GARBER-WELLINGTON MANAGEMENT STUDY

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Oklahoma Water Resources Board

Presented to:
Oklahoma Water Resources Board
August 19, 2014

GARBER-WELLINGTON MANAGEMENT STUDY

Team Members

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Jessica S. Magers – OWRB/USGS

GARBER-WELLINGTON MANAGEMENT STUDY

Additional Support

Scott Christenson – USGS

John Harrington - ACOG

Scott Bowen – Tinker AFB

Neil Suneson- Oklahoma Geological Survey

Stan Paxton - USGS

Noel Osborn– OWRB/USGS/NPS

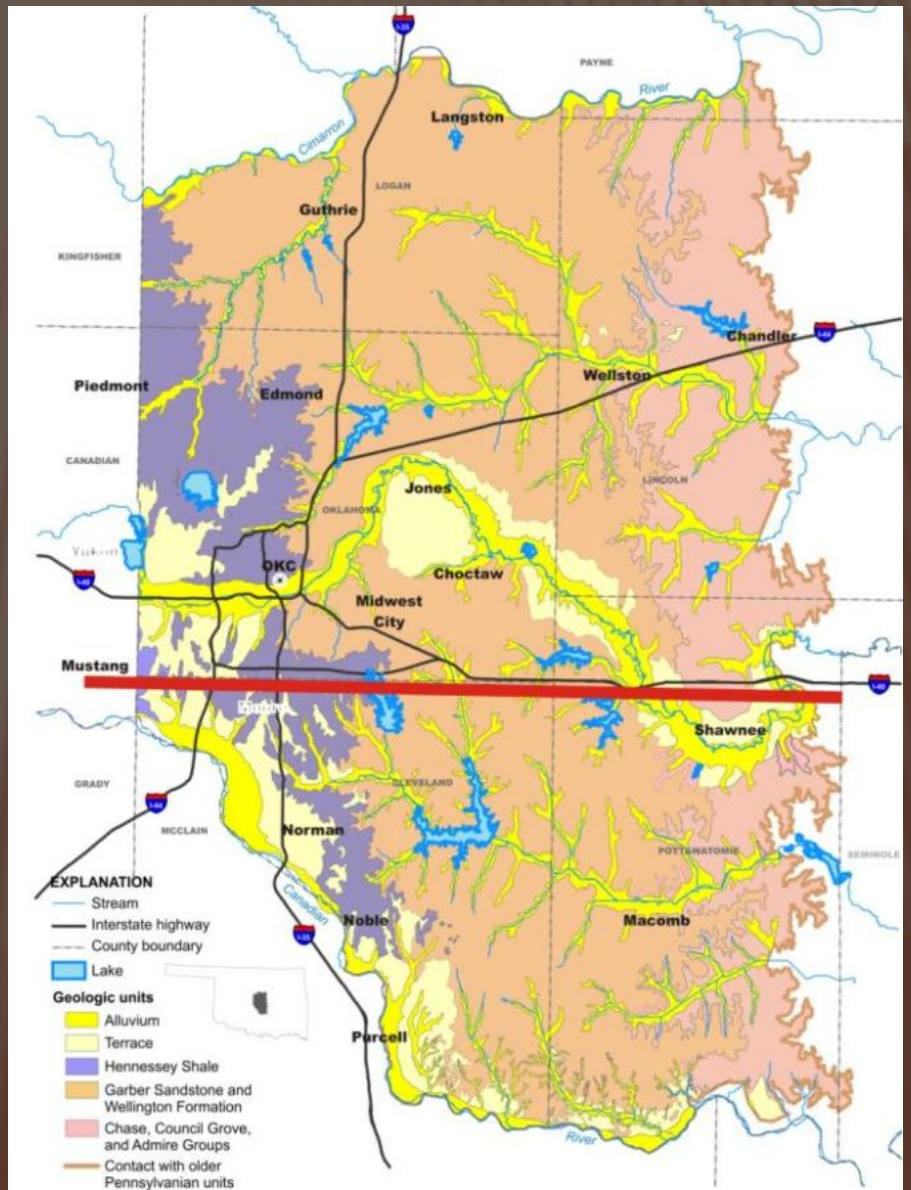
OVERVIEW

- Study began in Fall 2008
- 50/50 cost match with Bureau of Rec.
- OWRB Contracted with USGS
- Study was cooperative between USGS and OWRB
- Report was published in February 2014
- Cost ~ $764,000

MAJOR AQUIFERS

GEOLOGY

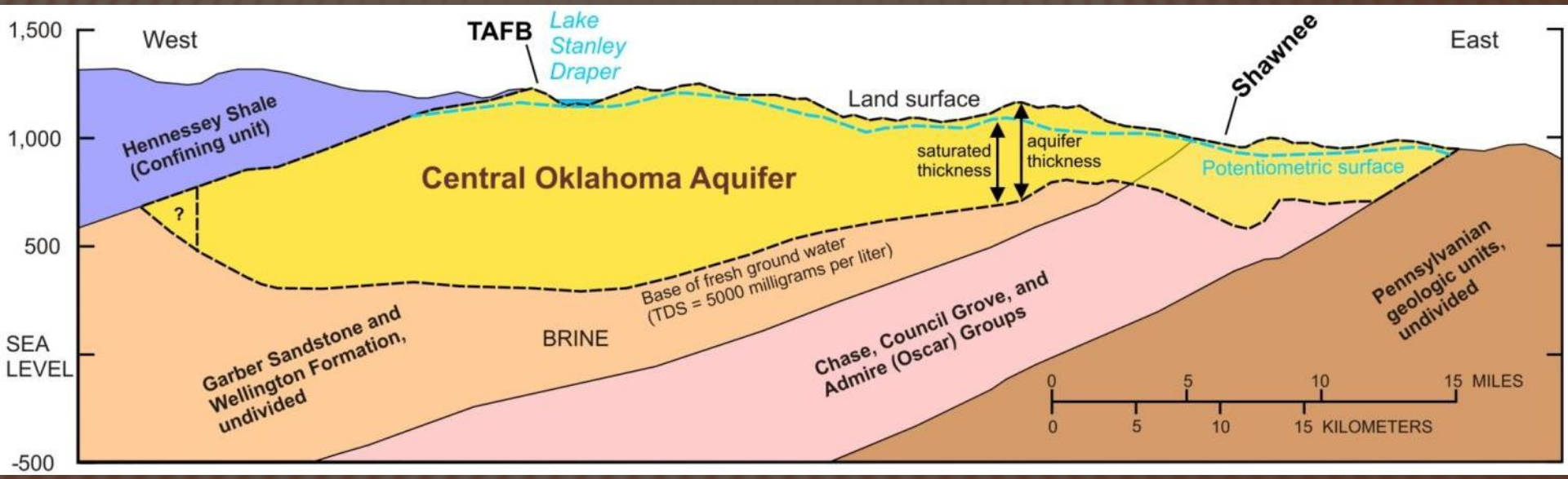
- Alluvium
- Terrace
- Hennessey Shale
- Garber Sandstone and Wellington Fm
- Chase, Council Grove, and Admire Gps
- Contact with older Pennsylvanian units



