Comprehensive Update of the Arkansas Water Plan

Groundwater Supply, Demand and Gaps in Northeast Arkansas

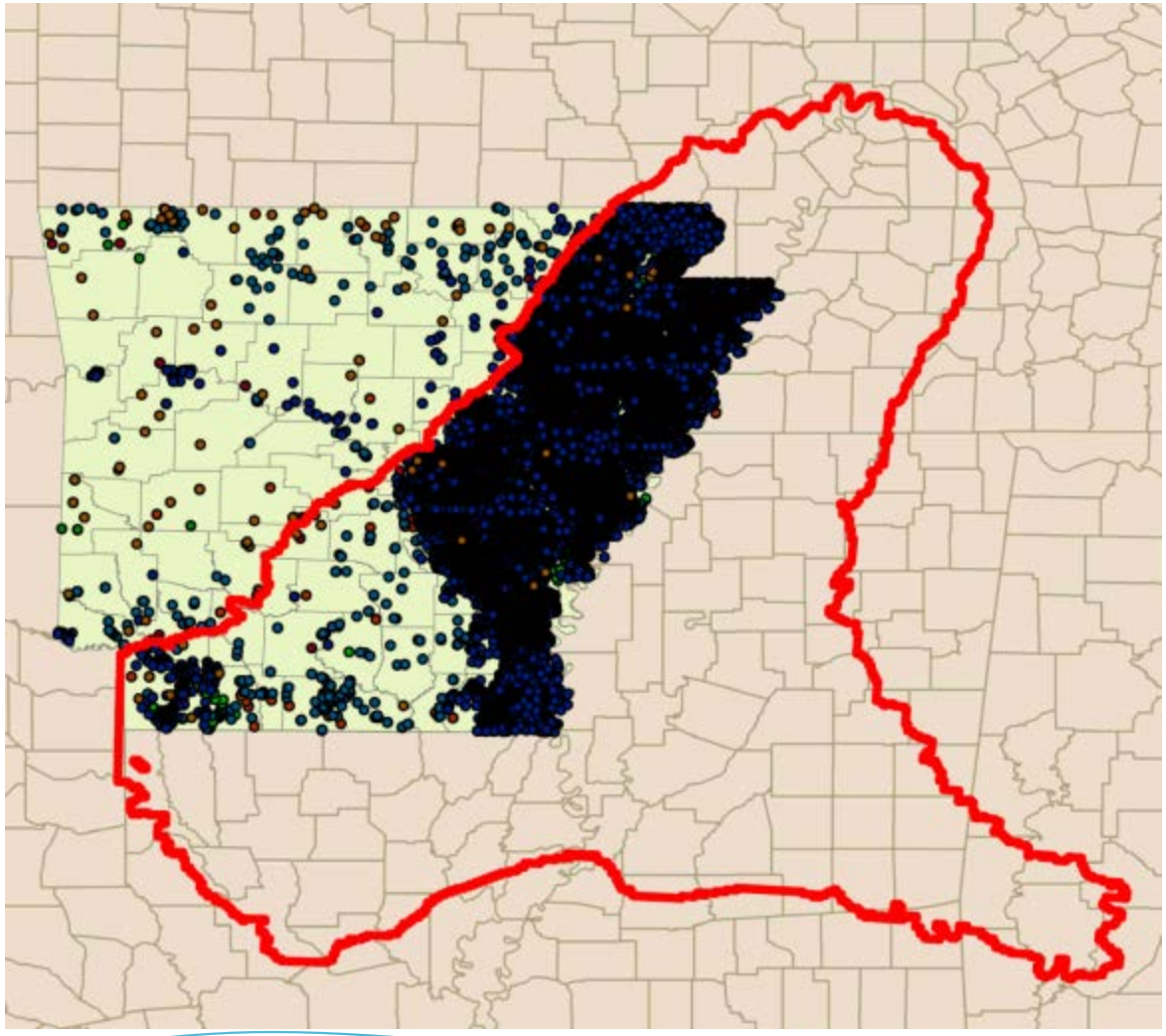
(Mississippi, Greene, Clay, Craighead, Poinsett, Cross, and St Francis Counties)

February, 2014

Outline

- Groundwater Availability
- Groundwater Demand
- Groundwater Gap

USGS Groundwater Model



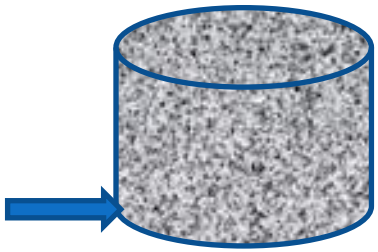
Role of the Mississippi River

- The MERAS model is configured with limited recharge to the aquifer from the river.
- For example, in a 43 mile long segment, the flow from the Mississippi River to the alluvial aquifer is about 22 MGD, which is about 6% of the water pumped from the alluvial aquifer in Mississippi County in 2010.
- Recharge induced by increased pumping is limited by the modeled character of the streambed.
- The model predictions of drawdown in the alluvial aquifer include little recharge from the Mississippi River.

Groundwater Modeling Scenarios

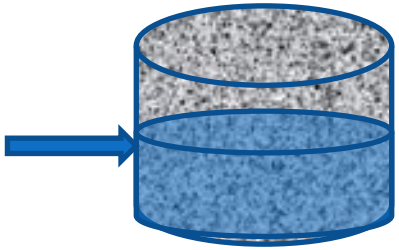
- **Scenario 1:**

Allows full dewatering or mining of the aquifer



- **Scenario 3:**

Stops pumping when the water level reaches half the thickness of the aquifer



Groundwater Water Demands

Crop Irrigation Technical Sub-Group

- Approach to estimating demands was presented
- Suggestions for changing/refining approach provided by sub-group
- Revised approach used to project agricultural water demands
- Completed projections presented to sub-group
- Demand projections presented at series of public meetings in May 2012

Name	Organization/Affiliation
Evan Teague;	Arkansas Farm Bureau
Dennis Carman	White River Irrigation District
Andrew Grobmyer	Agricultural Council of Arkansas
Charles Glover and Andrew Wargo as alternate	Arkansas Association of Conservation Districts
Ben Noble	Rice Federation
Adam McClung	Cattleman's
Marvin Childers	Poultry Federation
Dow Brantley	Producer
Terry Dabbs	Producer
David Gairhan	Producer
Park Eldridge	Lehman Elevator
Davis Bell	Producer
Dr. Bert Greenwalt	Arkansas State University
Charolette Bowie Civil Engineer	NRCS
Jamie Burr	Tyson Poultry water use
Cynthia Edwards	Arkansas Department of Agriculture
Chris Henry	University of Arkansas Rice Research Center, Stuttgart

Crop Irrigation General Methodology

Crop Irrigation Demand in County for Crop =

Irrigated Acres for Crop

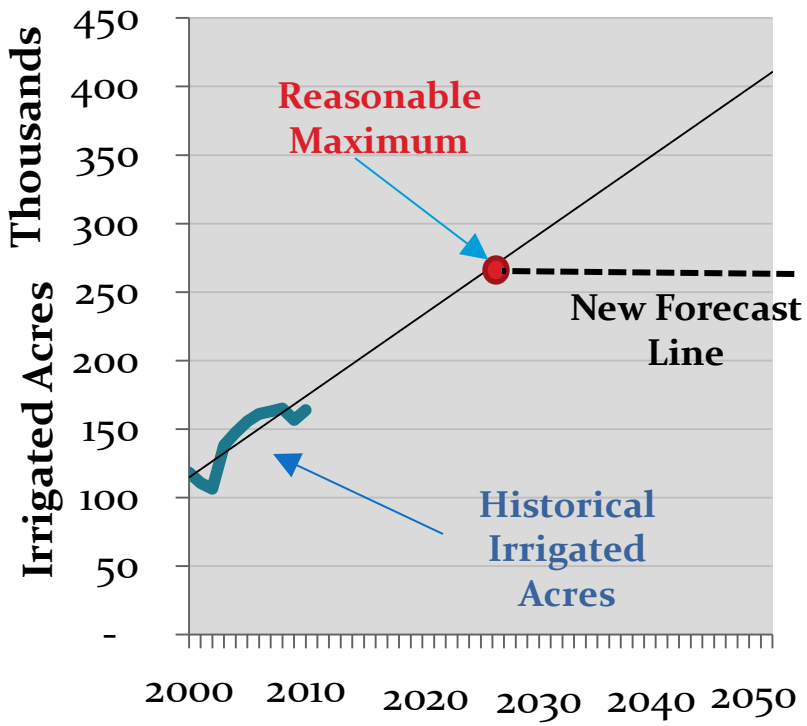
X

Application Rate for Crop

Total Irrigation Demand is sum of all crop withdrawals in county

Forecast Irrigated Acres

- Irrigated Acres for Crop by County 2010 = Actual
- Irrigated Acres for Crop by County 2020-2050 = historic trend
- When trend model reaches the "reasonable maximum" irrigated acres, no more growth assumed



