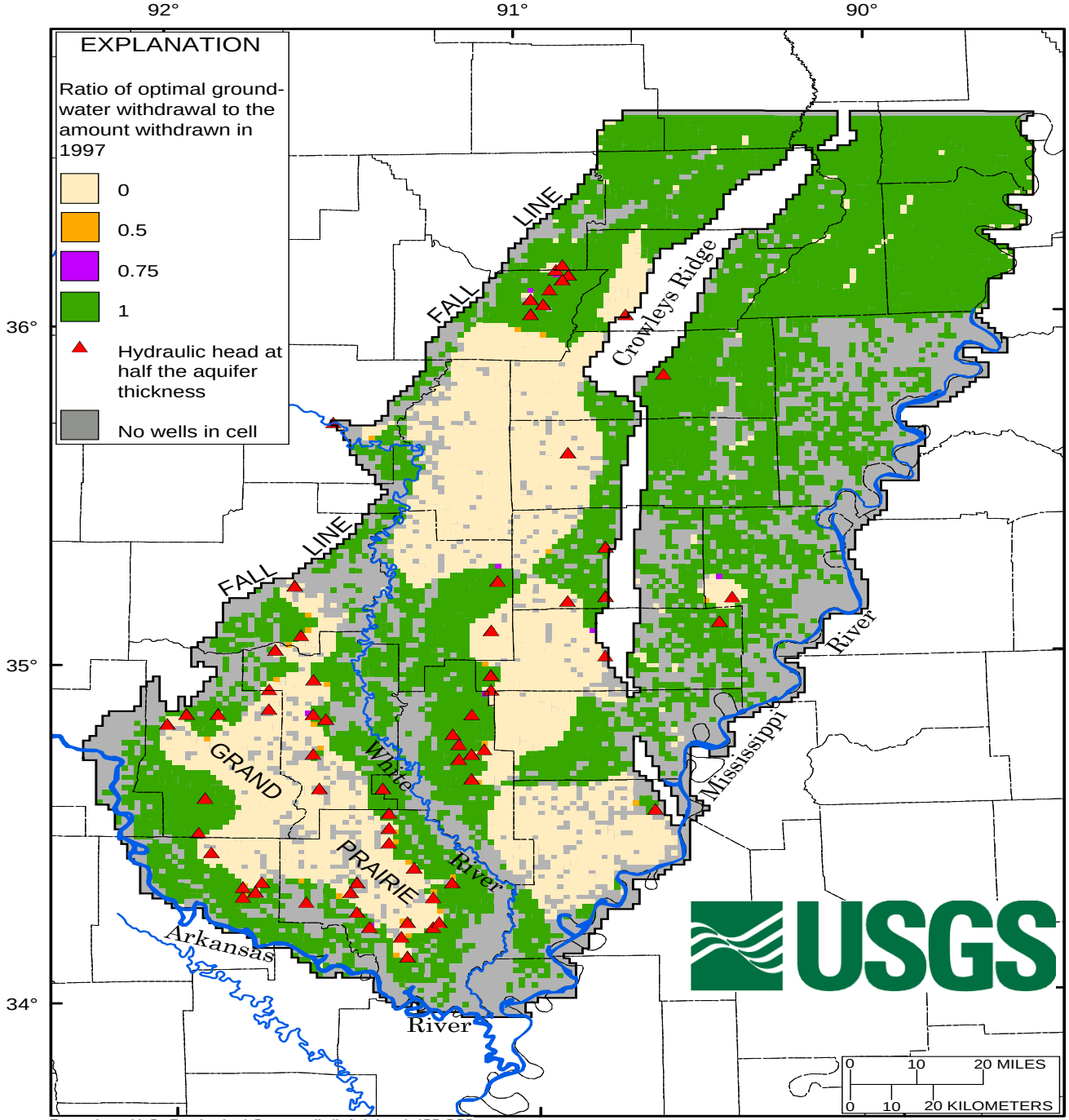
1,971 cells half depleted

2049



401 dry cells

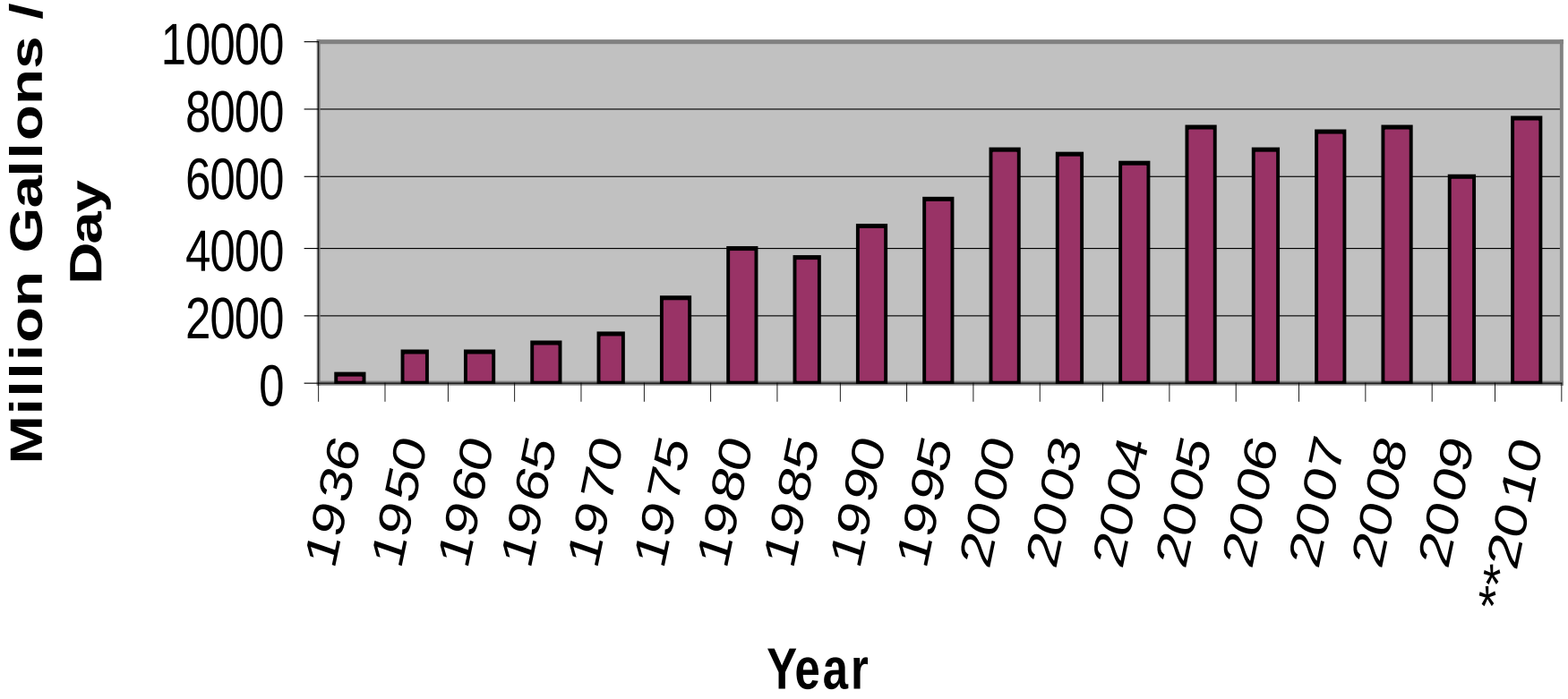
2,195 cells half depleted



Base from U.S. Geological Survey digital data, 1:100,000

Total Ground Water Use in Arkansas

1936 - 2010