Slide courtesy of the USGS

GEOLOGY

- Cross-section

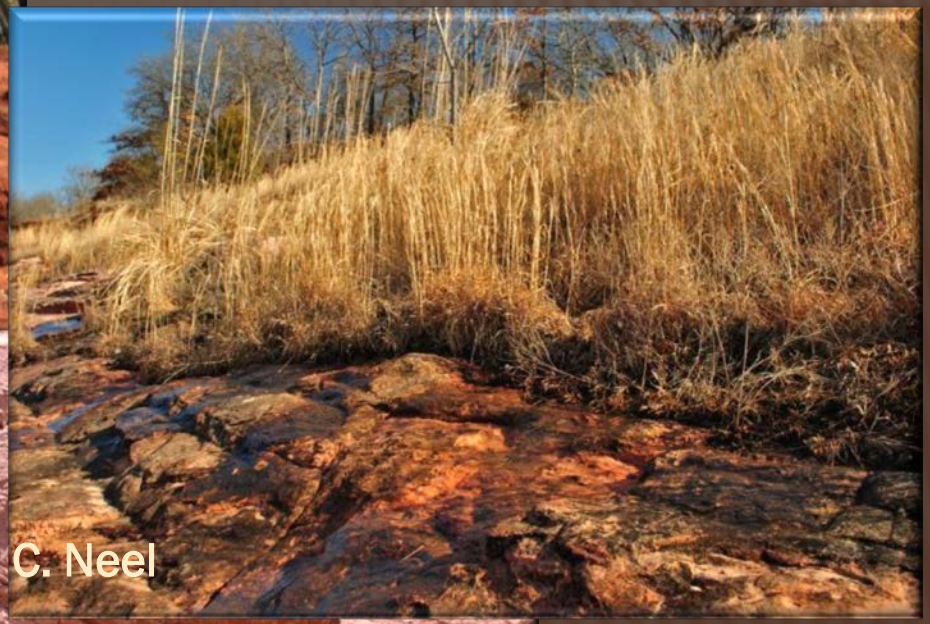


Vertical scale greatly exaggerated – beds are nearly horizontal

Slide courtesy of the USGS

GEOLOGY

Photo Courtesy of the U



C. Neel

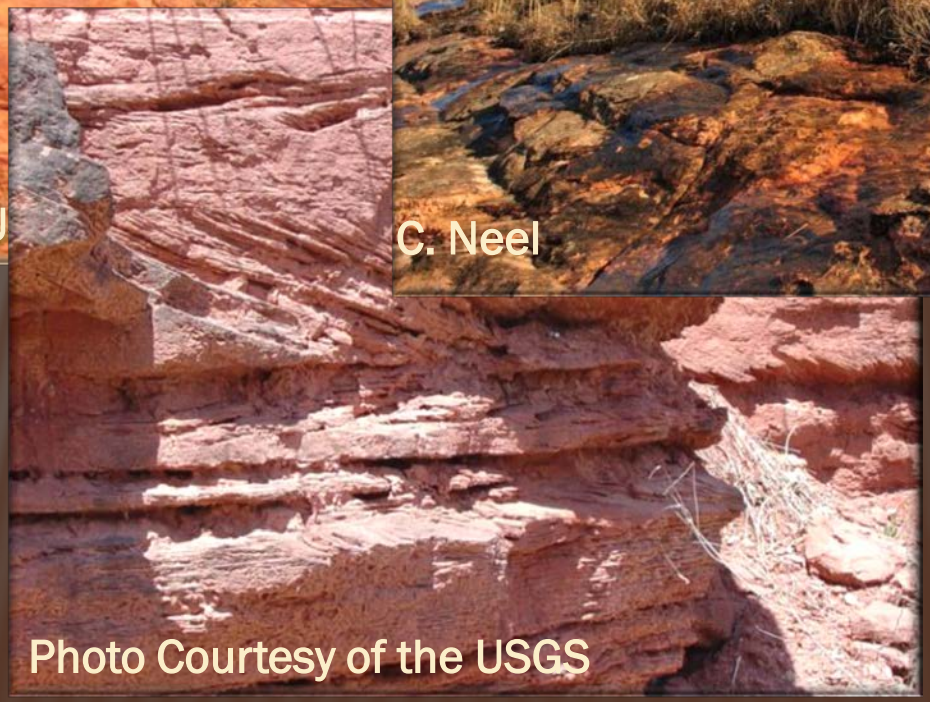
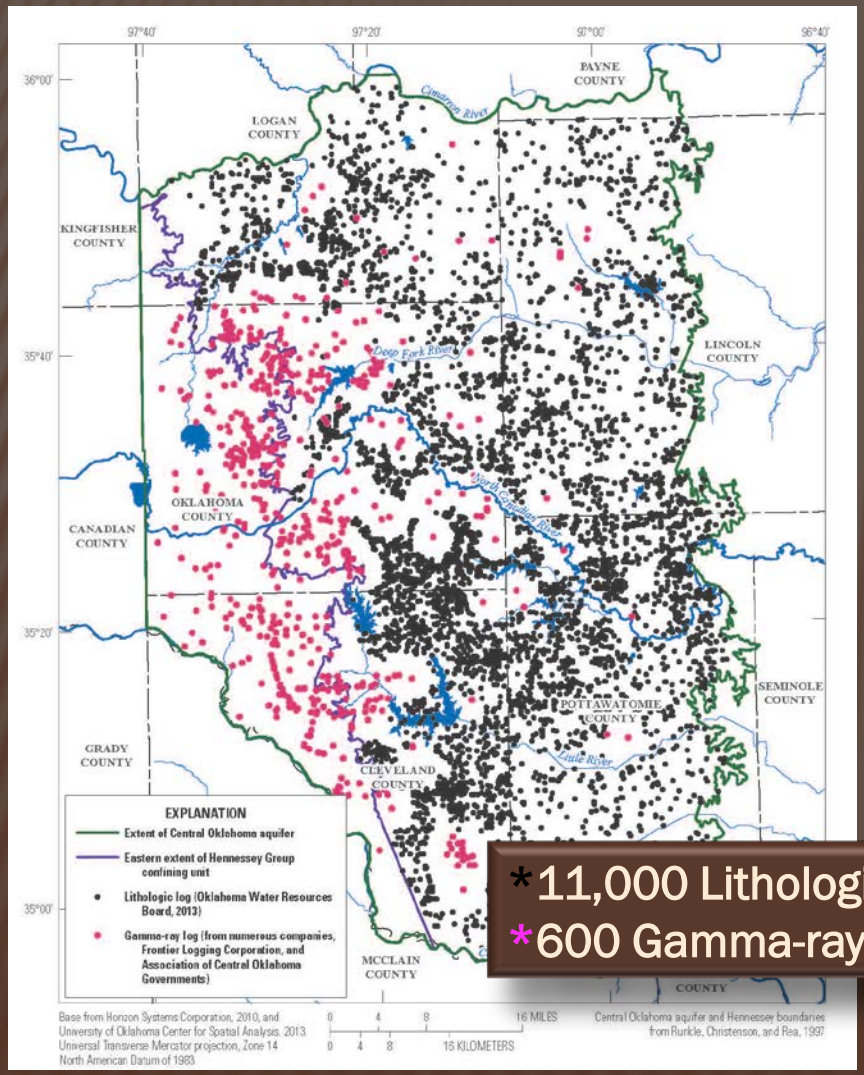