Reasonable Maximum Irrigated Acres

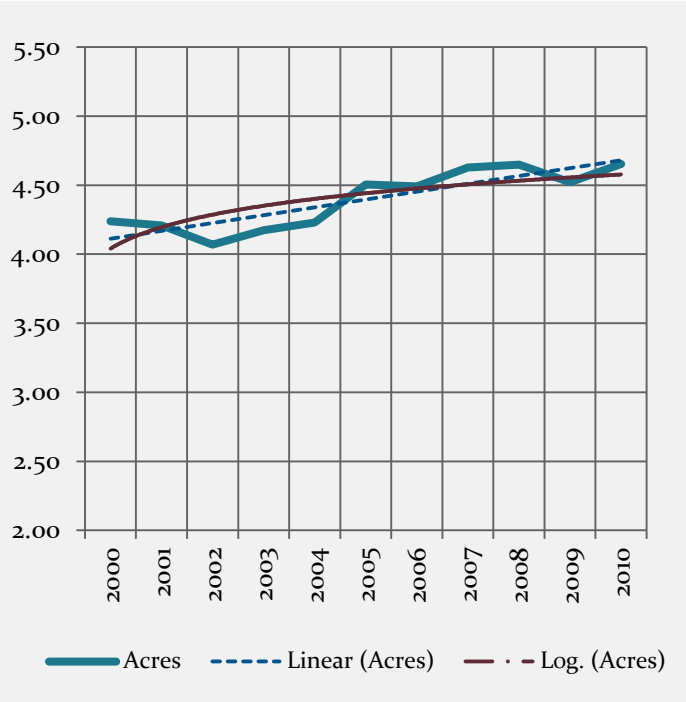
- Maximum of total tillable acres by county

County	Tillable Cropland (acres)	County 2010 Total (acres)	% of Total Tillable Acres Developed in 2010
Clay	256,917	210,790	82%
Craighead	303,396	266,664	88%
Cross	279,742	242,291	87%
Greene	200,532	163,133	81%
Mississippi	477,552	306,343	64%
Poinsett	358,973	327,857	91%
St Francis	254,941	185,653	73%

Source: National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL)

Basis of Irrigated Crop Forecast

- 10 years historical data (2000-2010) summarized by crop type and grouped by county
- Used NASS CAP survey as source for rice & soybeans irrigated acres
- Used WUDBS as source for corn, cotton, and all other minor crops
- Total irrigated acres = rice + soybeans + corn + cotton + "other"



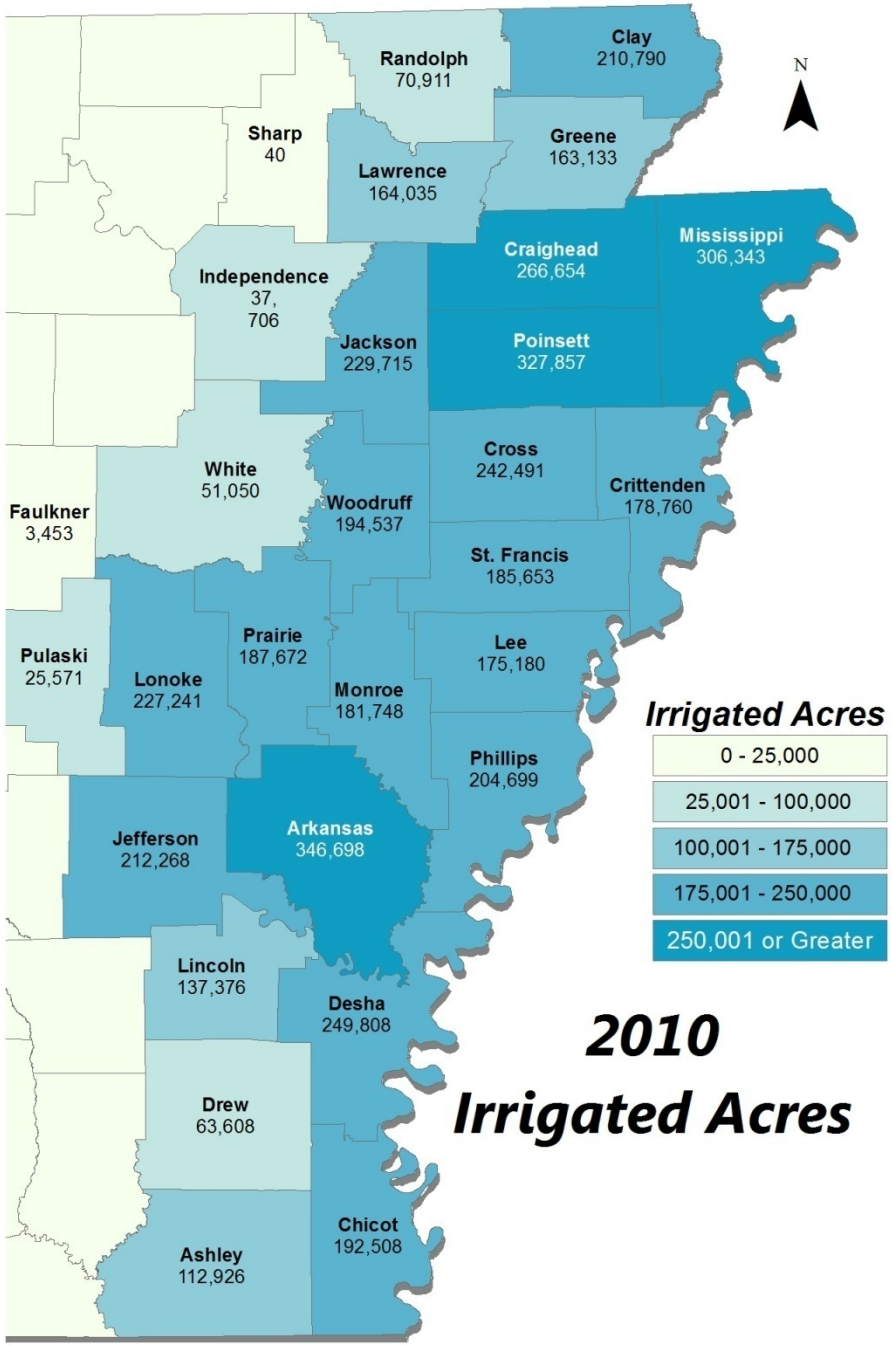
Crop Mix

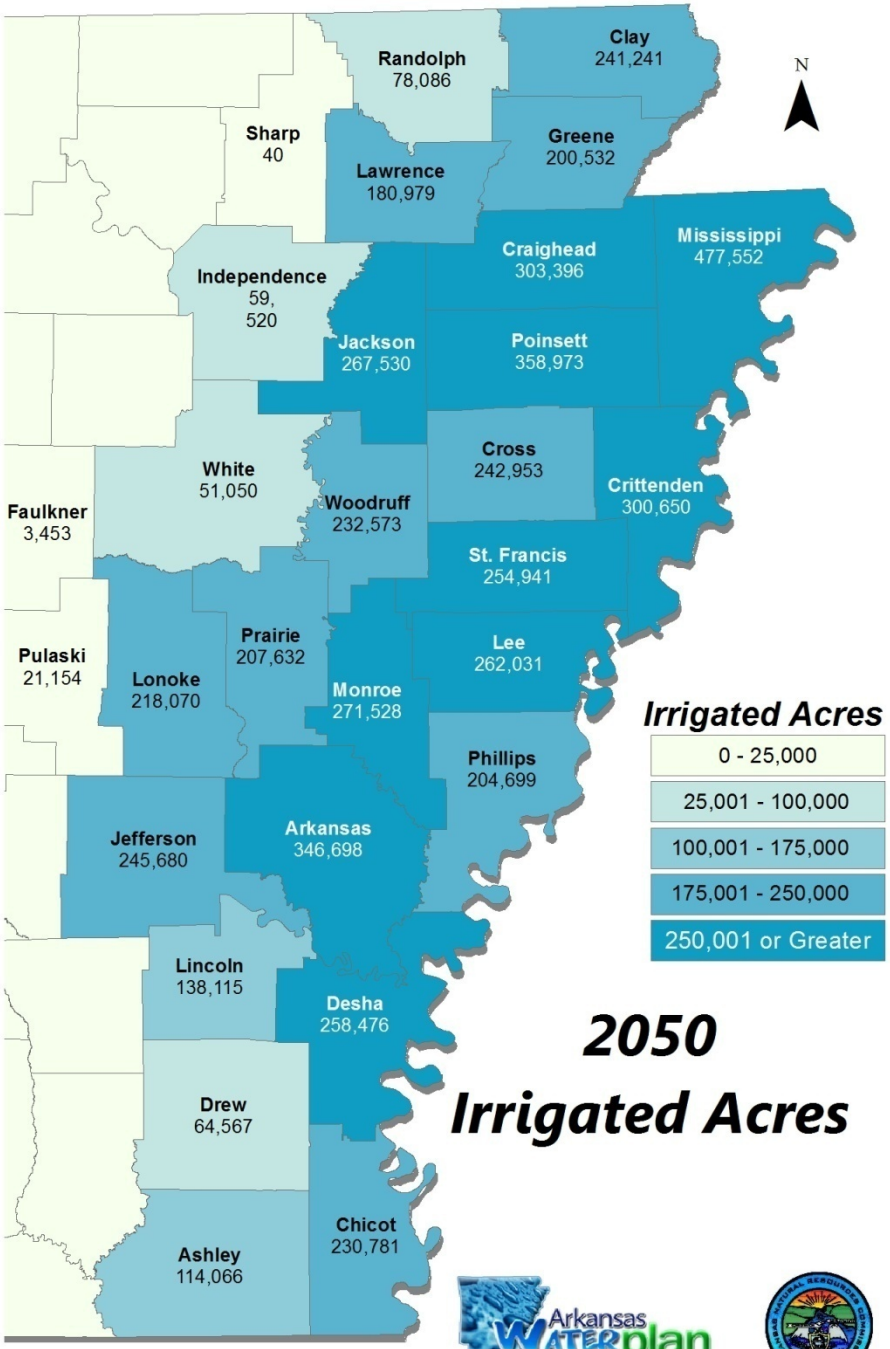
- Corn: Price from USDA Long-term Projections to 2022
- Soybeans, Rice, and Cotton: historical trends
- "Other" : historic trend of combined "Other" crops
- Historic trend inconclusive = no assumed growth in irrigated acres

