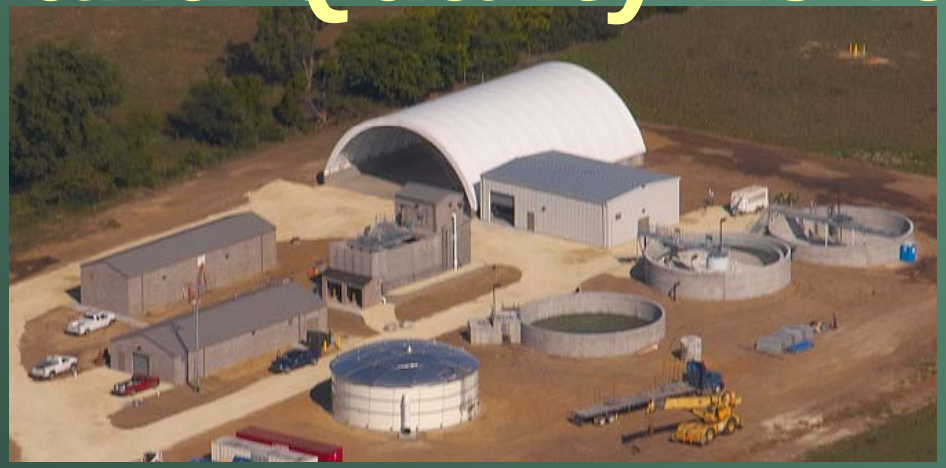
Equus Beds Water Quantity and Quality 1940-2008