Photo Courtesy of the USGS

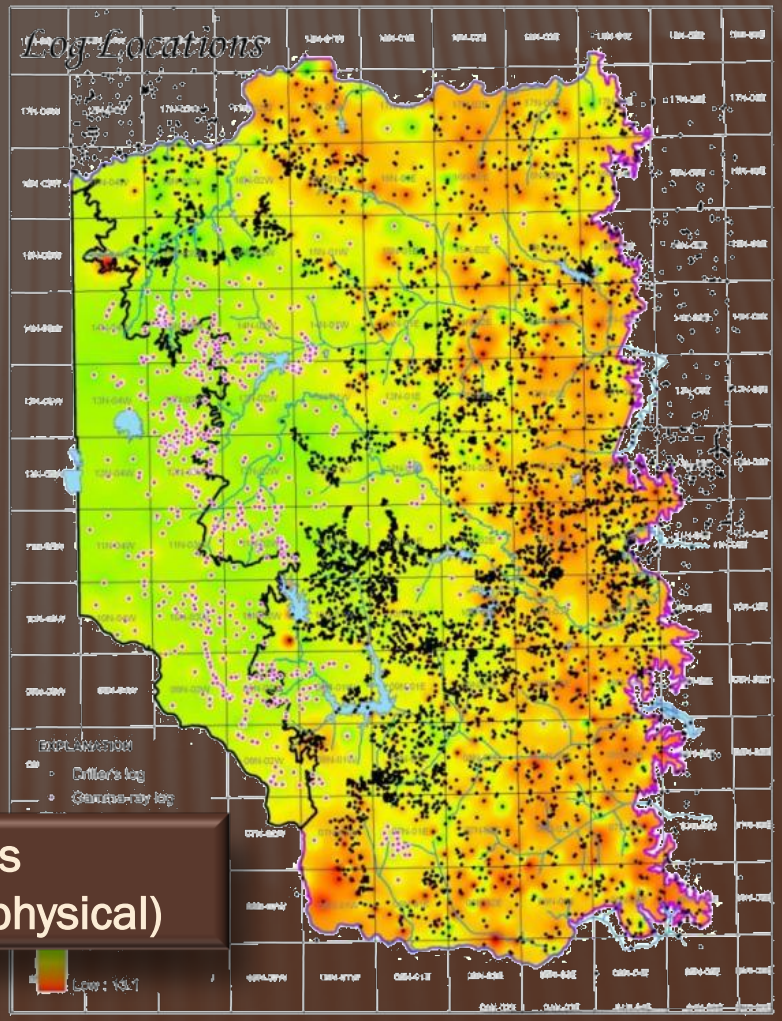
GEOLOGIC FRAMEWORK

GEOLOGIC FRAMEWORK



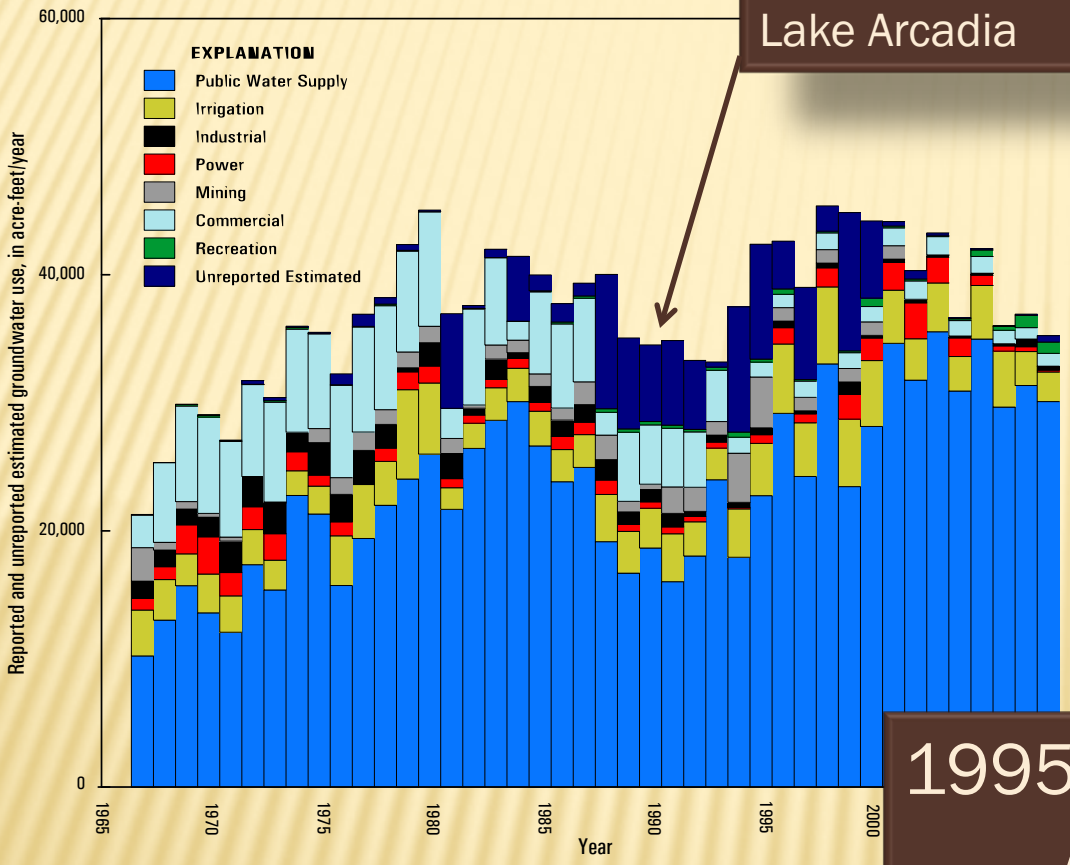
*11,000 Lithologic Logs
*600 Gamma-ray (geophysical)

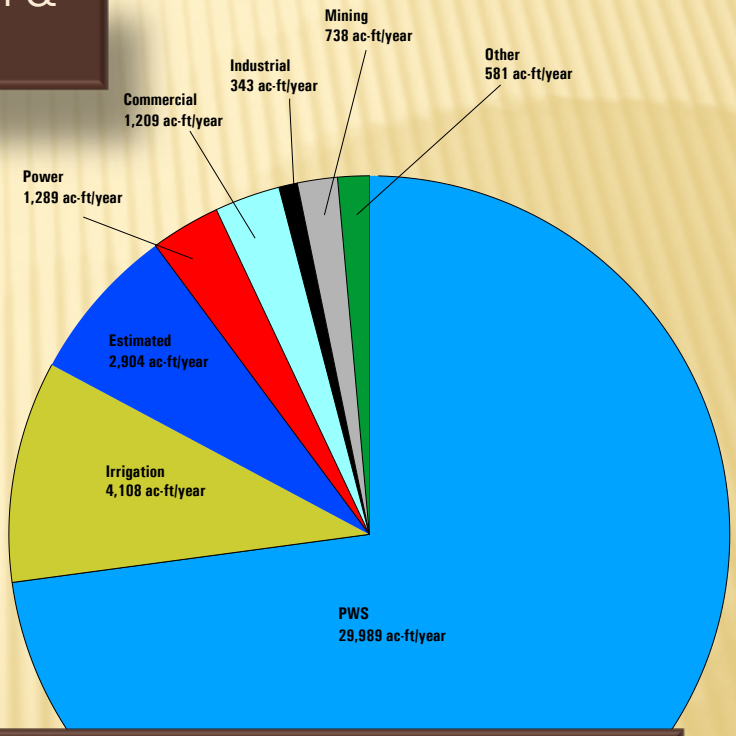
Percent Sand



PERMITTED GROUNDWATER USE

Higher Precipitation & Lake Arcadia





1995-2008

- Avg. use 41,155 ac-ft
- PWS = 73% (29,989 ac-ft)