Year	Corn ($/bushel)
2013	$5.00
2014	$4.30
2015	$4.40
2016	$4.45
2017	$4.50
2018	$4.50
2019	$4.55
2020	$4.60
2021	$4.65
2022	$4.65

Crop Application Rate

Crop	Value	AF/A	In/A
Rice	Min	1.1	13.5
	Max	4.0	47.6
	Average	3.1	37.0
Soybeans	Min	0.1	1.0
	Max	2.7	32.3
	Average	1.4	16.3
Corn	Min	0.2	2.6
	Max	2.5	30.6
	Average	1.3	18.1
Cotton	Min	0.8	9.8
	Max	2.5	30.2
	Average	1.3	15.3


Randolph
70,911
Clay
210,790
Sharp
40
Greene
163,133
Lawrence
164,035
Craighead
266,654
Mississippi
306,343
Independence
37,
706
Jackson
229,715
Poinsett
327,857
Cross
242,491
White
51,050
Crittenden
178,760
Faulkner
3,453
Woodruff
194,537
St. Francis
185,653
Pulaski
25,571
Prairie
187,672
Lee
175,180
Lonoke
227,241
Monroe
181,748
Phillips
204,699
Jefferson
212,268
Arkansas
346,698
Lincoln
137,376
Desha
249,808
Drew
63,608
Chicot
192,508
Ashley
112,926
N
Irrigated Acres
0 - 25,000
25,001 - 100,000
100,001 - 175,000
175,001 - 250,000
250,001 or Greater
2010
Irrigated Acres