** based on an unpublished estimate by t. holland (2/12/13) subject to revision

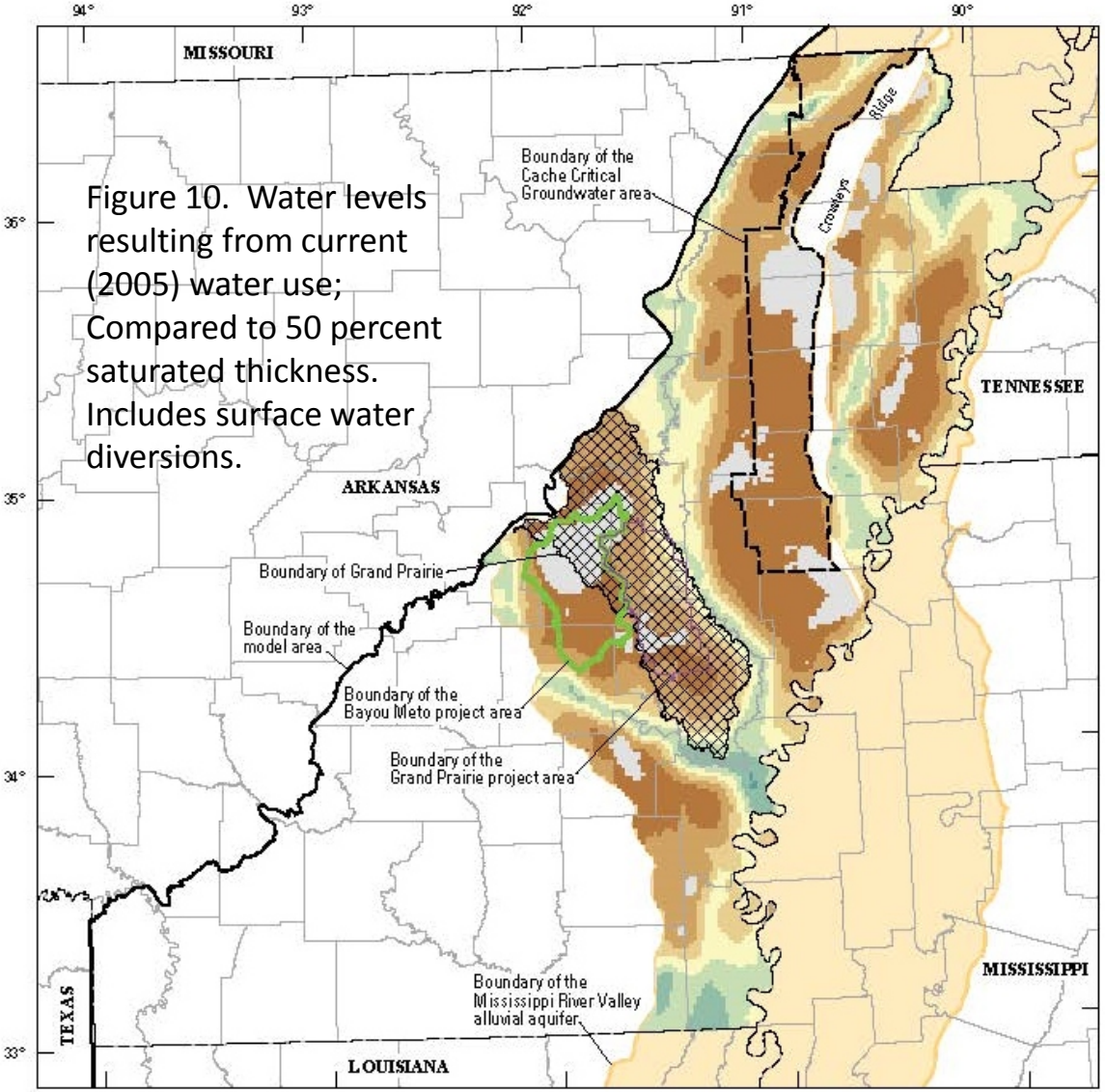


Figure 10. Water levels resulting from current (2005) water use; Compared to 50 percent saturated thickness. Includes surface water diversions.

