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Arbuckle Simpson Tentative Determination of Maximum Annual Yield: Implications for Chickasaw National Recreation Area

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May 15, 2012

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Outline of Presentation

- Background
- Determination of Maximum Annual Yield
- Numerical model in vicinity of Chickasaw NRA
- Simulated base flow in Chickasaw NRA
- Measured streamflow in Chickasaw NRA
- Summary
- Conclusions

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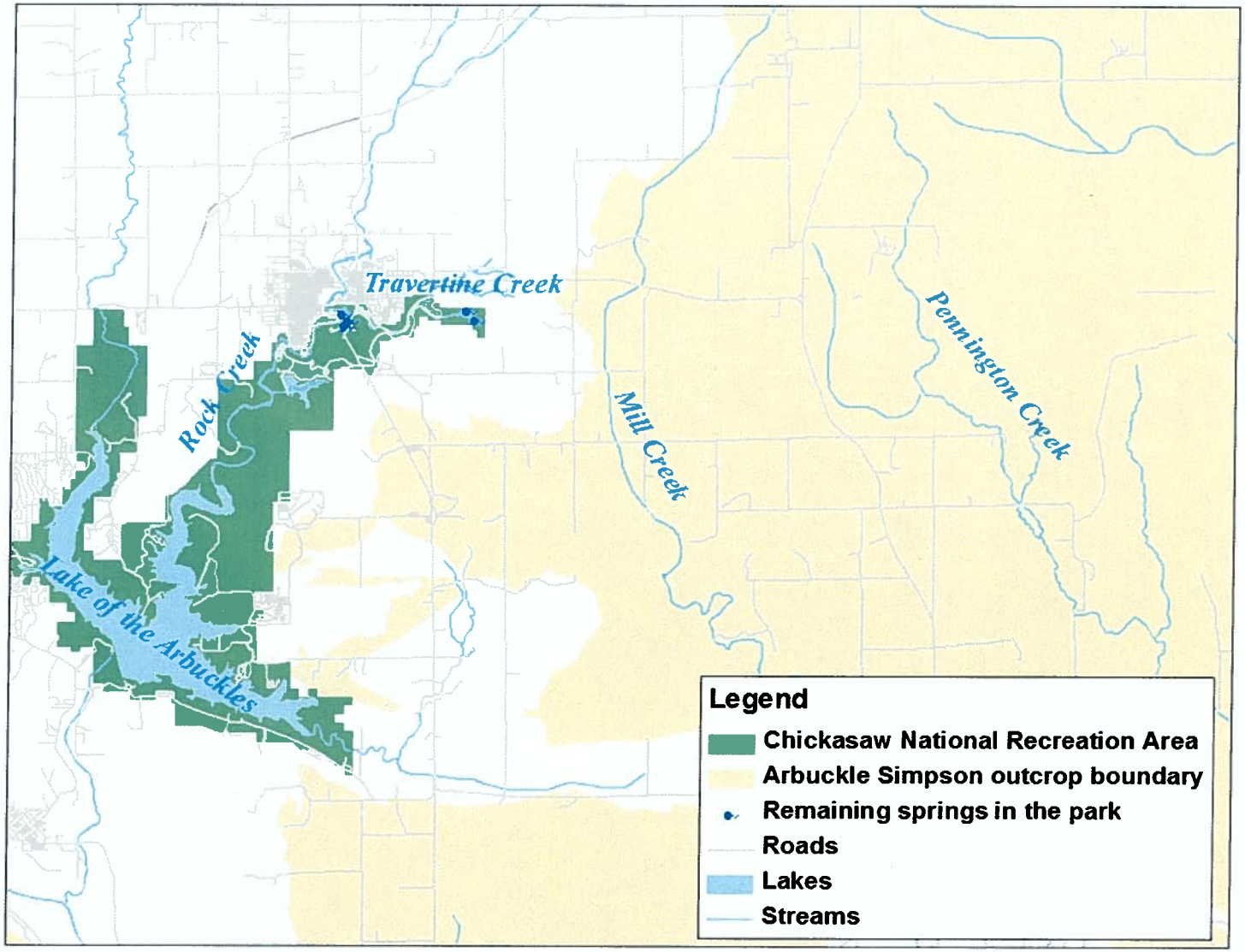