Randolph
78,086
Clay
241,241
Sharp
40
Greene
200,532
Lawrence
180,979
Craighead
303,396
Mississippi
477,552
Independence
59,
520
Jackson
267,530
Poinsett
358,973
Cross
242,953
White
51,050
Crittenden
300,650
Faulkner
3,453
Woodruff
232,573
St. Francis
254,941
Pulaski
21,154
Prairie
207,632
Lee
262,031
Lonoke
218,070
Monroe
271,528
Phillips
204,699
Jefferson
245,680
Arkansas
346,698
Lincoln
138,115
Desha
258,476
Drew
64,567
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114,066
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Irrigated Acres
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25,001 - 100,000
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250,001 or Greater
2050
Irrigated Acres
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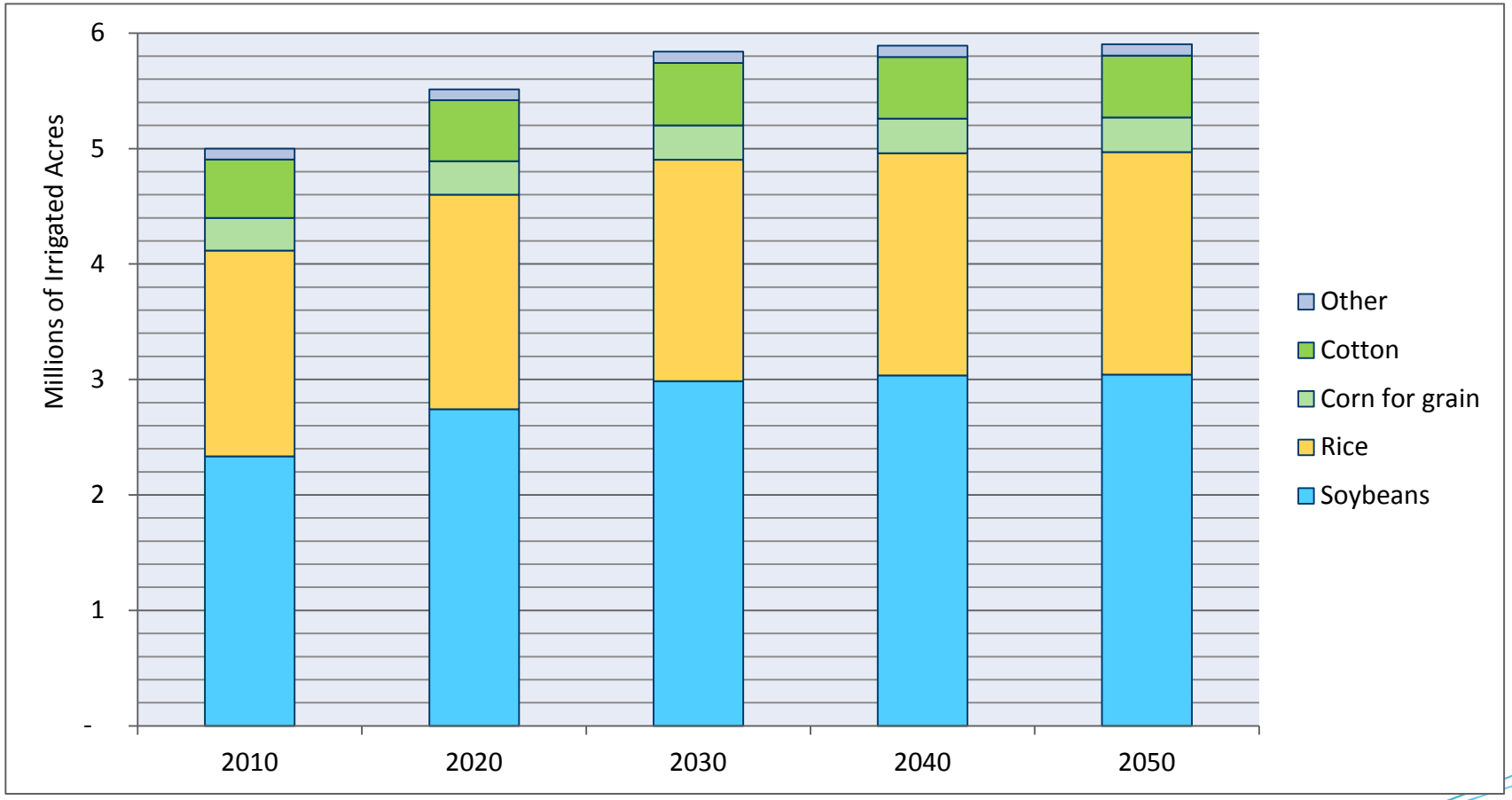
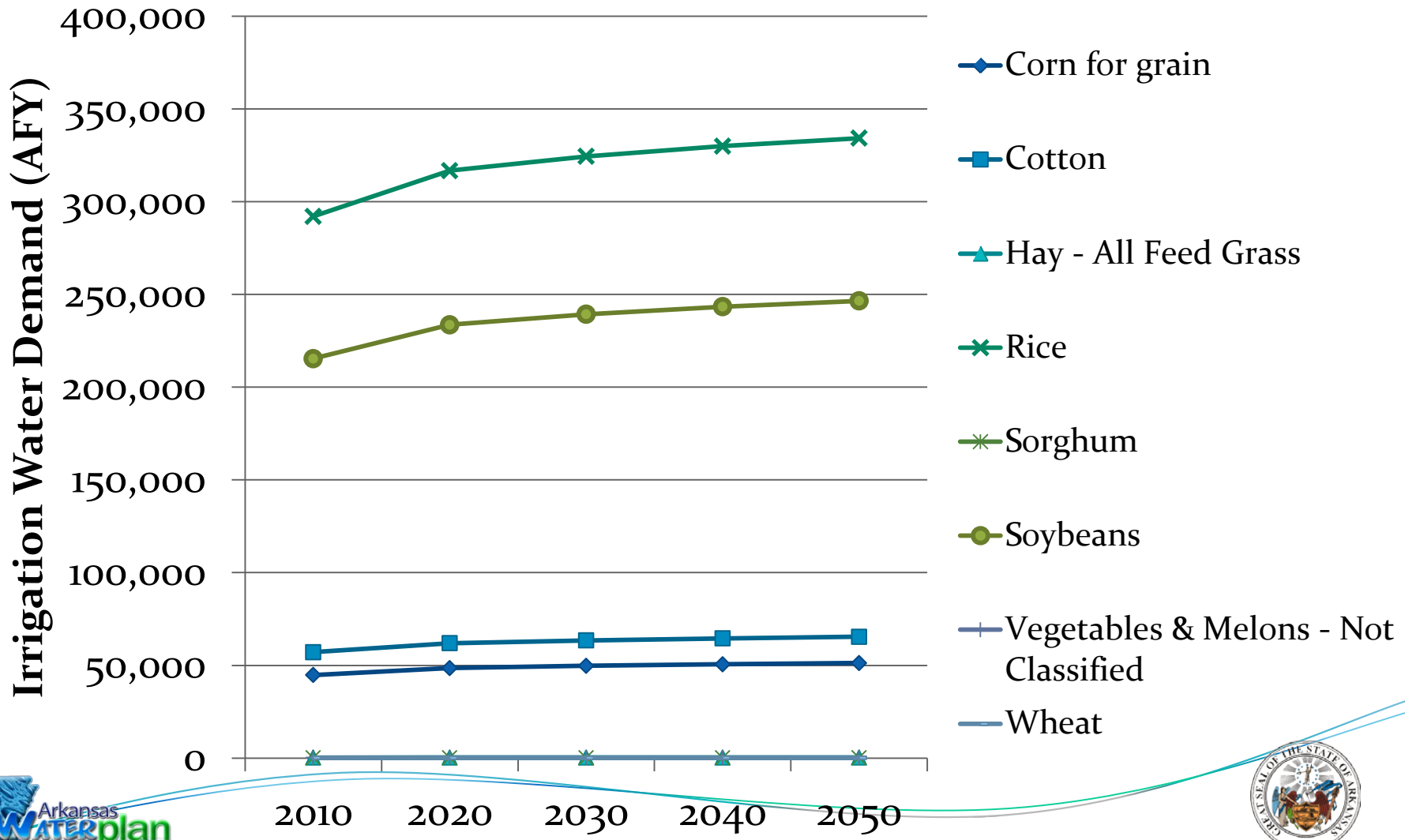
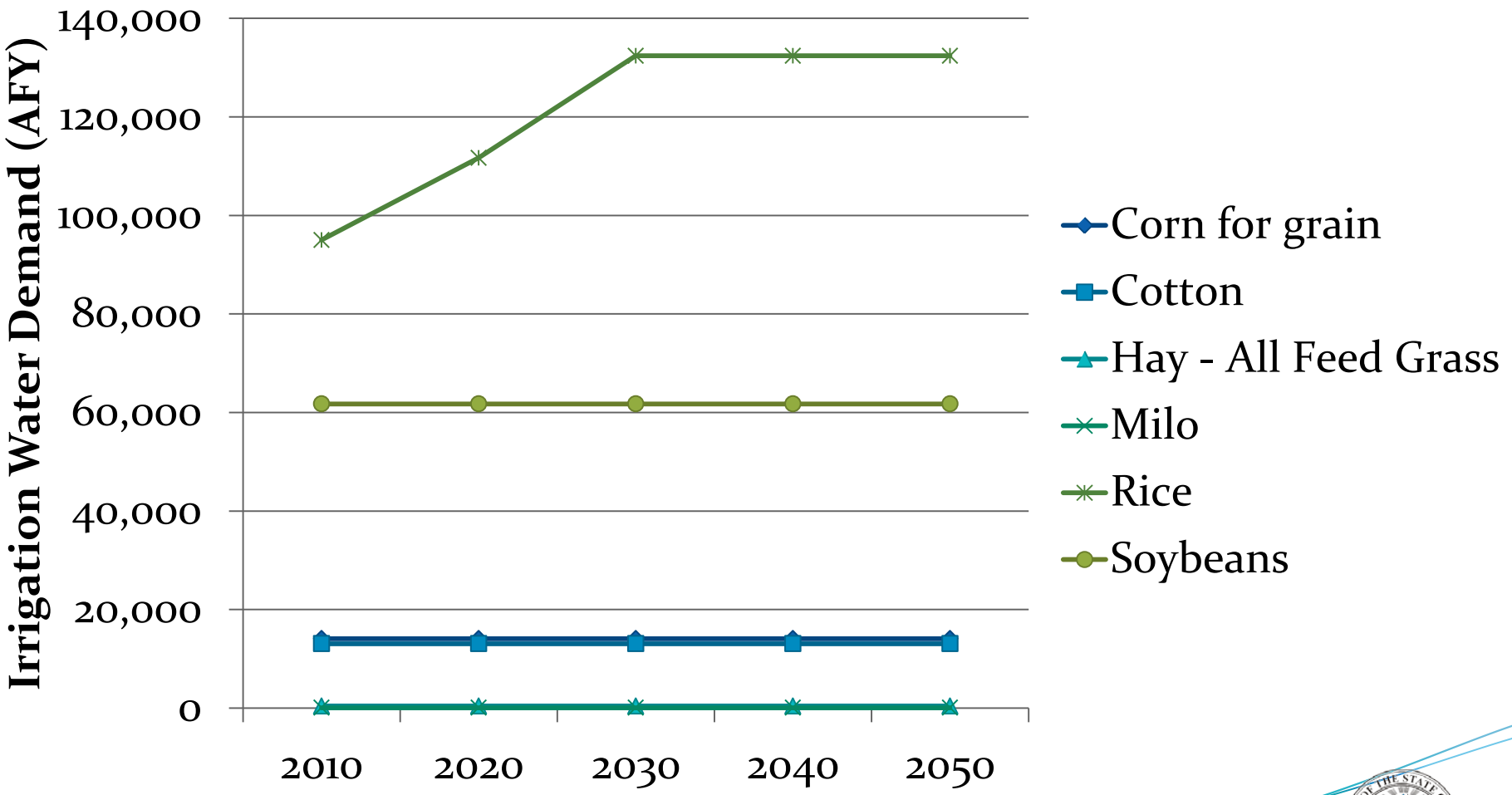
Statewide Forecast of Irrigated Acreage