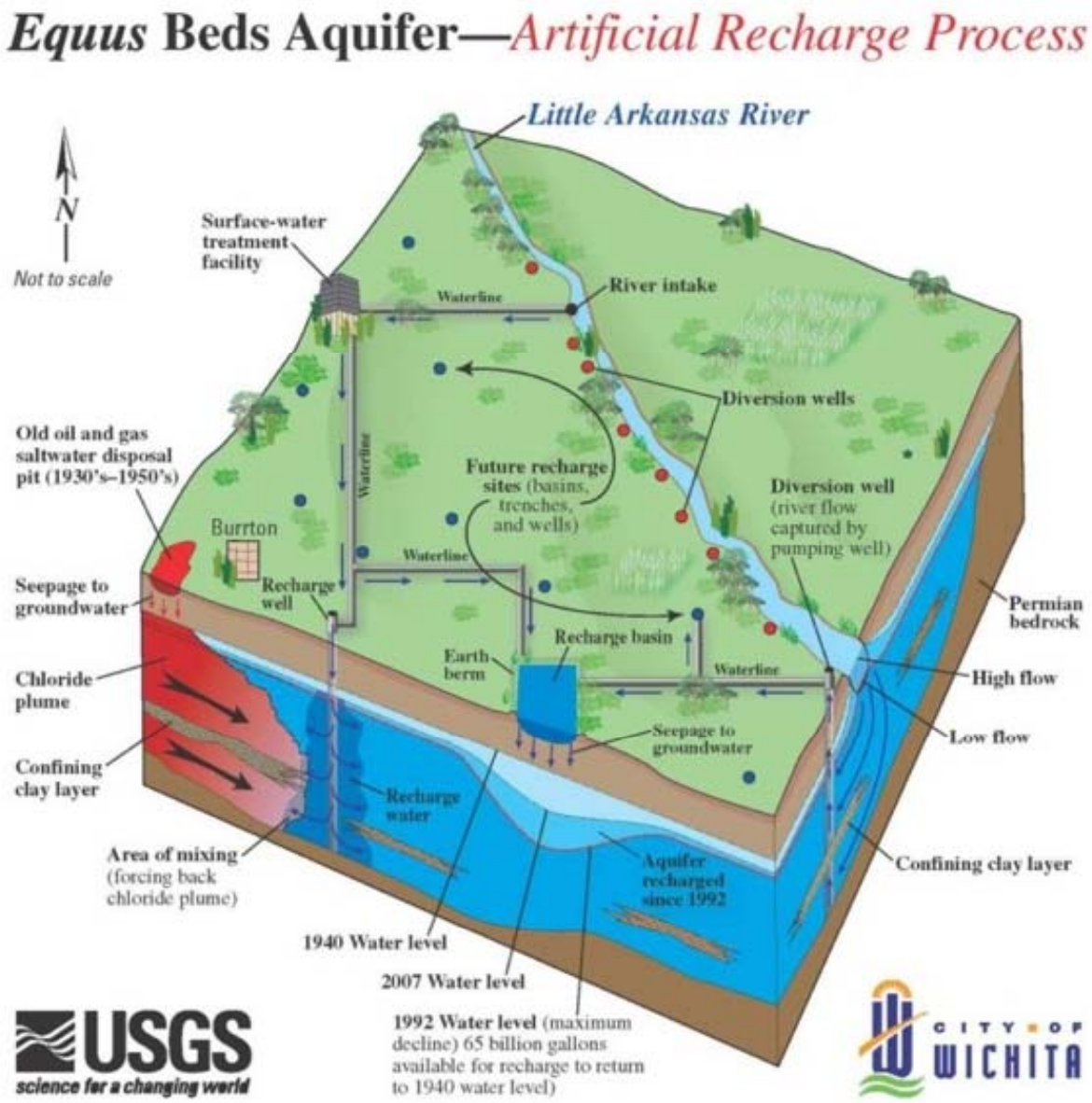
Andy Ziegler

USGS Lawrence, Kansas

Characterize water quantity and quality

U.S. Department of the Interior
U.S. Geological Survey

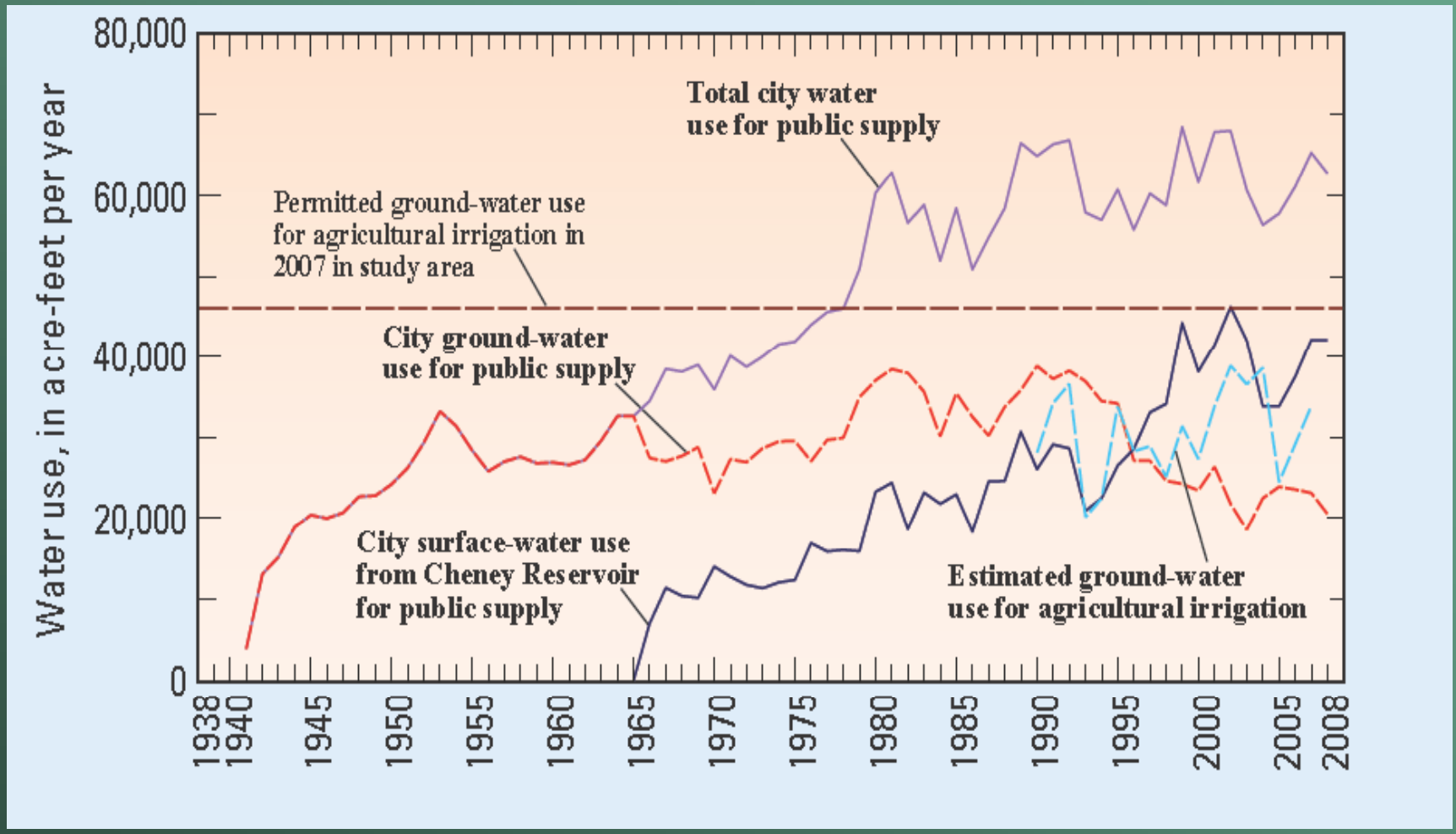
Equus Beds quantity and quality issues:



- Saltwater migration from Burrton and along the Arkansas River is accelerated because of large water –level declines from agricultural and city pumping.