Determination of Maximum Annual Yield for a Sensitive Sole Source Basin

- Board must approve a MAY that will ensure that any permit will not reduce the natural flow of springs or streams (82 O.S. Section 1020.9A)
- Board must determine whether a proposed use is likely to degrade or interfere with springs and streams (82 O.S. Section 1020.9A)
- Degradation or interference is interpreted to mean the cumulative impact of pumping from existing and proposed wells that may impact a stream by more than 25% of base flow (Tentative Conclusion 9a, Tentative Determination of MAY, issued March 13, 2012)

Hydrologic Study

- OWRB conducted a hydrologic study of the aquifer
- Arbuckle-Simpson MODFLOW groundwater-flow model optimized to stream flow on Pennington Creek and Blue River
- Calibrated model used to evaluate the response of the aquifer to equally distributed groundwater withdrawals
- Model simulated reductions in base flow under three different equal proportionate shares of distributed pumping (0.125, 0.250 and 0.392 ac-ft/ac/yr)
- OWRB selected a MAY of 78,404 acre-ft which equates to an equal proportionate share of 0.20 (ac-ft/ac)/yr

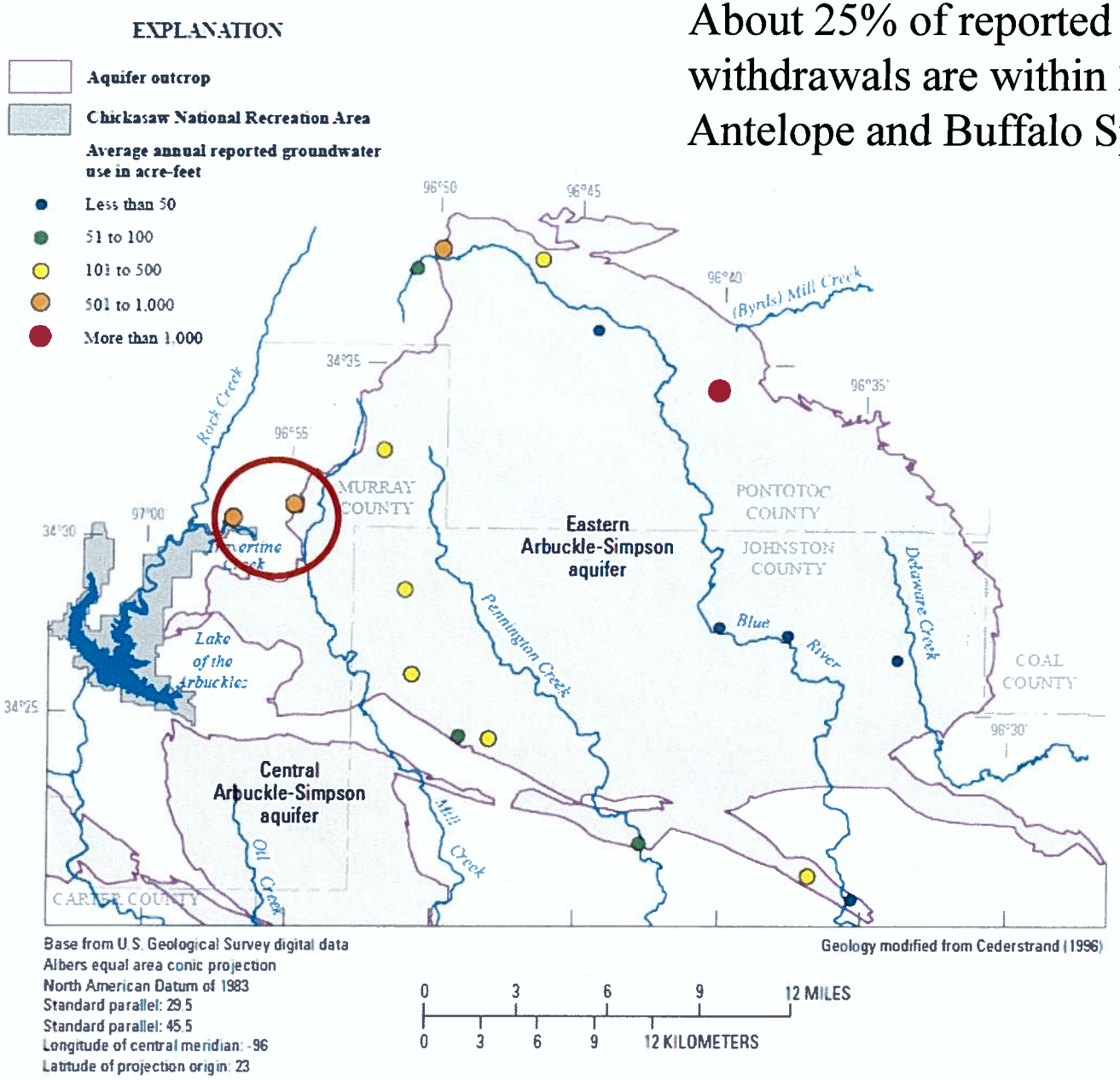
Evaluation of Numerical Model in Vicinity of Chickasaw NRA