Base from U.S. Geological Survey digital data, variously dated, various scales
Albers Equal-Area Conic projection
Standard parallels 29°30'N and 45°30'N, central meridian -96°W

EXPLANATION

Difference between altitudes of simulated water level and point of half saturated thickness, in feet—Positive values represent water levels below the point of half saturated thickness

Over -100	0.1 to 25
-99.9 to -75	25.1 to 50
-74.9 to -50	50.1 to 75
-49.9 to 25	75.1 to 100
-24.9 to 0	Depleted aquifer

0 25 50 MILES
0 25 50 KILOMETERS

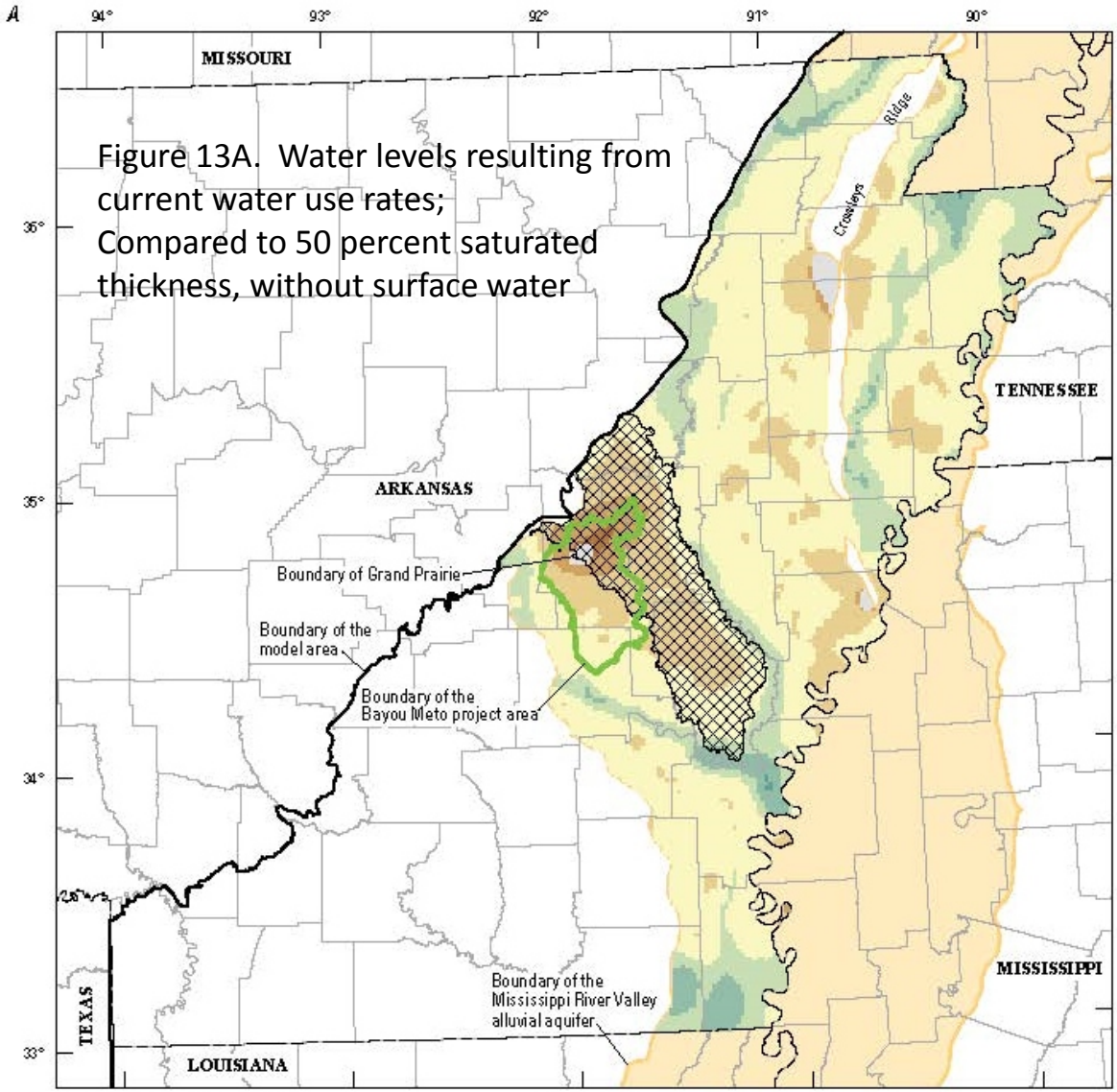


Figure 13A. Water levels resulting from current water use rates; Compared to 50 percent saturated thickness, without surface water

Base from U.S. Geological Survey digital data, variously dated, various scales
Albers Equal-Area Conic projection
Standard parallels 29°30'N and 45°30'N, central meridian -96°W