PERMITTED GROUNDWATER USE

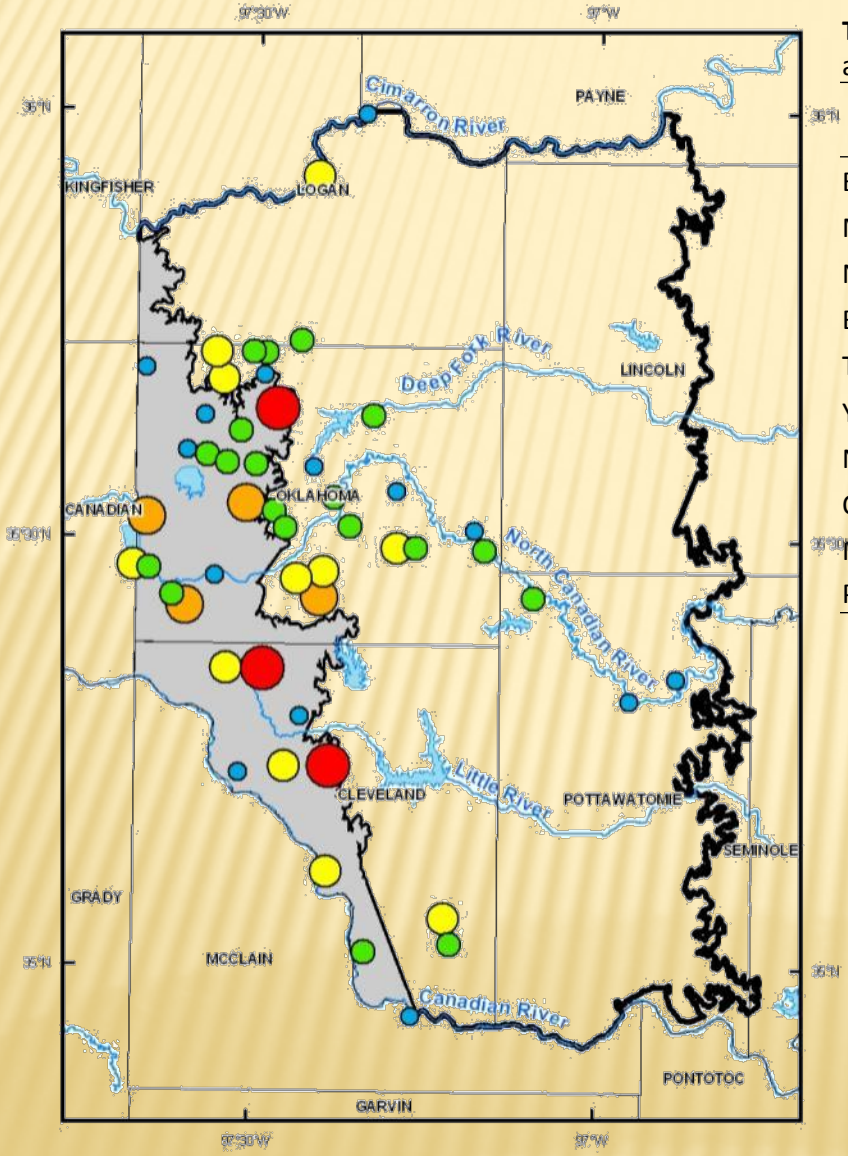


Table 5. Largest users of groundwater in the Garber-Wellington aquifer and associated alluvium and terrace deposits from 1995 to 2008.

	Annual Groundwater Use (acre-feet)		
	Reported Use	Unreported Use	Sum
Edmond, City of	5,998	0	**5,998**
Moore, City of	3,237	1,545	**4,782**
Norman, City of	3,132	207	**3,339**
Bethany, City of	2,317	429	**2,746**
Tinker Air Force Base	2,391	143	**2,534**
Yukon, City of	2,157	0	**2,157**
Nichols Hills, City of	2,000	0	**2,000**
Oklahoma Gas & Electric Company	1,284	0	**1,284**
Mustang, City of	1,107	171	**1,278**
Purcell, City of	942	0	**942**

Aquifer Outcrop

Aquifer Subcrop

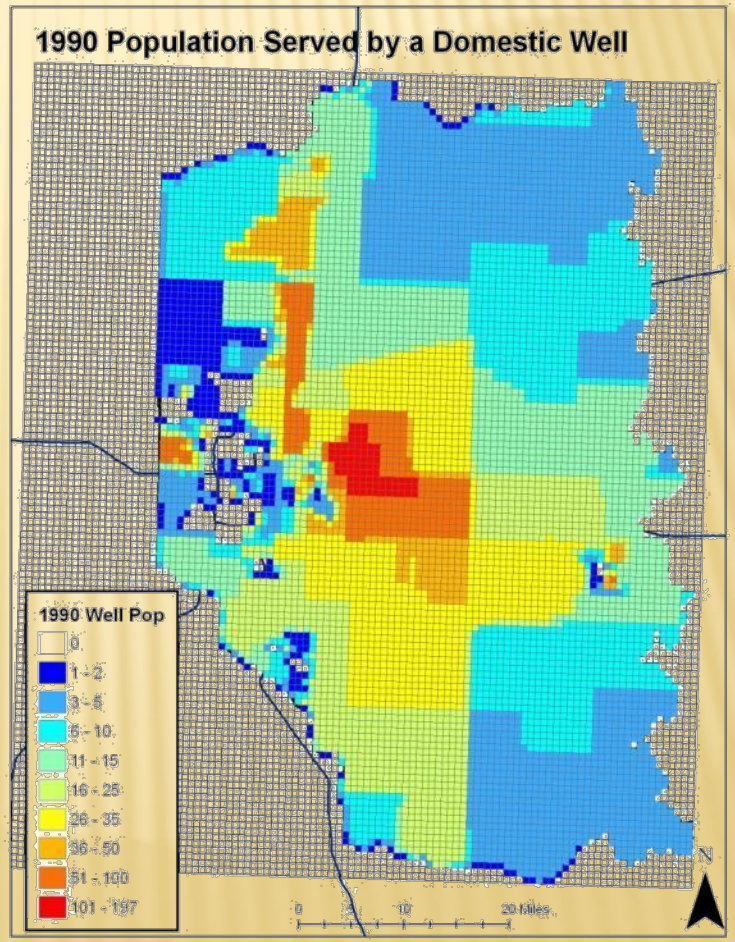
Average annual groundwater use in acre-feet, 1995-2008