	Blue River near Connerville	Pennington Creek near Reagan	Rock Creek at Sulphur
	cfs	*cfs*	*cfs*
Base Flow from PART Method and Measured Data	61.28	32.47	14.86
Base Flow from Model Simulations	61.34	32.19	15.42

Simulated 5-Year Average Base Flow of Area Streams

	Blue River	Pennington Creek	Travertine Creek	Mill Creek
	cfs	*cfs*	*cfs*	*cfs*
No withdrawals	63.68	32.5	16.9	8.96
Existing Water Use	61.3	32.2	15.4	8.5
EPS = 0.125	45.0	24.4	13.6	6.1
EPS = 0.20	32.2	18.9	11.1	4.3
EPS = 0.25	28.2	16.7	9.3	3.4
EPS = 0.392	11.6	8.0	2.6	1.0

About 25% of reported groundwater withdrawals are within 2 miles of Antelope and Buffalo Springs



Depletion in 5-Year Average Base Flow

Scenario	Average Annual Withdrawal Eastern Portion	Depletion in Base Flow of Travertine Creek
(acre-ft/ac)/yr	*acre-ft*	*%*
0	0	0
Reported Use	5,564	9
0.125	28,395	20
0.2	45,432	34
0.25	56,790	45
0.392	89,047	85