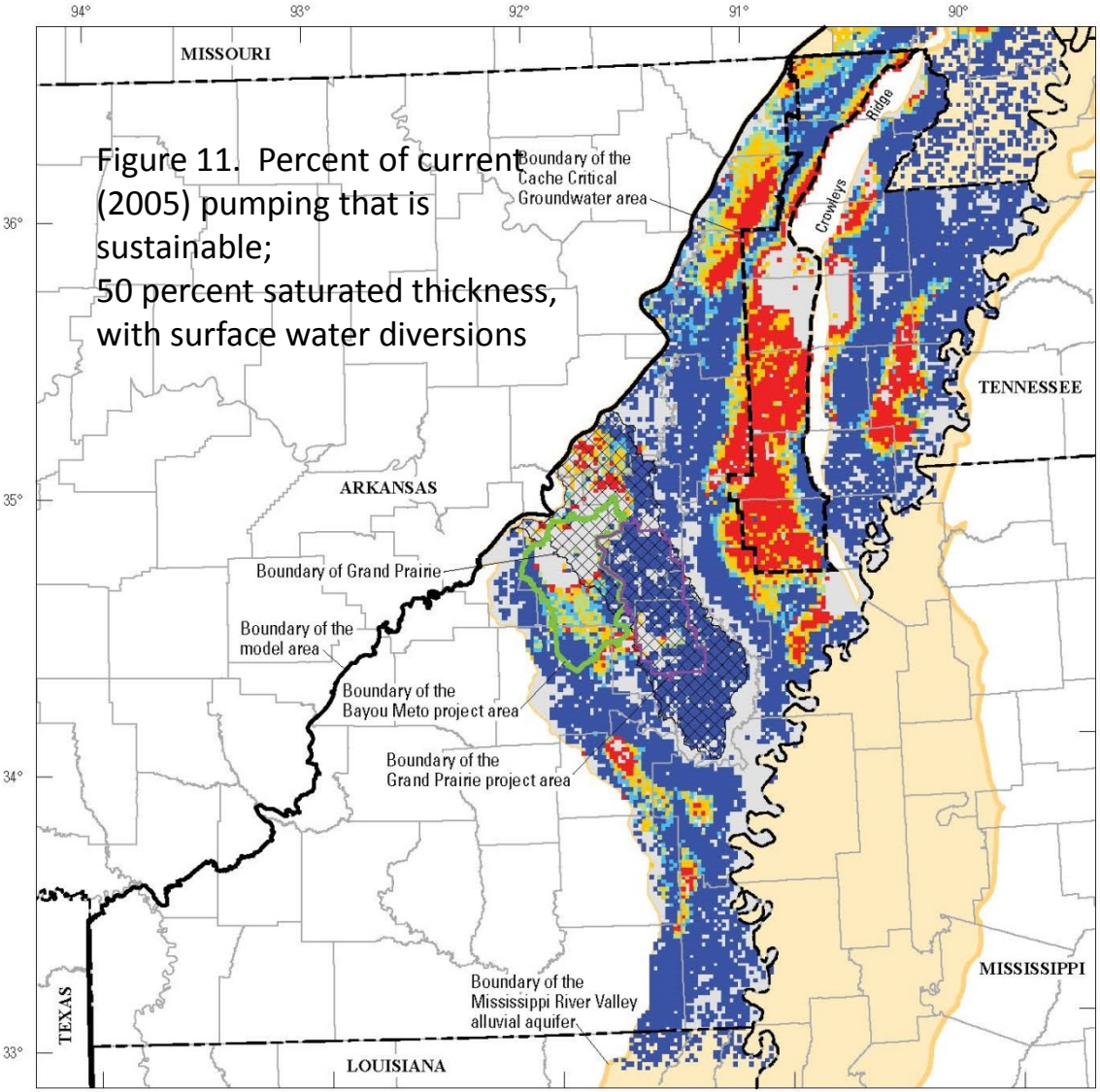
EXPLANATION

Difference between altitudes of simulated water level and point of half saturated thickness, in feet—Positive values represent water levels below the point of half saturated thickness

Over -100	0.1 to 25
-99.9 to -75	25.1 to 50
-74.9 to -50	50.1 to 75
-49.9 to -25	75.1 to 100
-24.9 to 0	Depleted aquifer

0 25 50 MILES
0 25 50 KILOMETERS

Figure 11. Percent of current (2005) pumping that is sustainable;
50 percent saturated thickness, with surface water diversions



Base from U.S. Geological Survey digital data, variously dated, various scales
Albers Equal-Area Conic projection
Standard parallels 29°30′N and 45°30′N, central meridian -96°W