- 100 to 250
- 251 to 500
- 501 to 1500
- 1501 to 3000
- 3001 to 6000

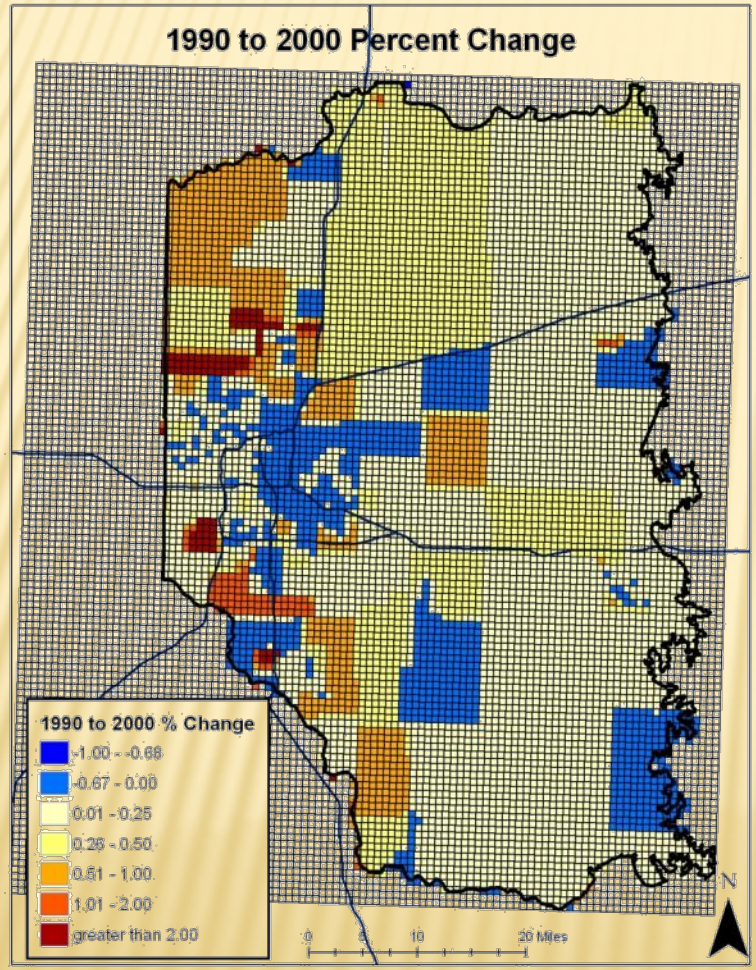
DOMESTIC GROUNDWATER USE

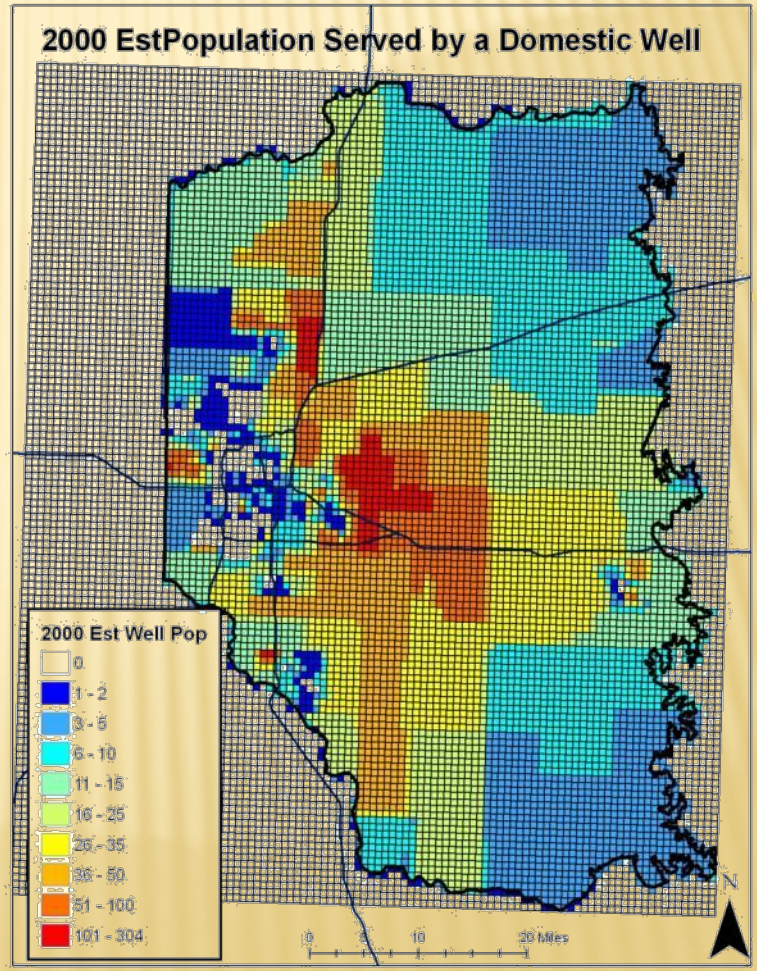
Used Census Data

- 1980, 1990, 2000, and 2010 Datasets
- 1990 Long-form Census asked “Water Source”