CITY OF WICHITA

Water use



Since 1995, most of Wichita's supply came from Cheney reservoir.

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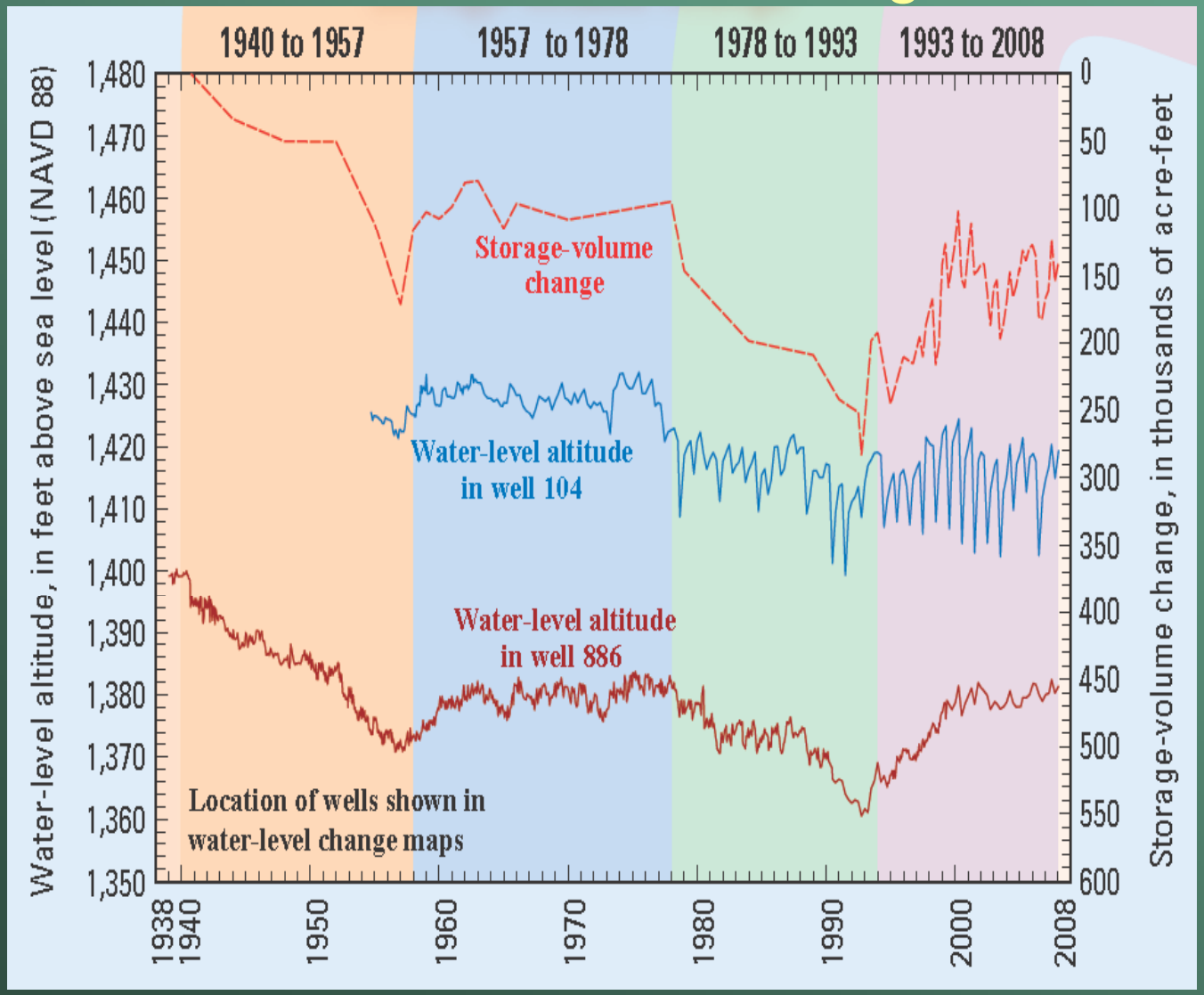
Ground-water levels and storage-volume change



- In 2007-2008, about 630 million gallons of water were artificially recharged.
- This is about 2,000 acre feet of the more than 150,000 acre feet of depletion.