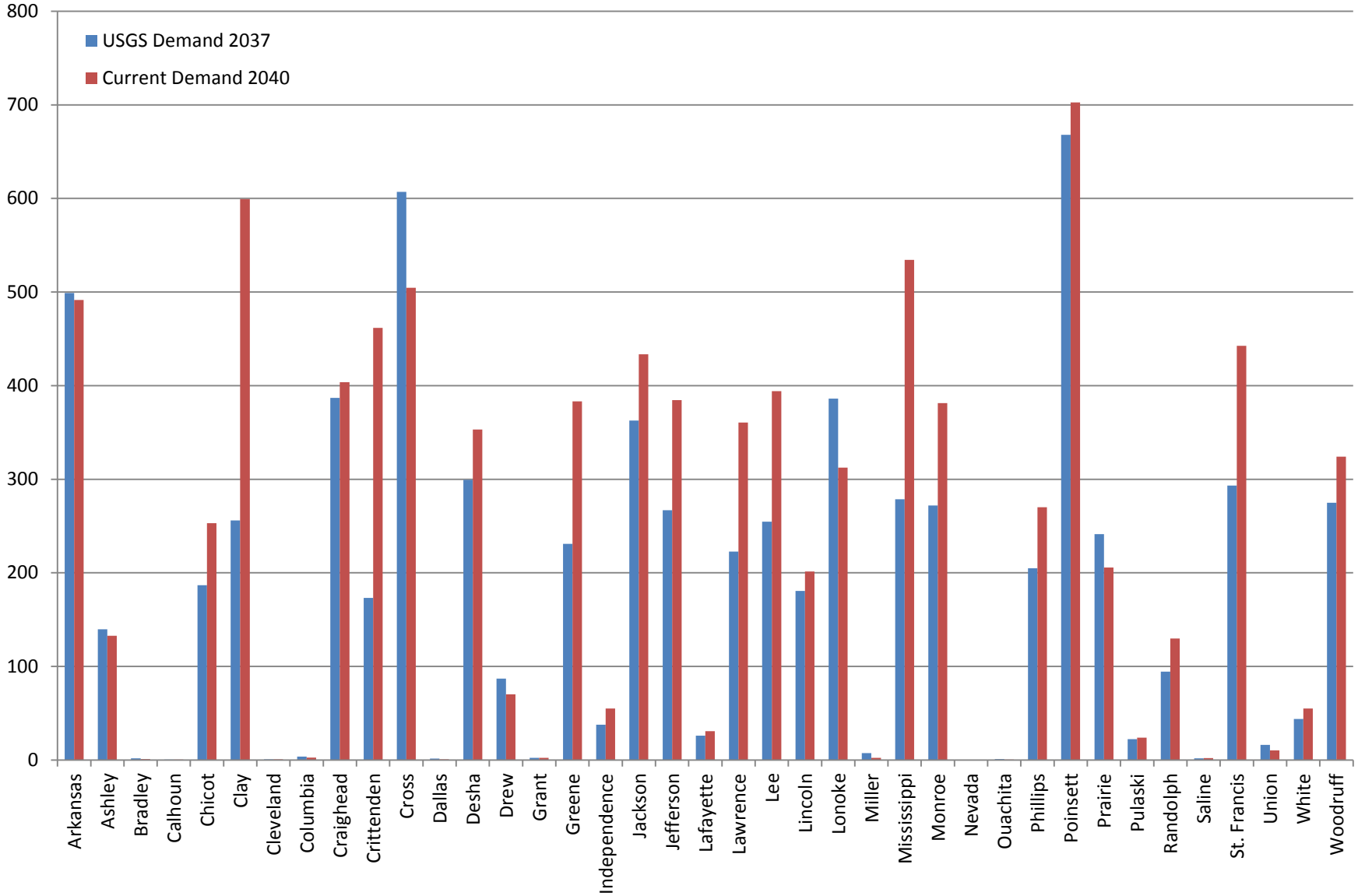
0 25 50 MILES
0 25 50 KILOMETERS

EXPLANATION

Percentage of pumping relative to amount of pumping specified for the scenario (desired pumping)

- 0.0 to 20.0
- 20.1 to 40.0
- 40.1 to -60.0
- 60.1 to 80.0
- 80.1 to 100
- Area of zero pumping

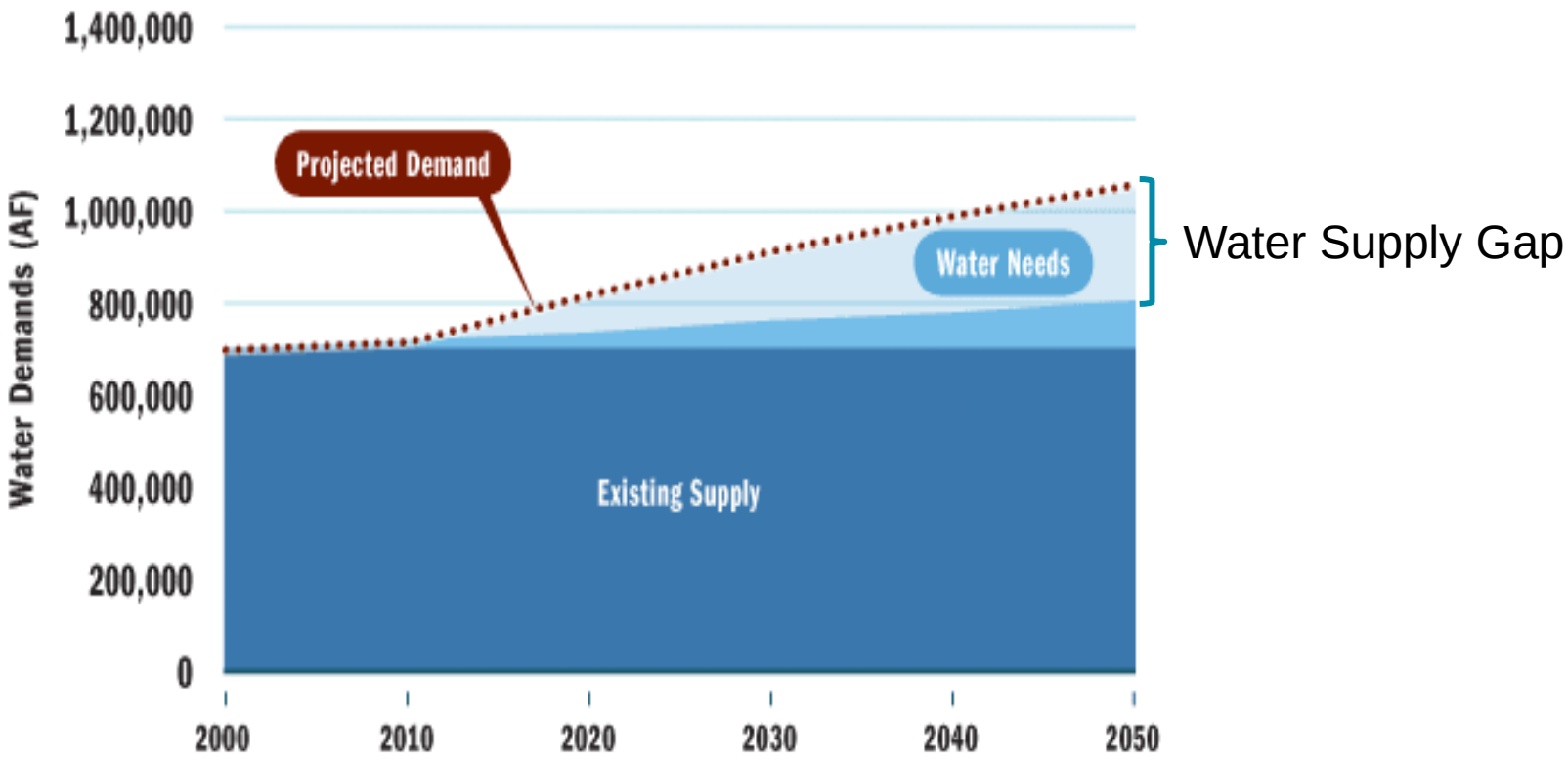
Demand (MGD)


USGS Demand 2037
Current Demand 2040
800
700
600
500
400
300
200
100
0
Arkansas
Ashley
Bradley
Calhoun
Chicot
Clay
Cleveland
Columbia
Craighead
Crittenden
Cross
Dallas
Desha
Drew
Grant
Greene
Independence
Jackson
Jefferson
Lafayette
Lawrence
Lee
Lincoln
Lonoke
Miller
Mississippi
Monroe
Nevada
Ouachita
Phillips
Poinsett
Prairie
Pulaski
Randolph
Saline
St. Francis
Union
White
Woodruff