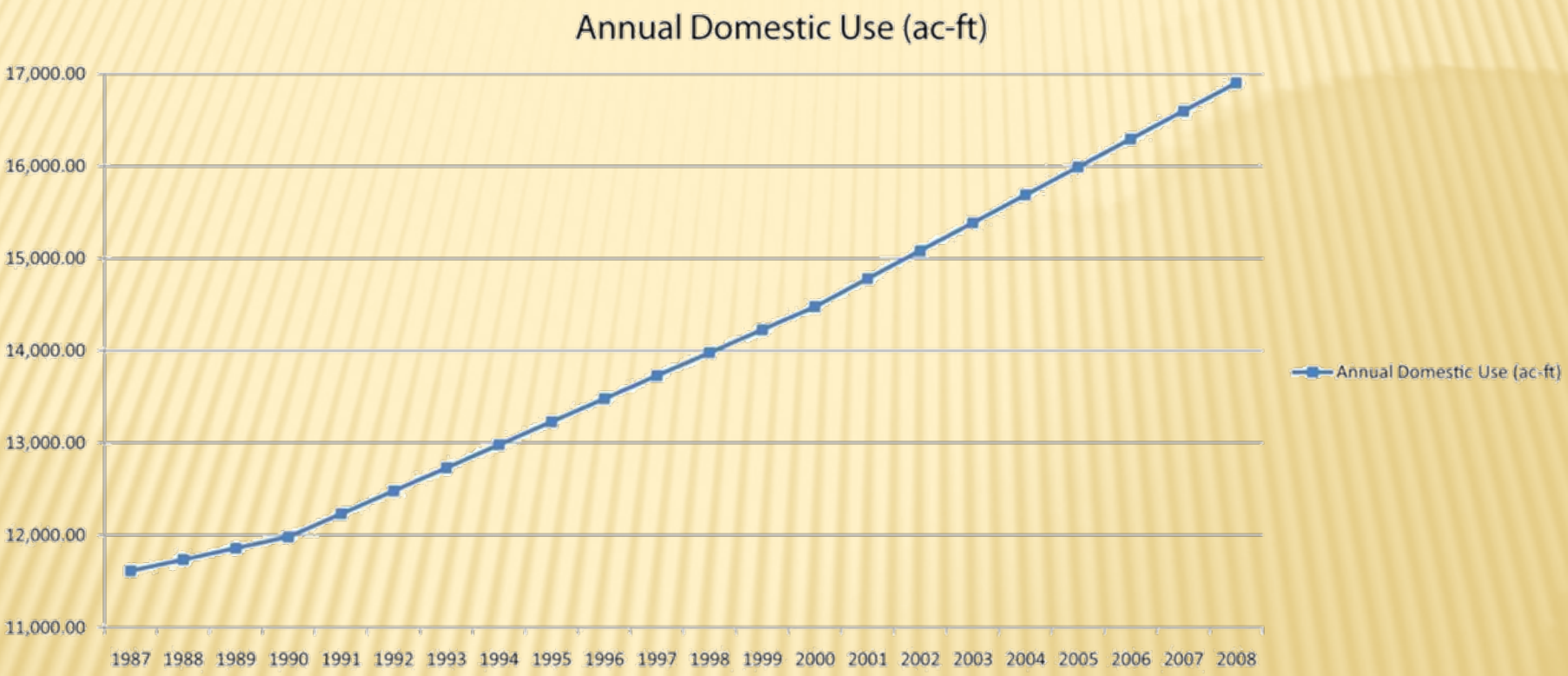


DOMESTIC GROUNDWATER USE



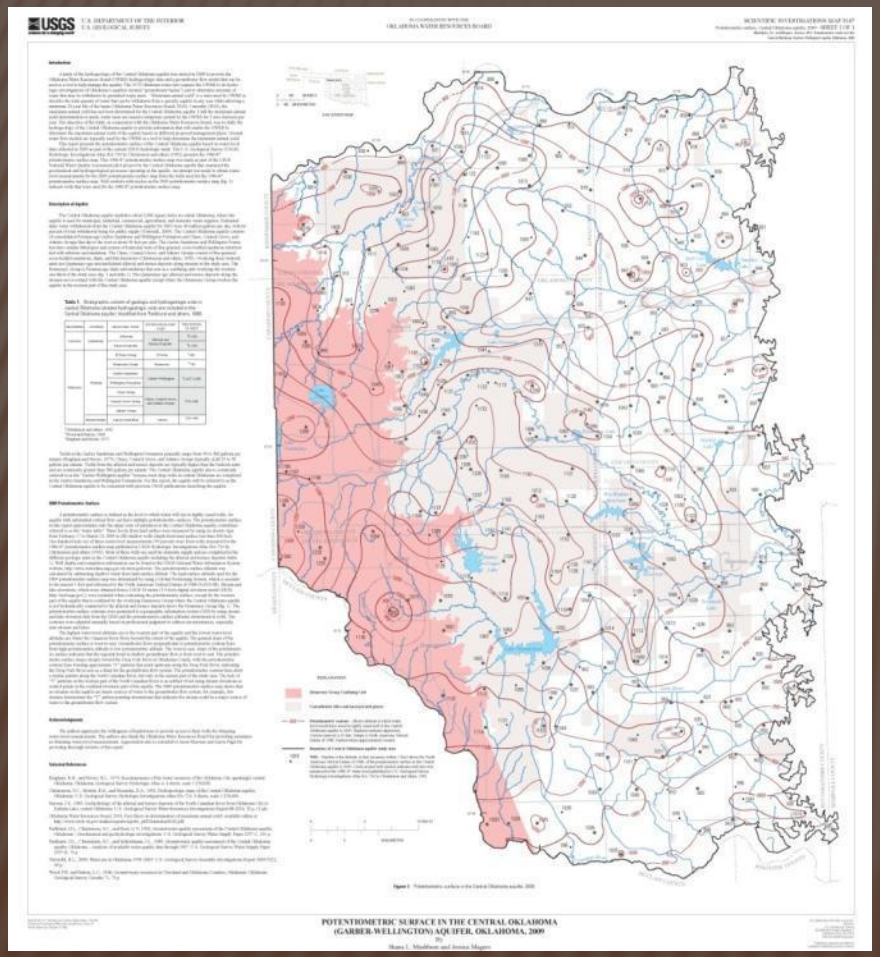


DOMESTIC USE



Based on 85 gpcd → 1990 – 11,983 ac-ft
2000 – 14,478 ac-ft
2010 – 17,506 ac-ft → ~25-30 % of aquifer use

2009 POTENTIOMETRIC MAP

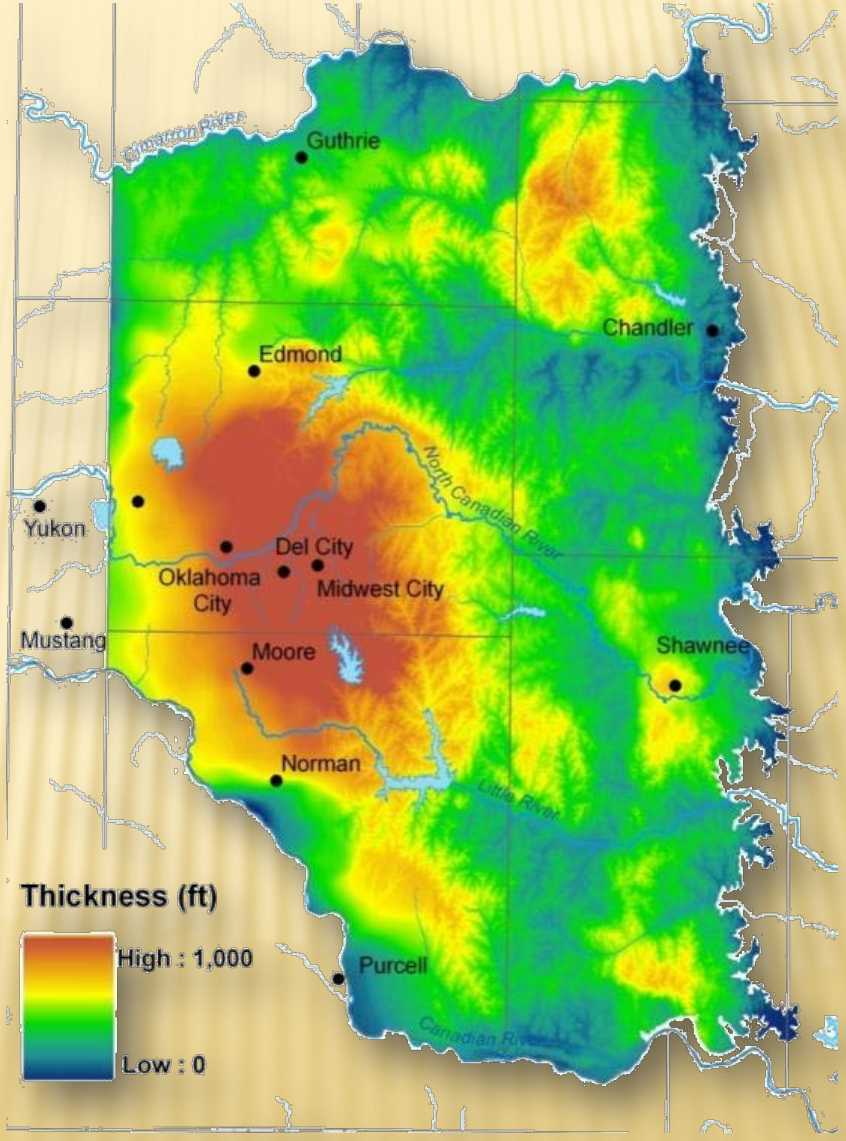


- Scientific Investigations Map 3147 – "Potentiometric Surface in the Central Oklahoma (Garber-Welllington) Aquifer, Oklahoma, 2009 by Mashburn & Magers
- OWRB Staff- T. Adkisson, G. Doussett, C. Maggard, C. Neel, J. Schiever, R. Wicker