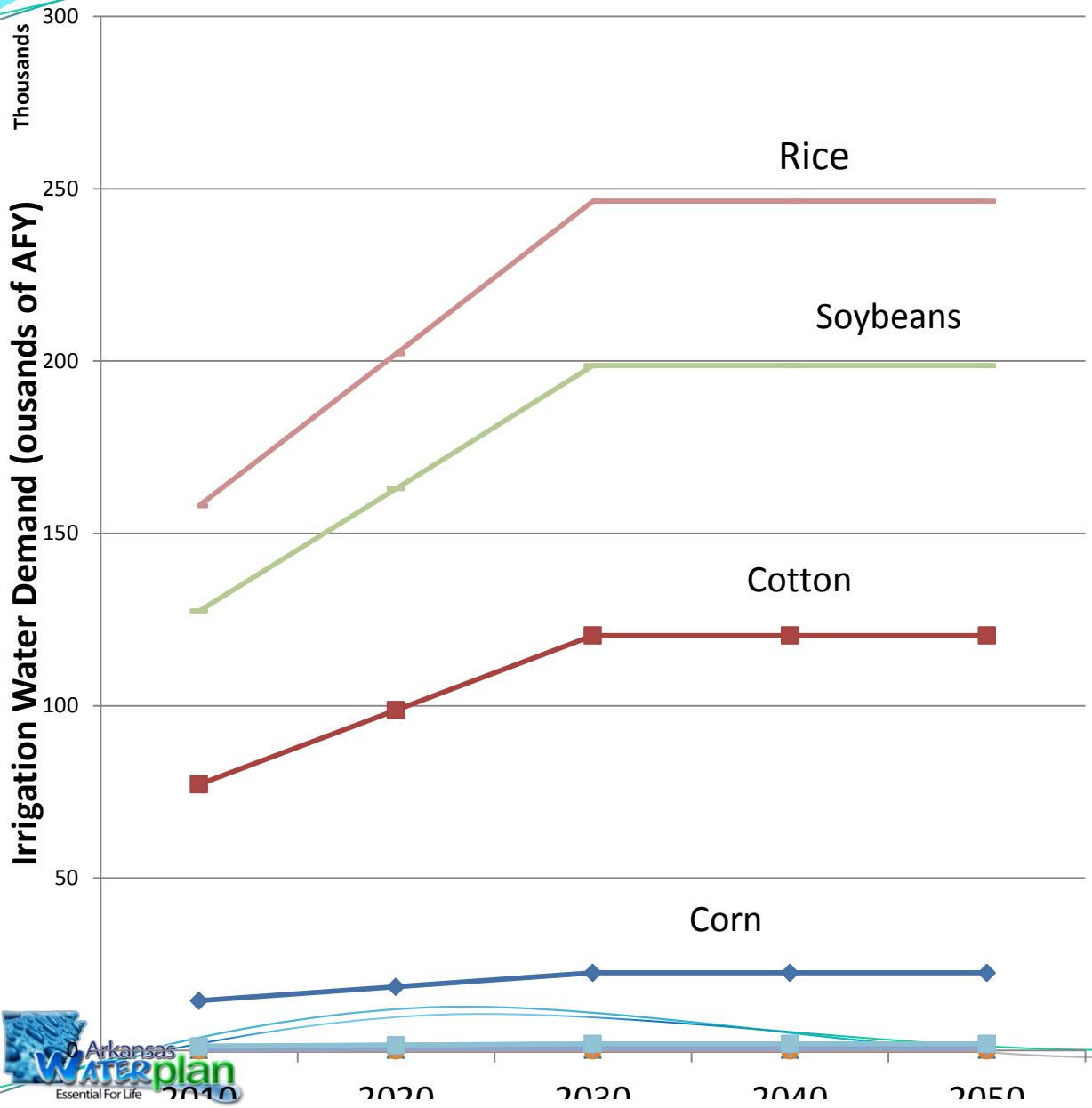
Clay County


Irrigation Water Demand (AFY)
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
2010
2020
2030
2040
2050
Corn for grain
Cotton
Hay - All Feed Grass
Rice
Sorghum
Soybeans
Vegetables & Melons - Not Classified
Wheat

Greene County



Mississippi County



- Corn for grain
- Cotton
- Crop Maintenance
- Hay - All Feed Grass
- Milo
- Pastures & Lawns
- Reservoirs for Crops
- Rice
- Soybeans
- Vegetables & Melons - Not Classified
- Wheat

Agriculture Demands Increase from 2010 - 2050

County	% Increase Acres	% Increase in Water Demand	Crop Mix
Clay	13	13	No change
Craighead	12	8	Less corn, more soybeans
Cross	0.2	0.2	No change
Greene	19	22	Increase in rice
Mississippi	36	36	No change
Poinsett	9	7	Less corn, more soybeans
St Francis	27	27	No change

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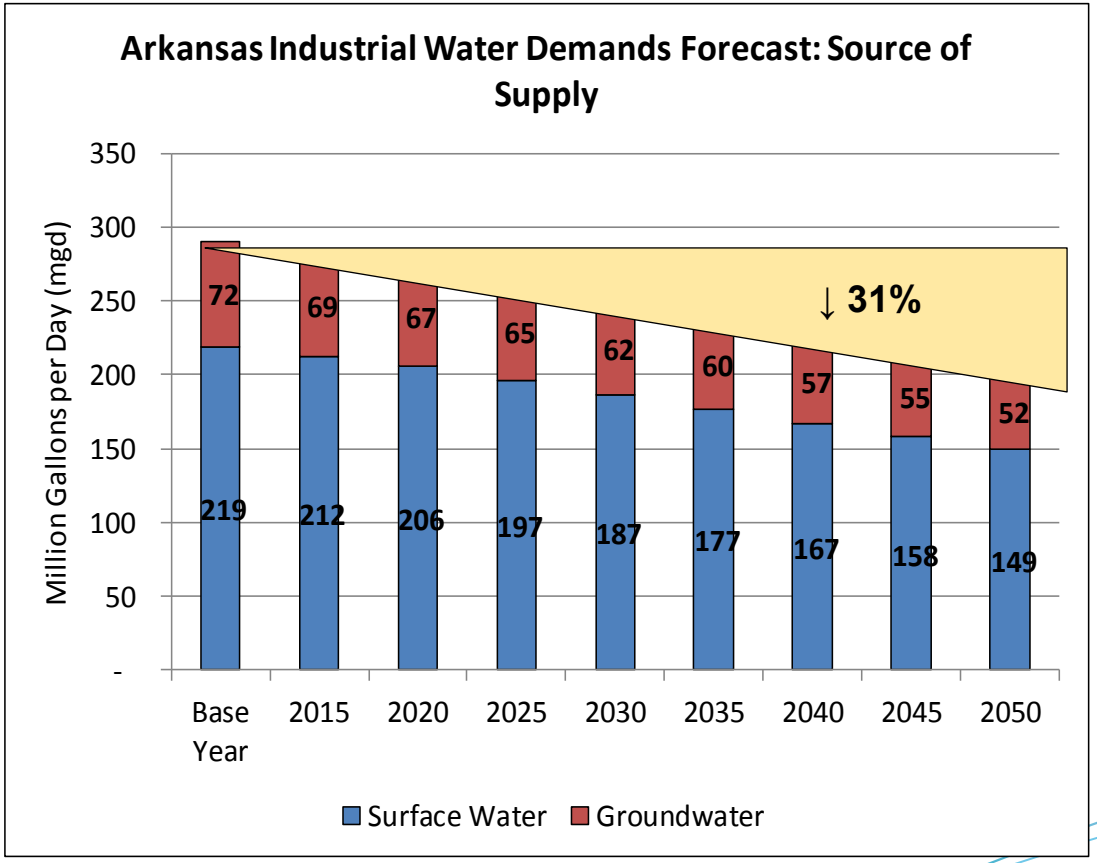
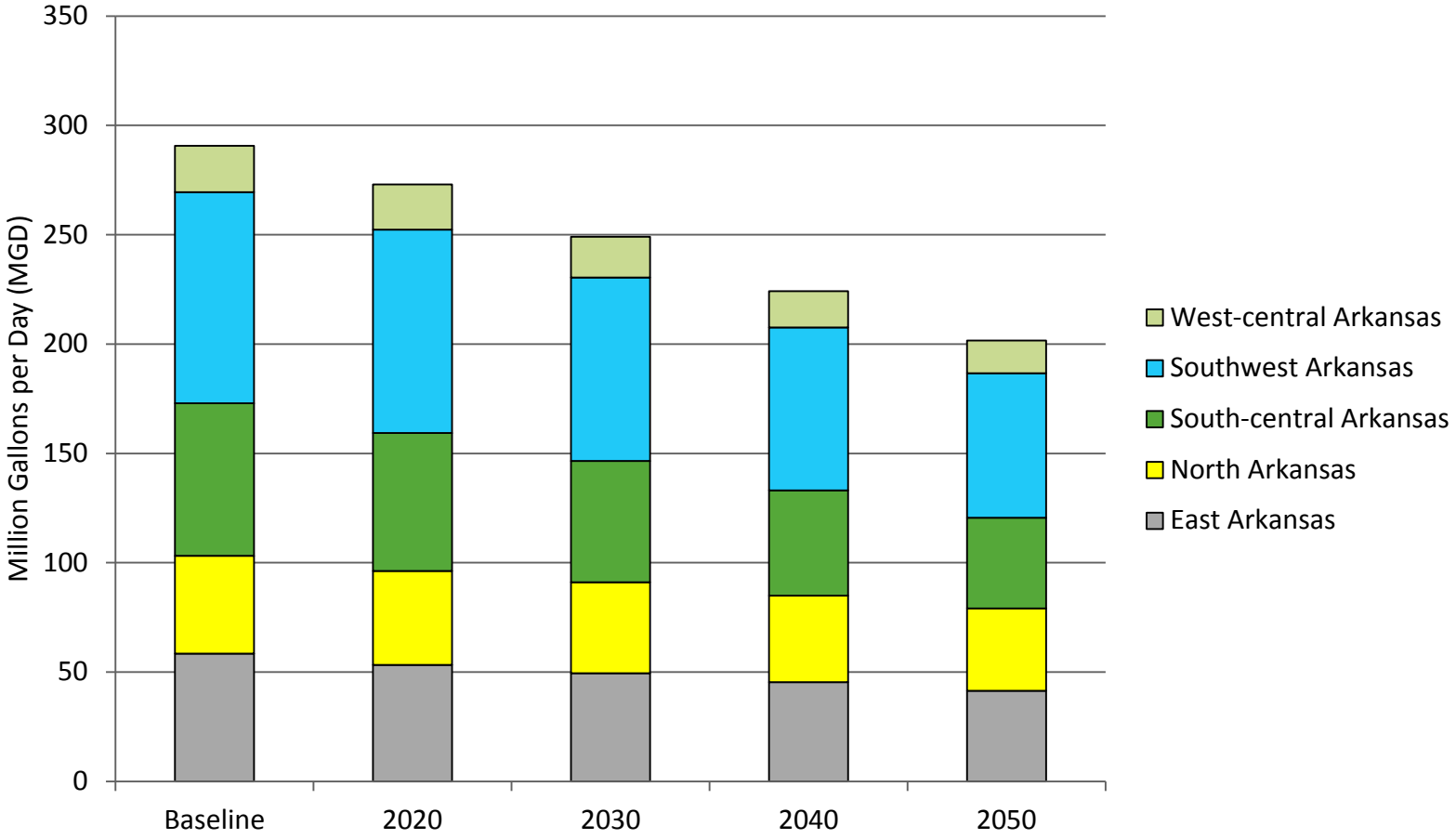
Industrial Water Demand Forecast: Results