Arkansas Water Plan Gap Analysis

February 18, 2014

Water Supply Gap

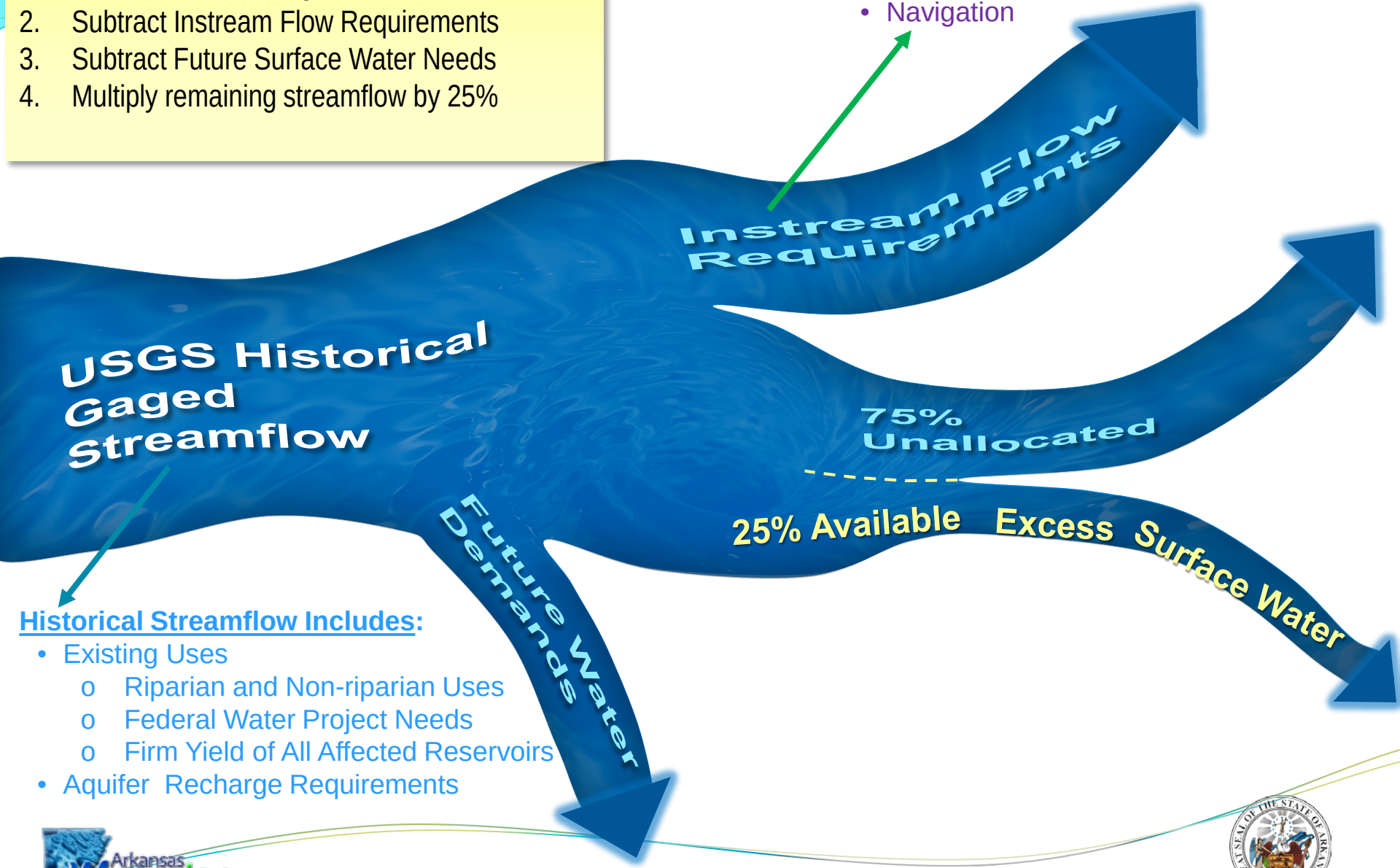


Excess Surface Water Calculation Steps

1. Obtain Historical Gaged Streamflow Data
2. Subtract Instream Flow Requirements
3. Subtract Future Surface Water Needs
4. Multiply remaining streamflow by 25%

Instream Flow Requirements Include:

- Fish & Wildlife Flows (Arkansas Method)
- Water Quality (7Q10)
- Navigation

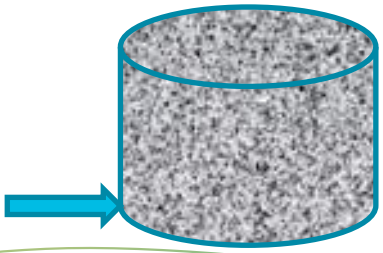


Historical Streamflow Includes:

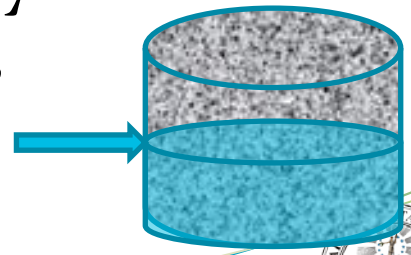
- Existing Uses
  - Riparian and Non-riparian Uses
  - Federal Water Project Needs
  - Firm Yield of All Affected Reservoirs
- Aquifer Recharge Requirements

Groundwater Modeling Scenarios

- **Scenario 1 and 2:** Minimum water elevation equal to the bottom elevation of both unconfined and confined aquifers for wet and dry climate conditions



- **Scenario 3 and 4:** Minimum water elevation equal to half the aquifer thickness in the alluvial aquifer and the top of formation in the confined aquifer for wet and dry climate conditions