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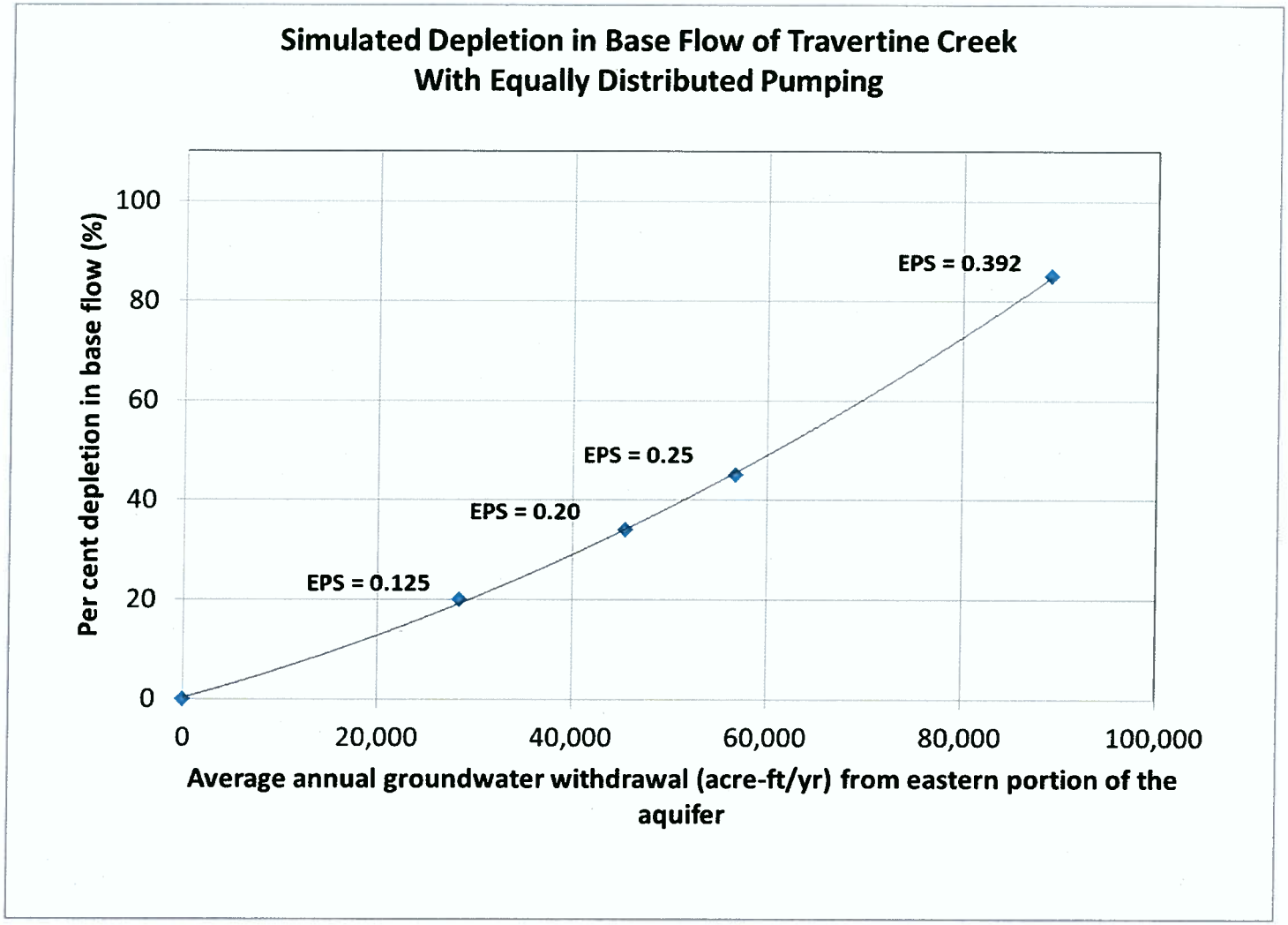