- Demand include both municipally-supplied and self-supplied industrial demands
- Industrial water demands decrease by 31% from Base Year to 2050
- Decrease attributed to projected decline in manufacturing employment
- Demand declines in nearly all counties



Industrial Water Demand by Region

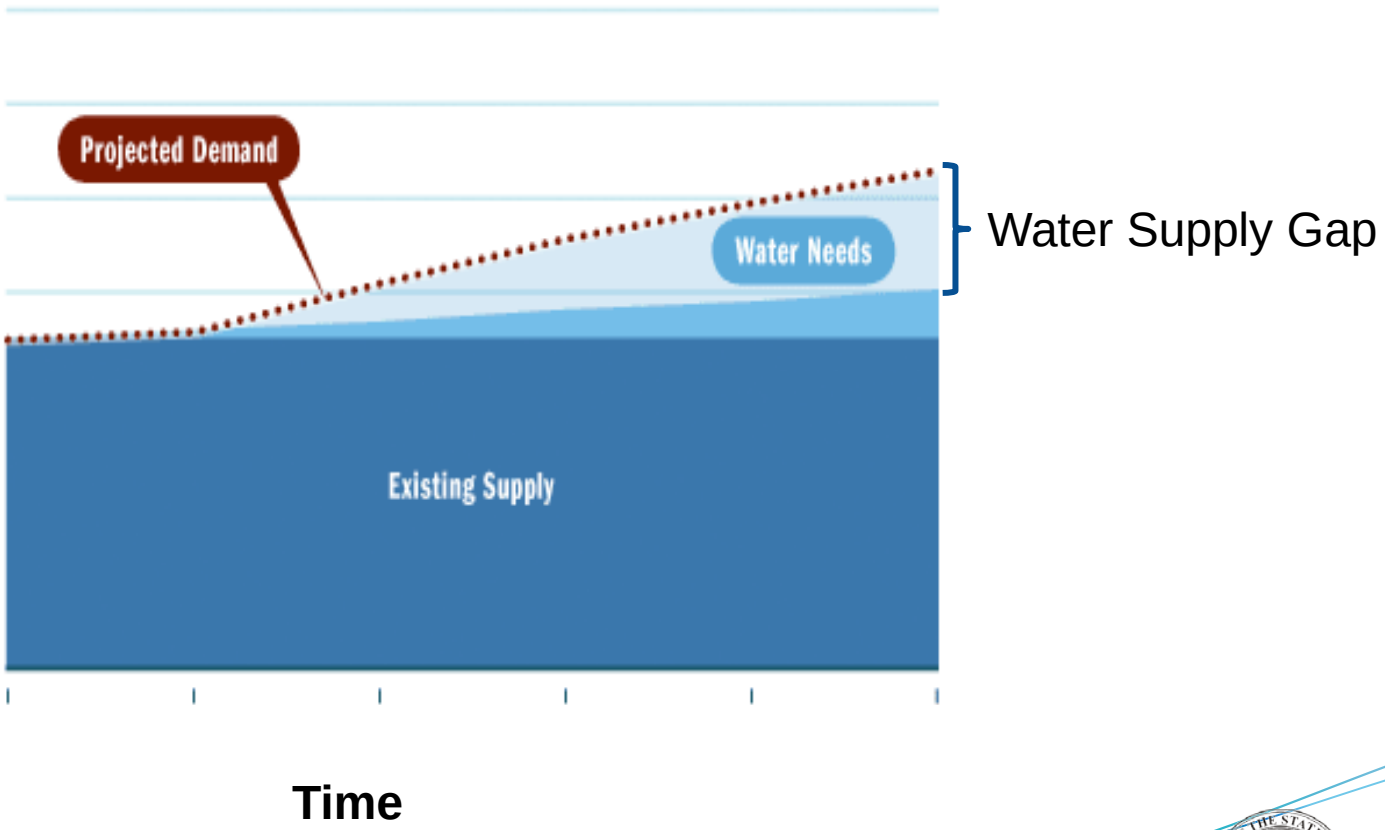


Groundwater Demand Assumption Summary

- The number of acres of crop land will increase at a rate similar to the historic trend in cropland development
- The reasonable maximum tillable acres will be reached in about 2030
- The mix of crops is will can be predicted based on historic trends and projected price
- Industrial demands are 11% of total water demand and is projected to decrease over the planning horizon

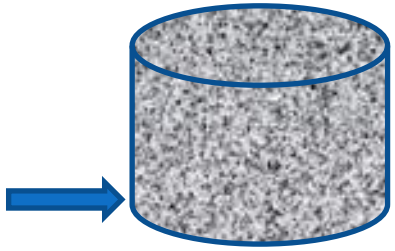
Groundwater Gap

Example Water Supply Gap



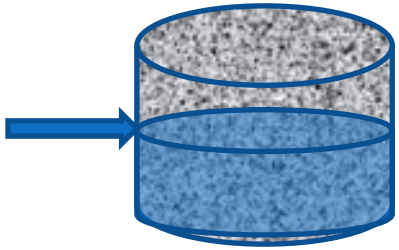
Groundwater Modeling Scenarios

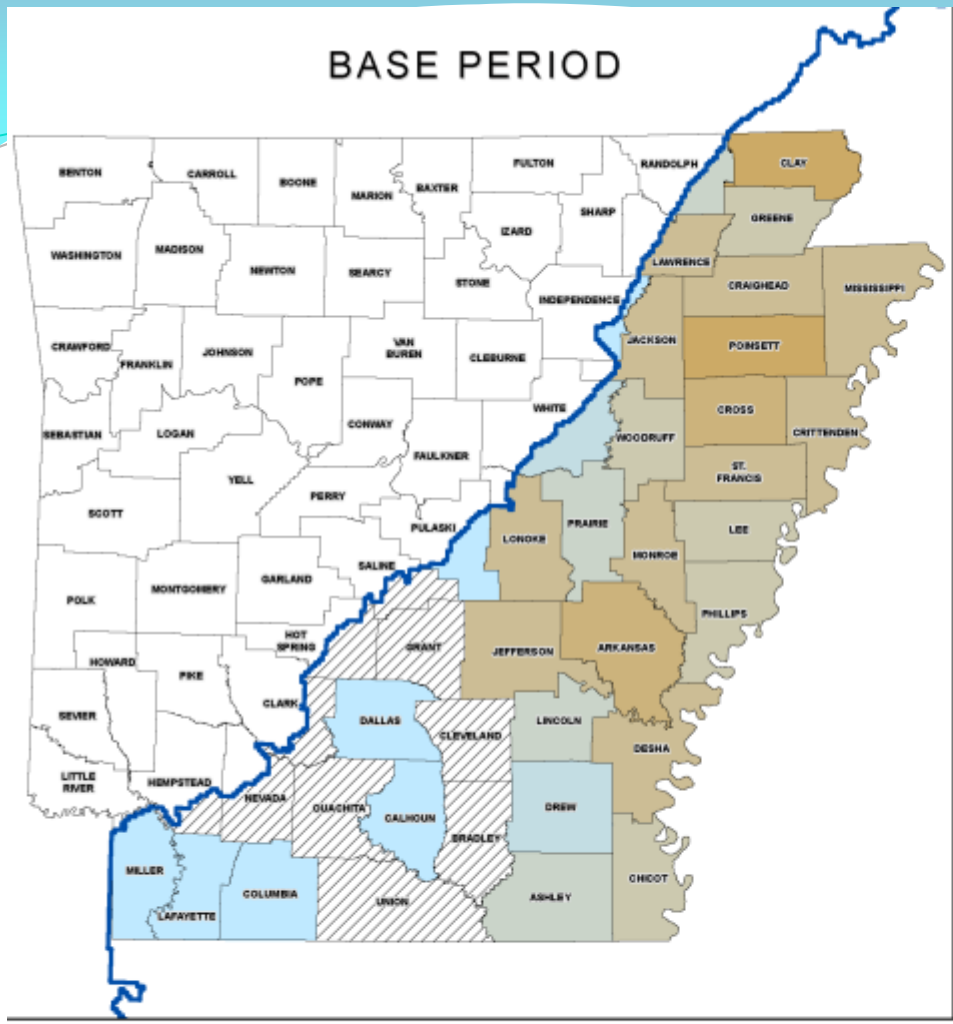
- **Scenario 1:**
- Allows full dewatering or mining of the aquifer