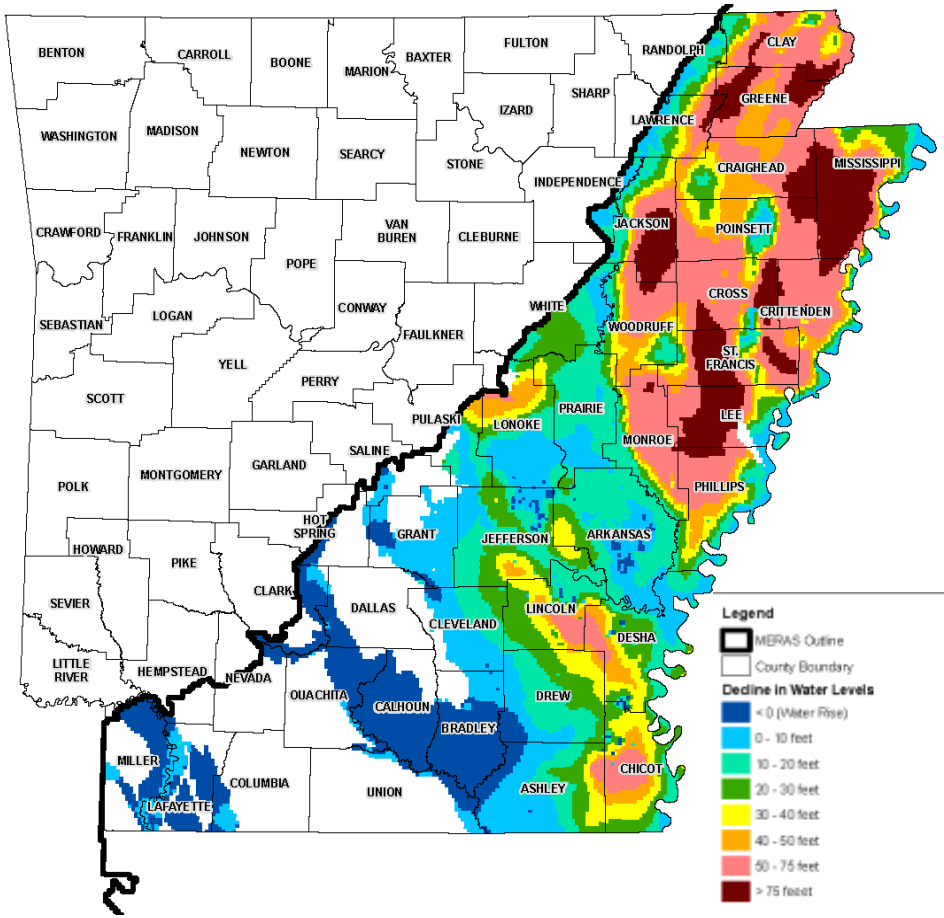


Figure 5-17
Decline in Water Levels
Base Period to 2050
Alluvial Aquifer, Scenario 1