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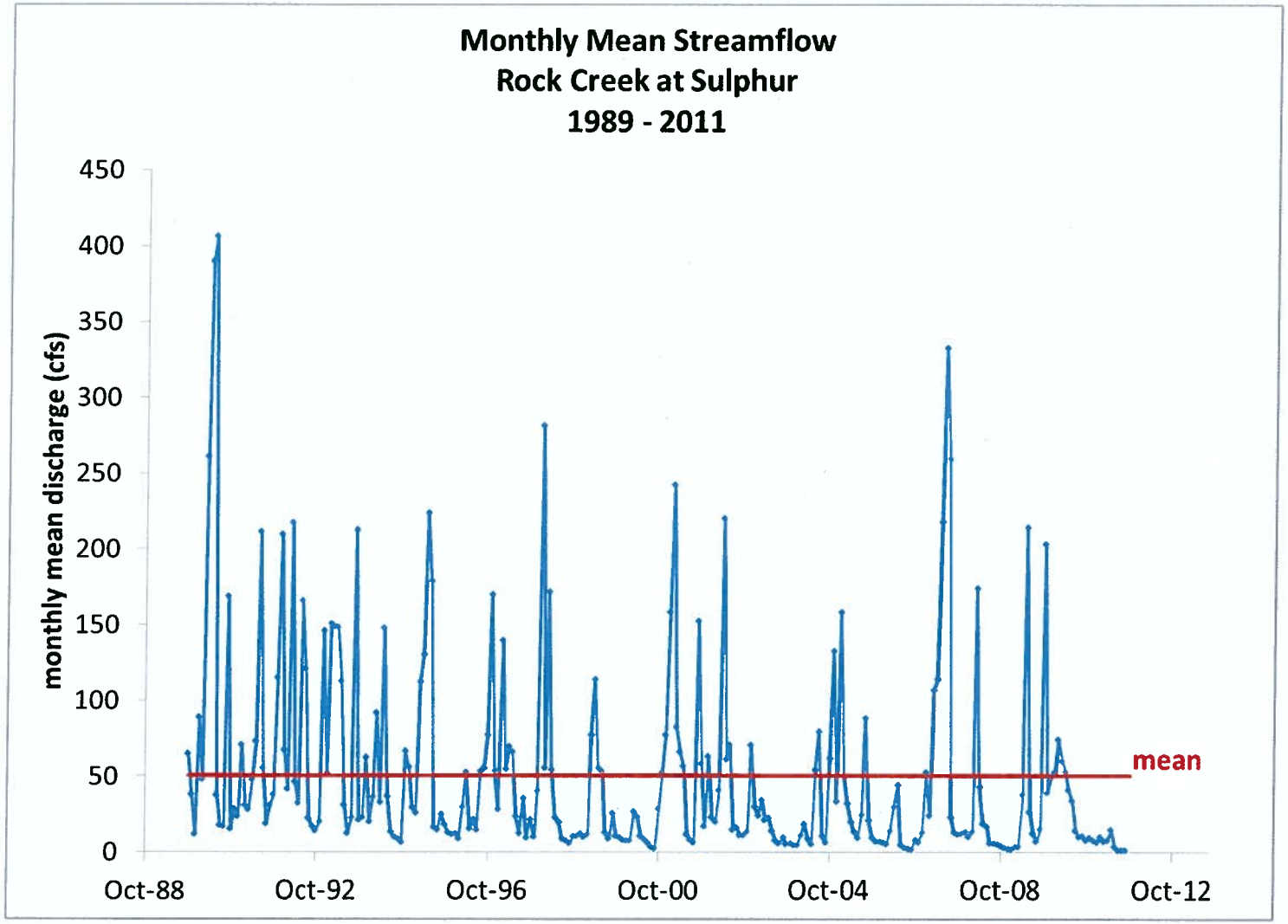