MAPS AND DATASETS

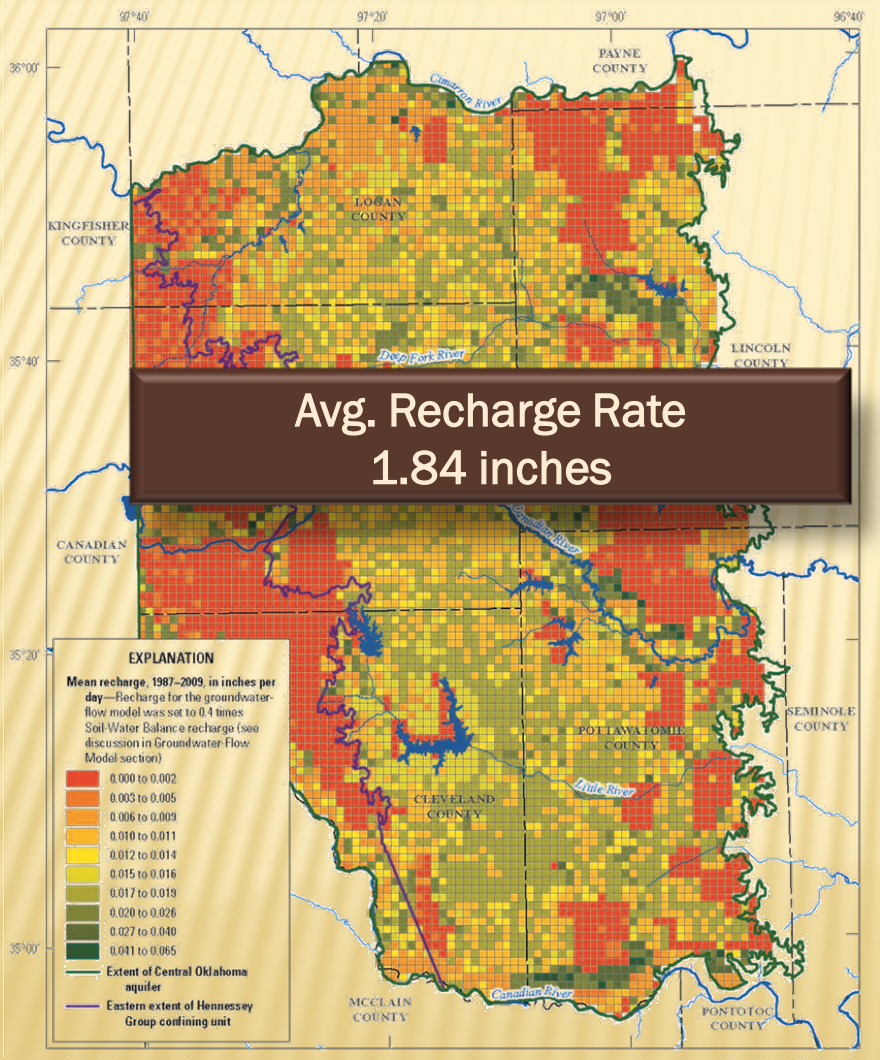
Aquifer Thickness

Avg. Aquifer Saturated Thickness ~400-500 ft.



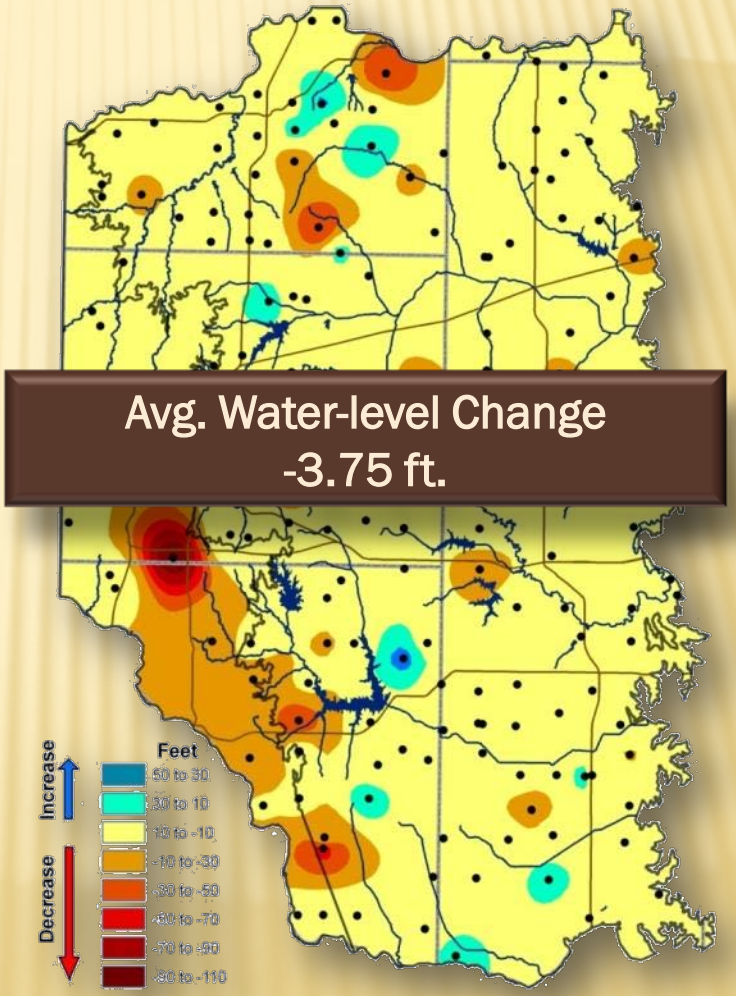
MAPS AND DATASETS

Recharge



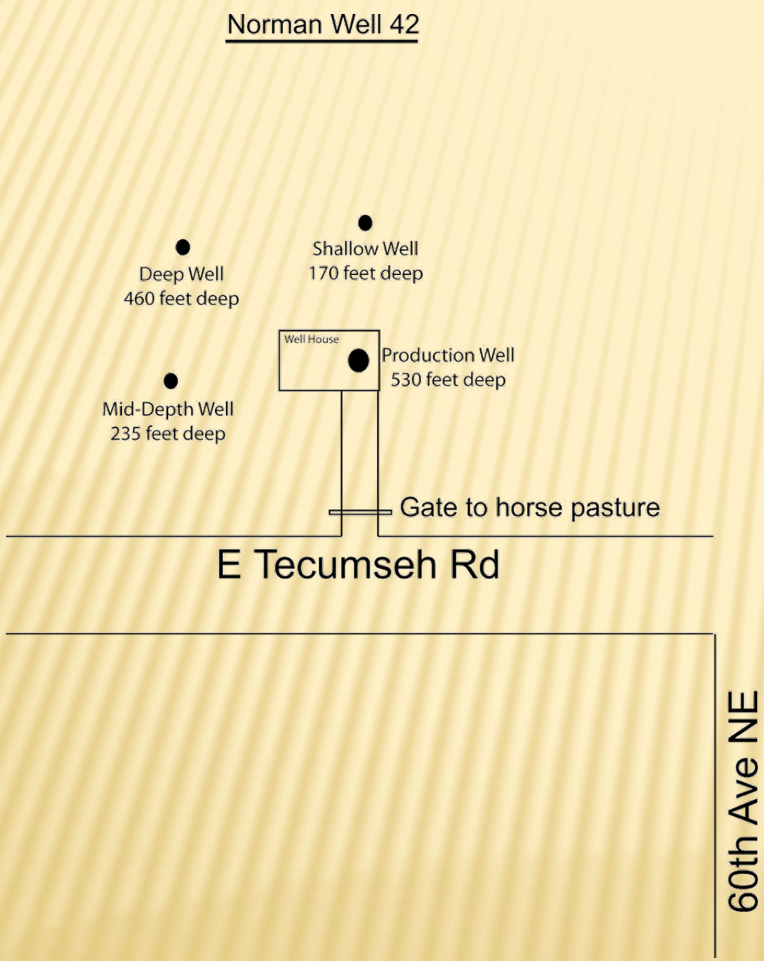
Avg. Recharge Rate
1.84 inches

1987-2009 Water-level Change



Avg. Water-level Change
-3.75 ft.