- **Scenario 3:**

Stops pumping when water level reaches half of the aquifer thickness





Legend

- MERAS Outline
- County Boundary

Demand

- No significant demand
- < 50 MGD
- 50 - 100 MGD
- 100 - 200 MGD
- 200 - 300 MGD
- 300 - 400 MGD
- 400 - 500 MGD
- > 500 MGD

Figure 5-12
Distribution of Demand in the Alluvial Aquifer in Base Period and 2050

Arkansas State Water Plan Update
Groundwater Availability

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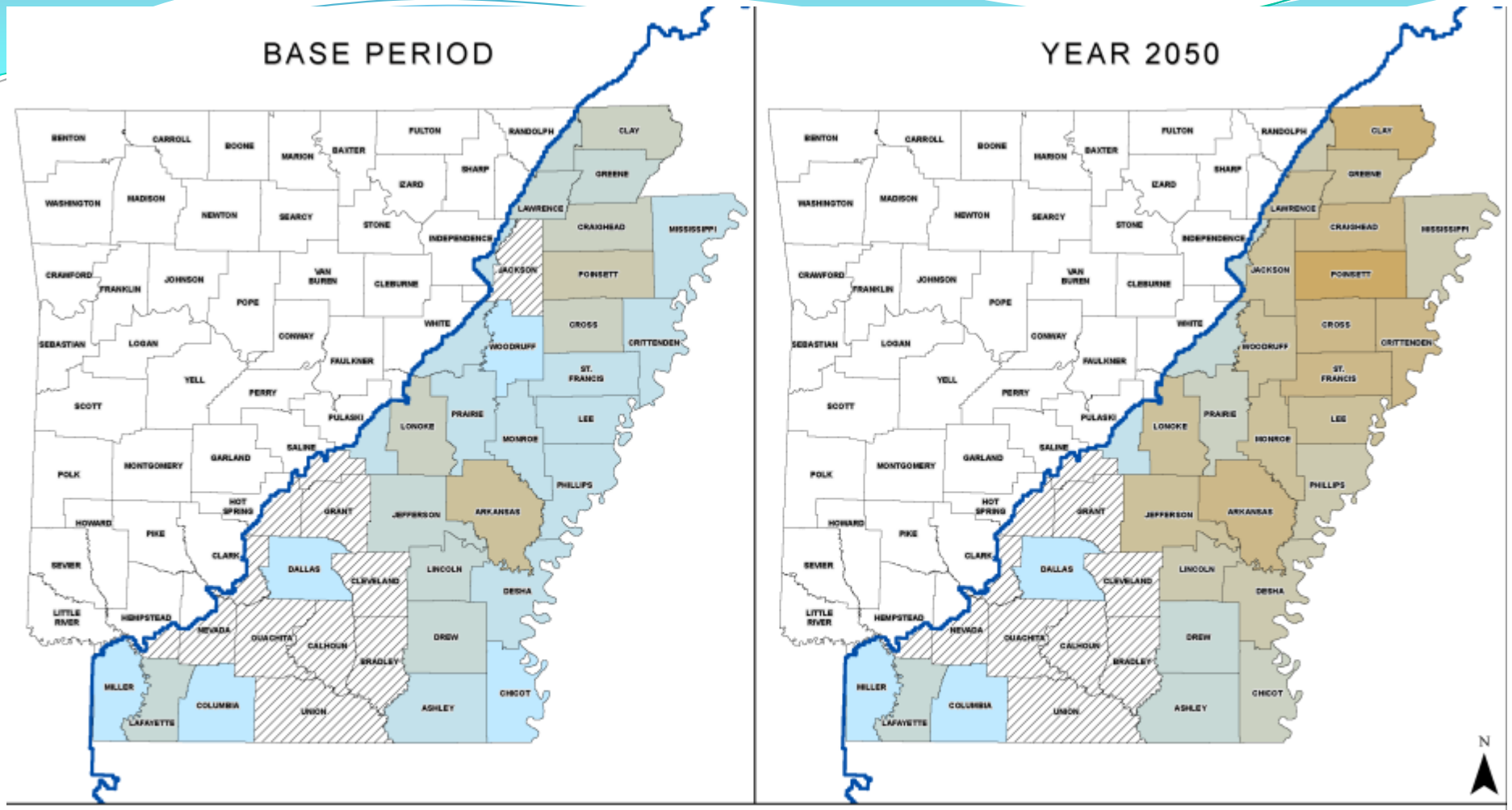