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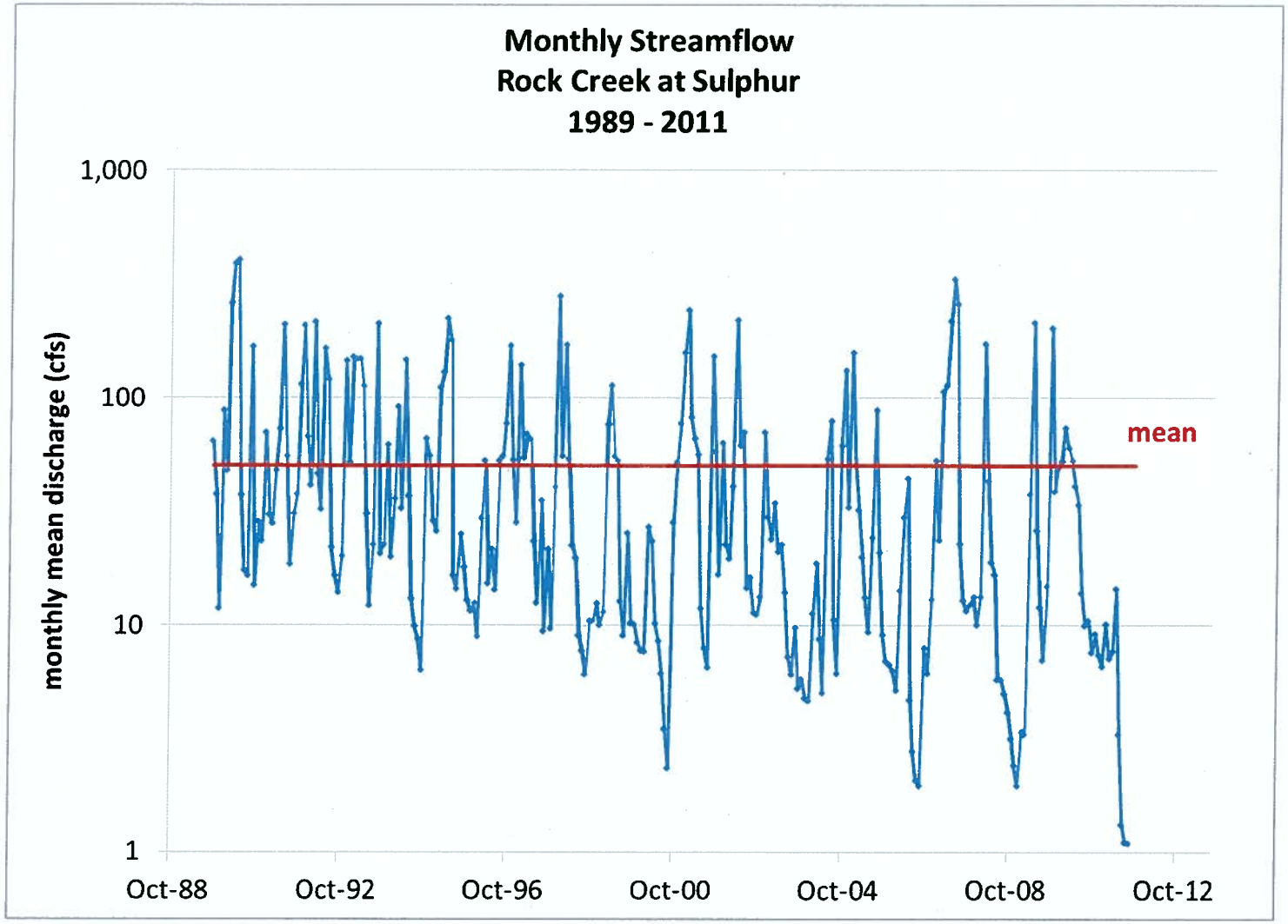