Arkansas State Water Plan Update
Groundwater Availability

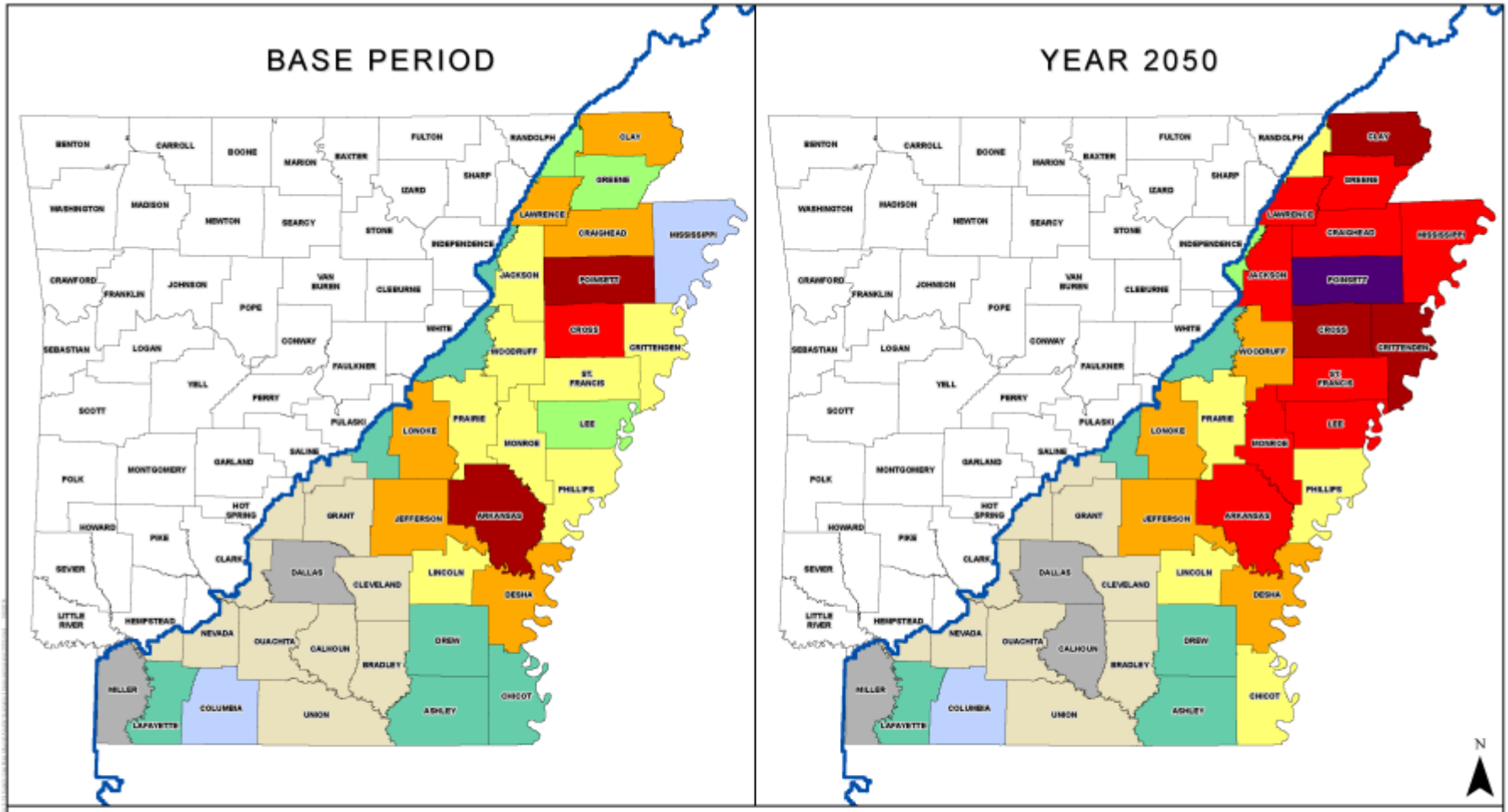


Figure 5-19
Supply Gap Map for Alluvial Aquifer Scenario 3 Base Period and 2050

Arkansas State Water Plan Update
Groundwater Availability

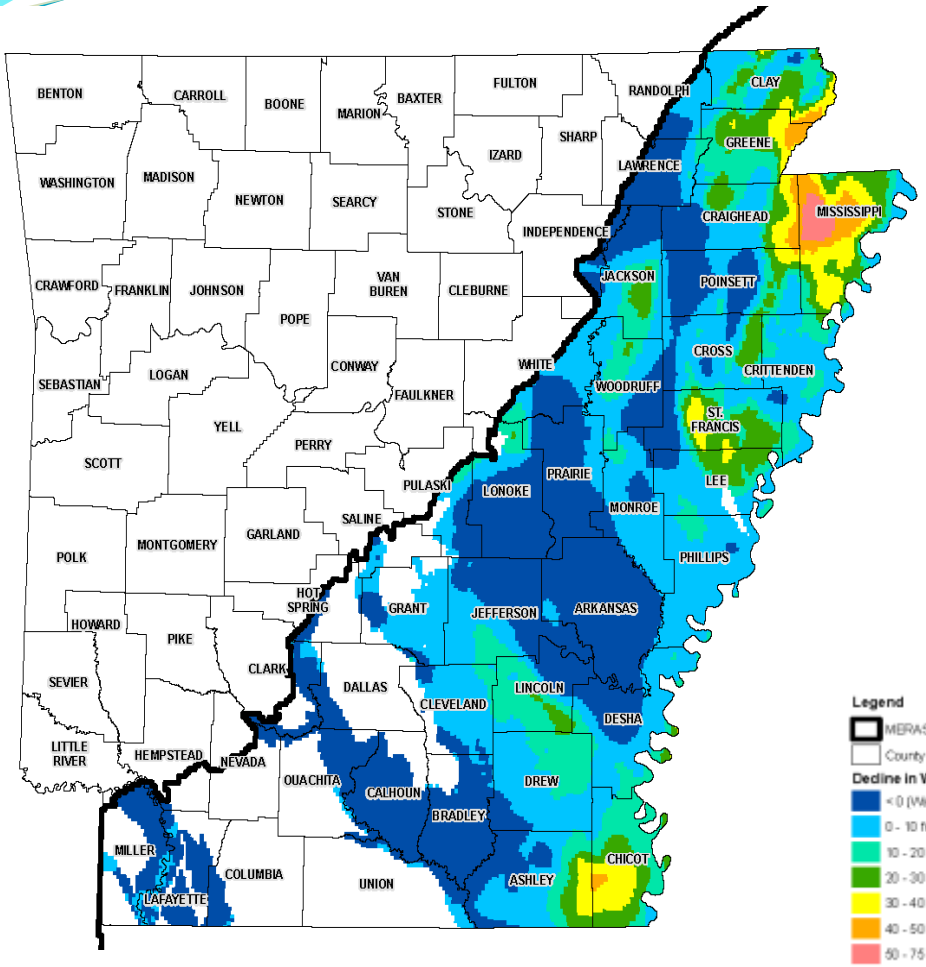


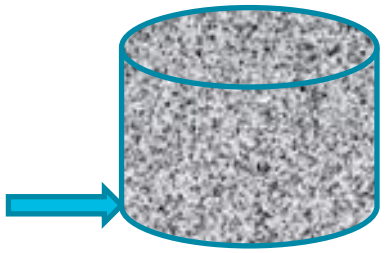
Figure 5-21
Decline in Water Levels
Base Period to 2050
Alluvial Aquifer, Scenario 3

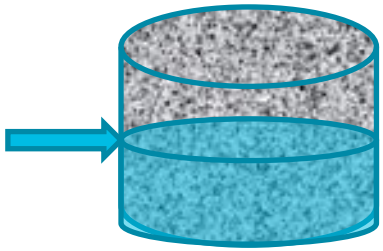
Arkansas State Water Plan Update
Groundwater Availability

East Planning Area Groundwater Gap

Available Groundwater	2050 Groundwater Supply Gap	Units
3,070	4,935	MGD
3,438,665	5,527,974	AFY

Available Groundwater	2050 Groundwater Supply Gap	Units
1,770	5,943	MGD
1,982,680	6,656,388	AFY





Groundwater Gap Summary

- About 35% of water demand can be met with groundwater in 2050 under full dewatering scenario
- Significant drawdown in groundwater levels by 2050 would result under the full dewatering scenario
- In the sustainable pumping scenario, about 20% of water demand can be met with groundwater
- Declines in groundwater levels would be moderated under sustainable pumping

Combined Source Gap Summary – East Regional Planning Area

- A Combined Source Gap of over 3,000,000 AFY is predicted for 2050 in the Bayou Macon, Boeuf River, L'Anguille River, St. Francis River, and White River basins (full dewatering scenario)
- A Combined Source Gap of over 4,200,000 AFY is predicted for 2050 in the Bayou Bartholomew, Bayou Macon, Boeuf River, L'Anguille River, St. Francis River, and White River basins (sustainable pumping scenario)
- The Combined Source Gap is seasonal, occurring in May - September

Comments

Questions