Figure 5-15
Supply Gap Map for Alluvial Aquifer Scenario 1 Base Period and 2050

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Groundwater Availability

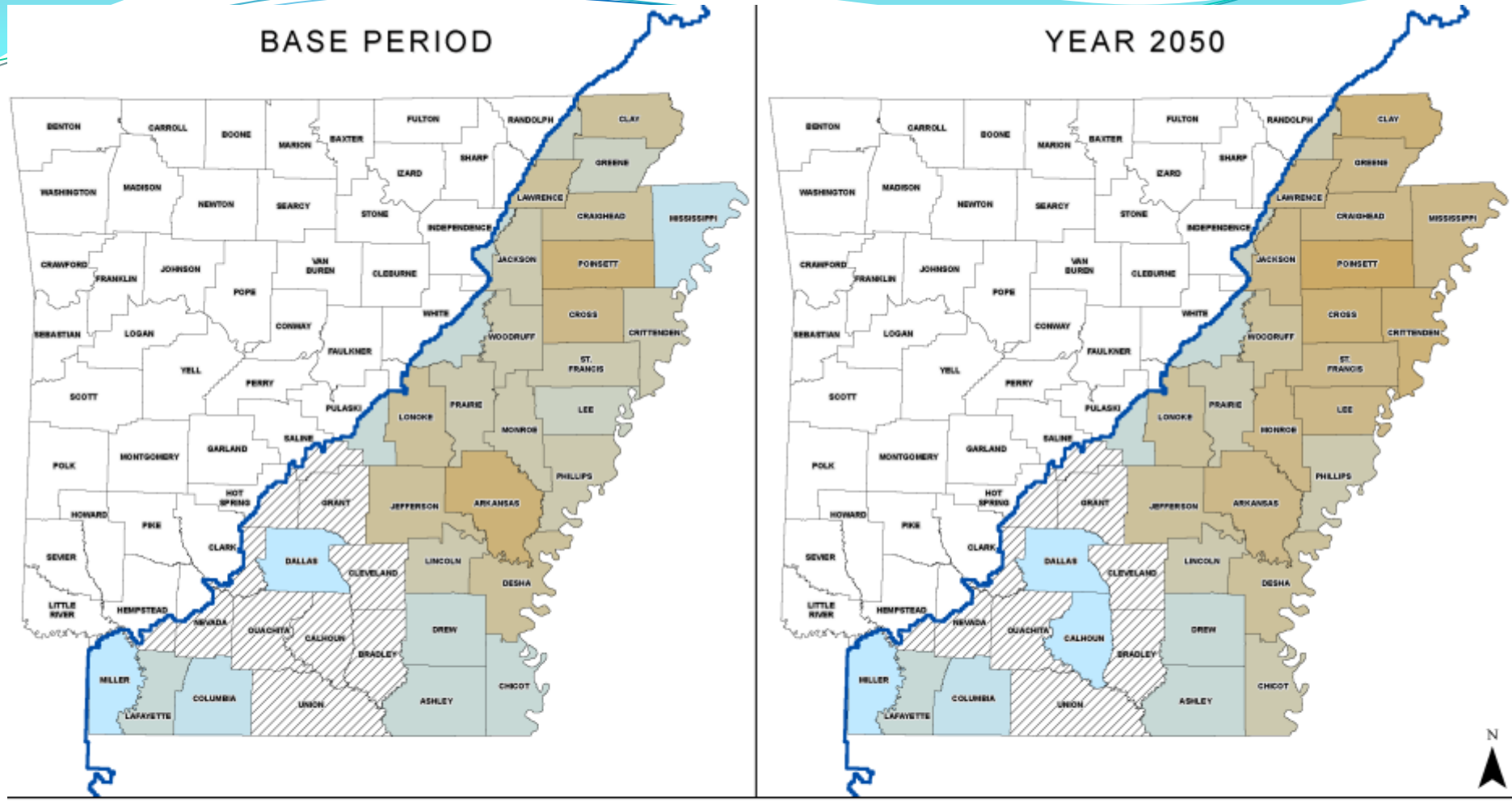

Figure 5-19
Supply Gap Map for Alluvial Aquifer Scenario 3 Base Period and 2050

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Groundwater Availability

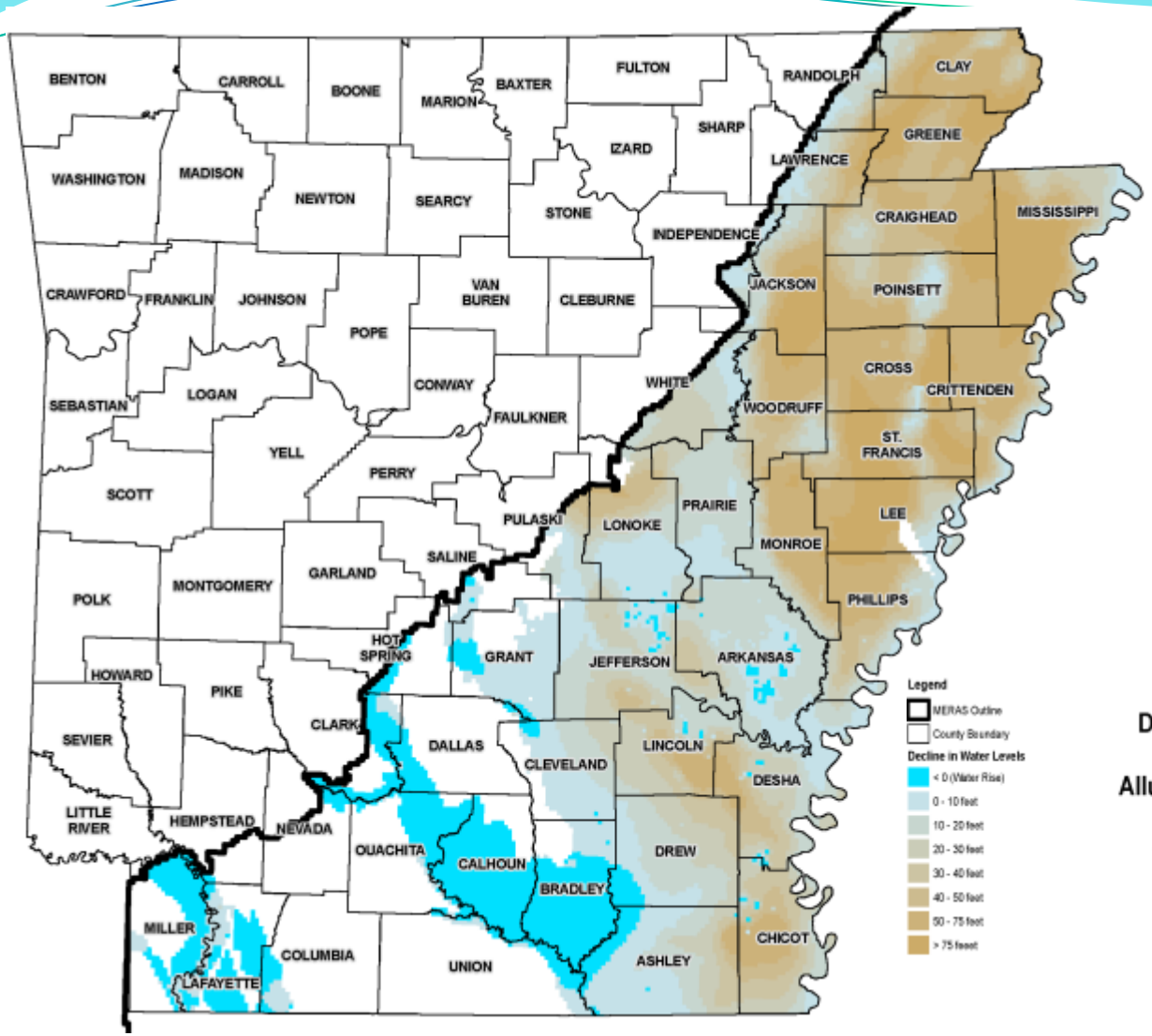

Figure 5-17
Decline in Water Levels
Base Period to 2050
Alluvial Aquifer, Scenario 1

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Groundwater Availability

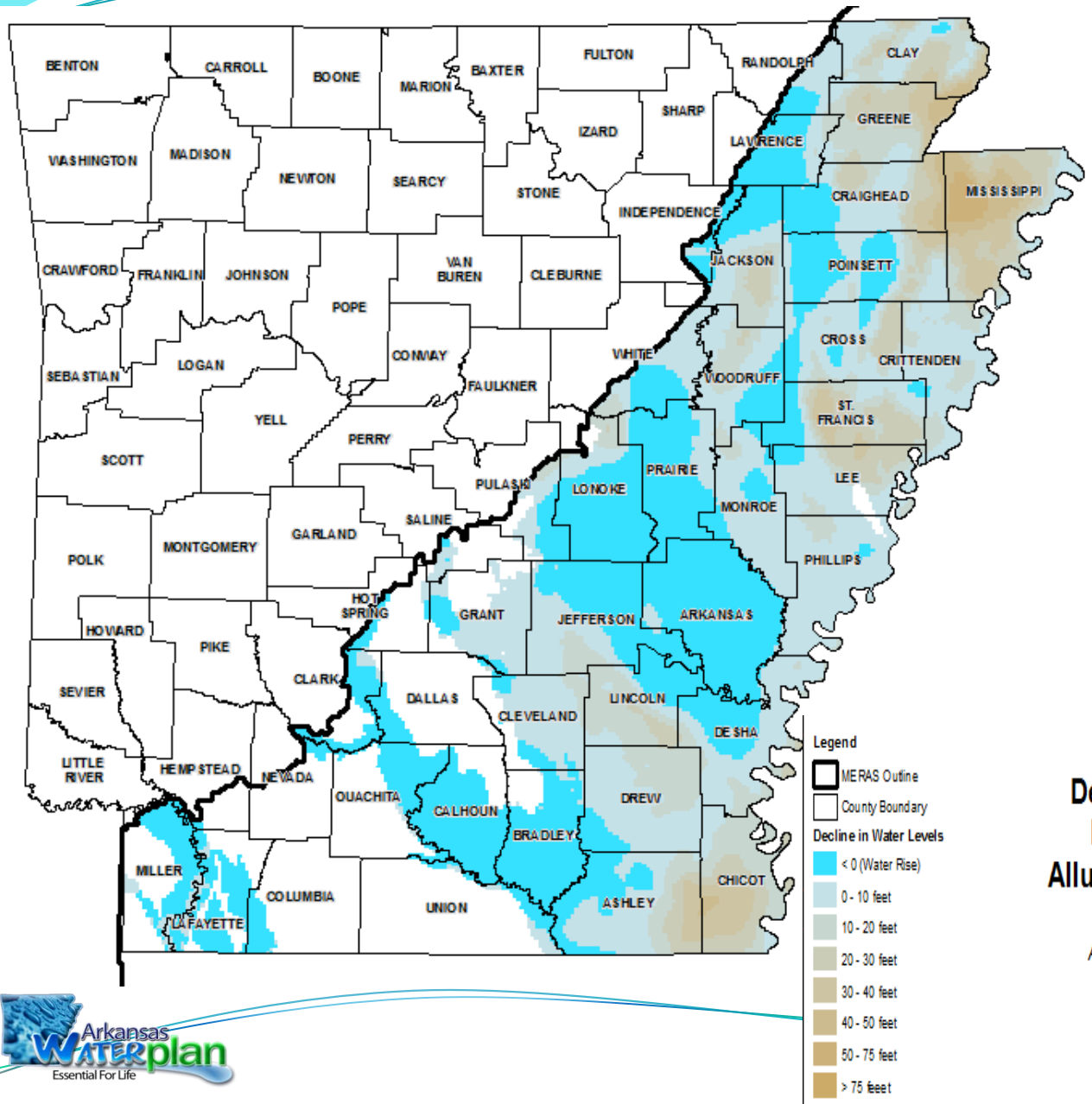

Figure 5-21
Decline in Water Levels
Base Period to 2050
Alluvial Aquifer, Scenario 3

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Groundwater Availability

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Groundwater Supply Gaps

County	Scenario 1 Supply Gap 2050 (MGD)	Scenario 3 Supply Gap 2050 (MGD)
Clay	462	496
Craighead	305	340
Cross	398	425
Greene	282	321
Mississippi	185	311
Poinsett	612	632
St Francis	321	375

Summary

- Average 28% of water demand can be met with groundwater in 2050 in full dewatering scenario
- Average 18% of water demand can be met with groundwater in sustainable pumping scenario
- Significant drawdown in groundwater levels are predicted by 2050
- Water level declines can be moderated by sustainable pumping

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