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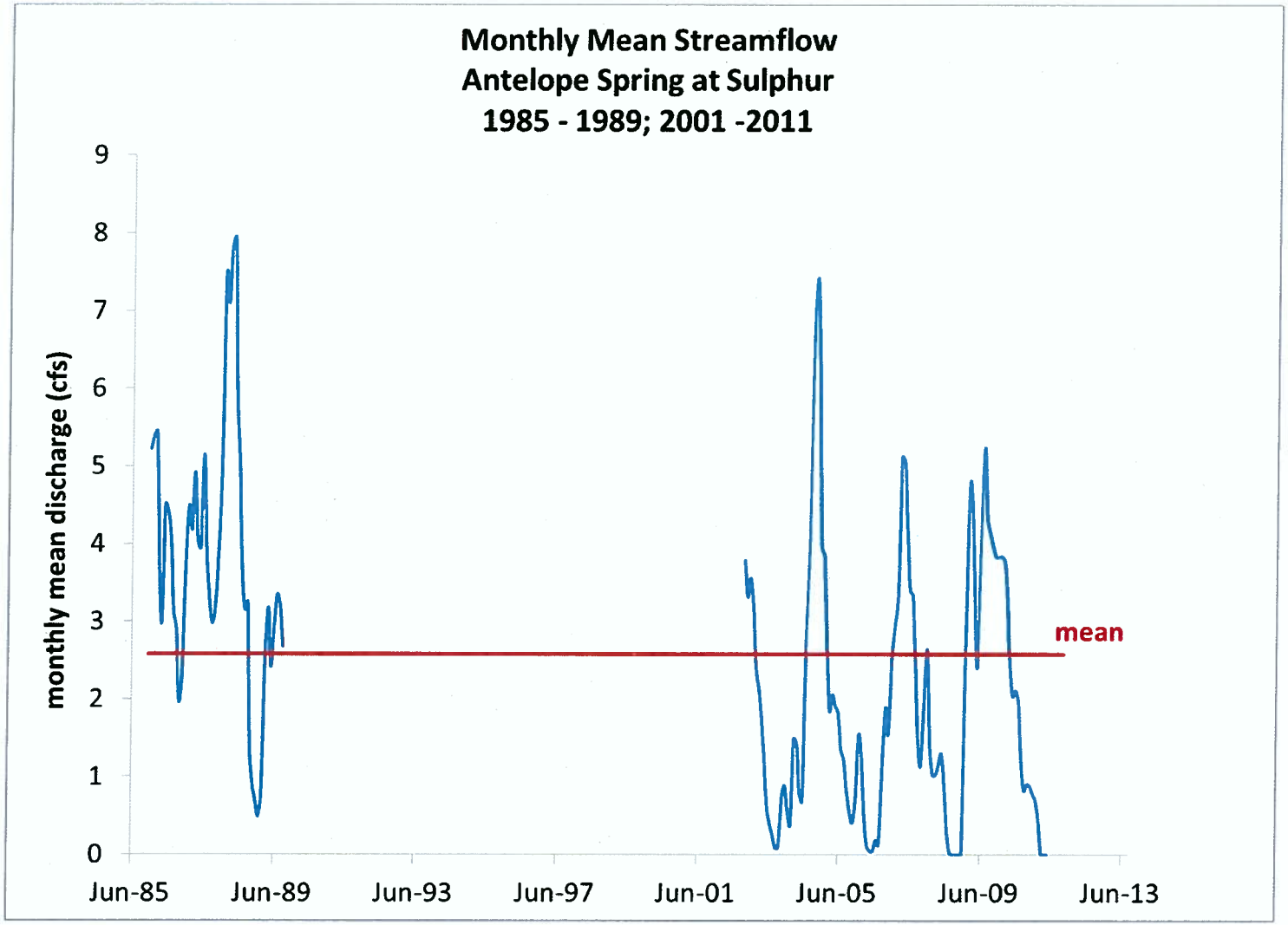

Summary

- Model results indicate:
  - An EPS of 0.2 (ac-ft/ac)/yr will reduce the base flow of Travertine Creek by more than 25%
  - Existing water use is impacting Travertine Creek
- Measured data indicate :
  - Streamflow of Rock Creek and Antelope Spring is declining
  - Existing stresses on the aquifer affect spring discharge
- Both the numerical model and measured data indicate that springs and streams will respond to increased groundwater withdrawals

Conclusions

- NPS supports the process that has been adopted to protect springs and streams emanating from the Arbuckle Simpson
- The numerical model is the best available tool to evaluate the effects of groundwater withdrawals on springs and streams
- The numerical model shows that an EPS = 0.20 results in degradation of more than 25% of base flow of Travertine Creek
- Additional measures will be necessary to protect the natural flow of springs and streams in Chickasaw NRA