NORMAN AQUIFER TEST

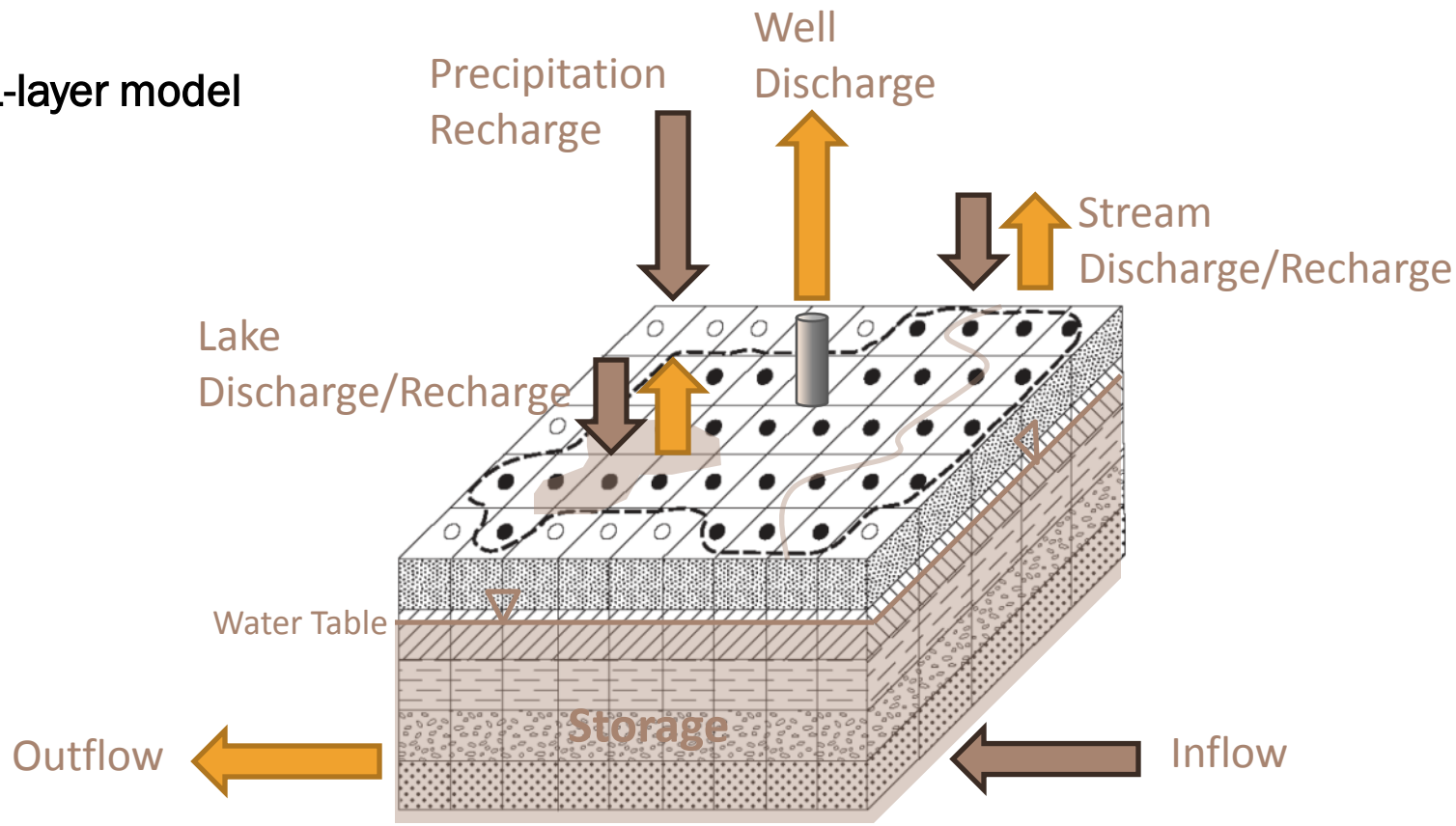


Best Fit as a Leaky Confined Aquifer:

- Transmissivity – 224 ft^2/day
- Storage Coefficient – 0.0013

DIGITAL GROUNDWATER-FLOW MODEL

11-layer model

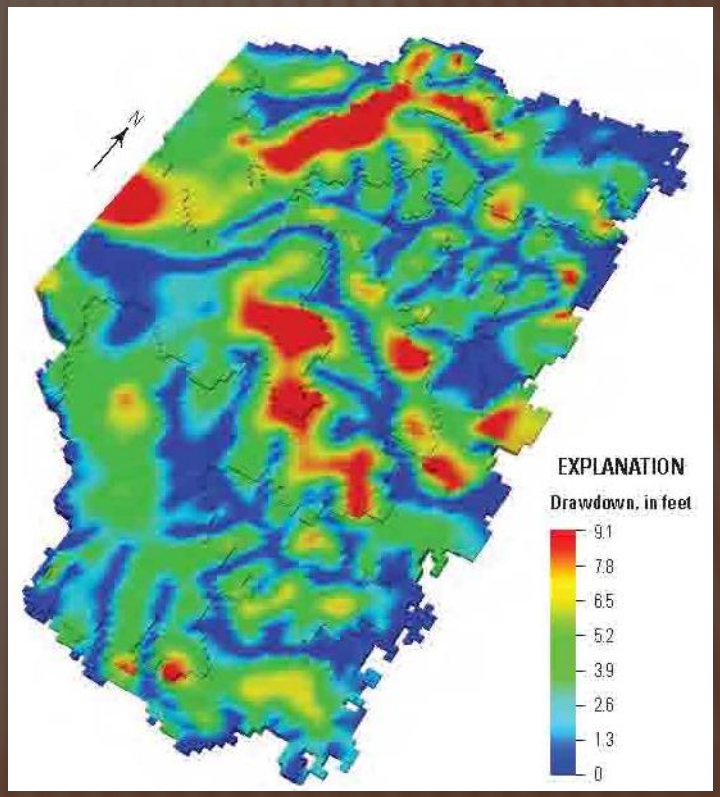


Δ Storage = (Precipitation + Inflow ± Lake ± Stream) – (Well + Outflow ± Lake ± Stream)

Slide courtesy of the USGS

CURRENT USE SCENARIO

Designed to test areas of localized drawdown



SCENARIOS

MAY Scenarios

Pump until 50% of the aquifer has 15 ft. of saturated thickness or less

50-year Scenario →

EPS range 1.1-1.5 acft/ac/yr

2 acft/ac/yr Scenario →

Life of Basin = 35-41 years

SUMMARY

- Not the easiest geology to model
- Permitted groundwater use → 41,155 ac-ft/yr
- Domestic use is significant (~17,000 ac-ft/yr)
- Current-use Scenario → some localized drawdowns
- 50-yr MAY Scenario (1.1-1.5 EPS)
- 2 acft/ac/yr Scenario (35-41 years)

QUESTIONS?