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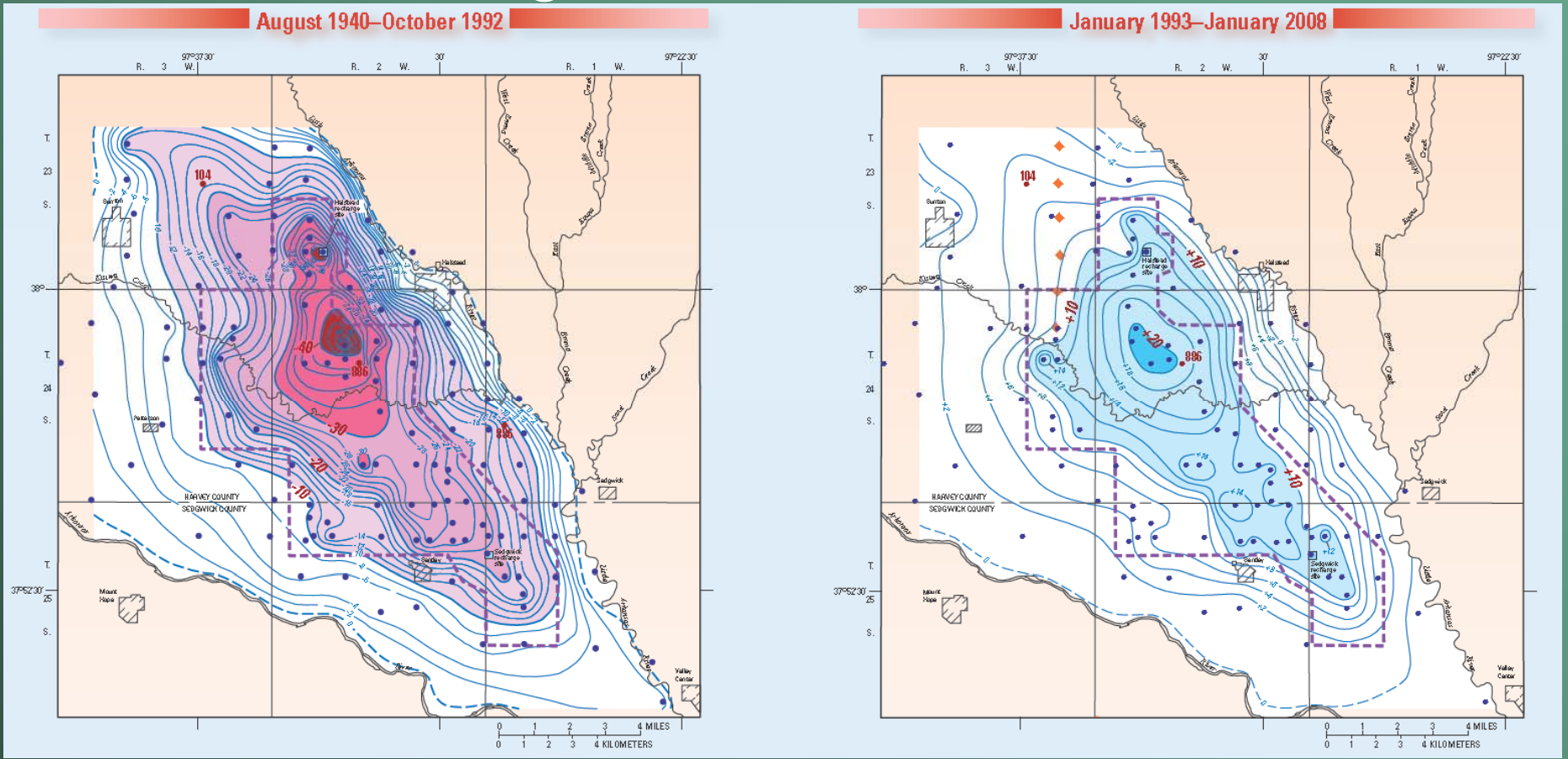
What has changed since 1992?



- **55-percent of lost aquifer-storage volume was replenished through January 2008**
- **Gradient from Burrton to maximum decline area has decreased from 12 feet per mile in 1992 to about 8 feet per mile**
- **Decreased gradient means movement of chloride contamination has slowed.**

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Water Quality

- Baseline sampling and during demonstration phase defined the constituents of concern for artificial recharge;
- surface water:
  - Chloride, atrazine, and bacteria
- ground water:
  - Chloride, sulfate, nitrate, iron, manganese, and arsenic
- Concentrations before and after recharge are similar
- A number of organic compounds have been detected—atrazine most commonly (about 30 percent of the shallow wells), but no concentrations exceed water-quality standards

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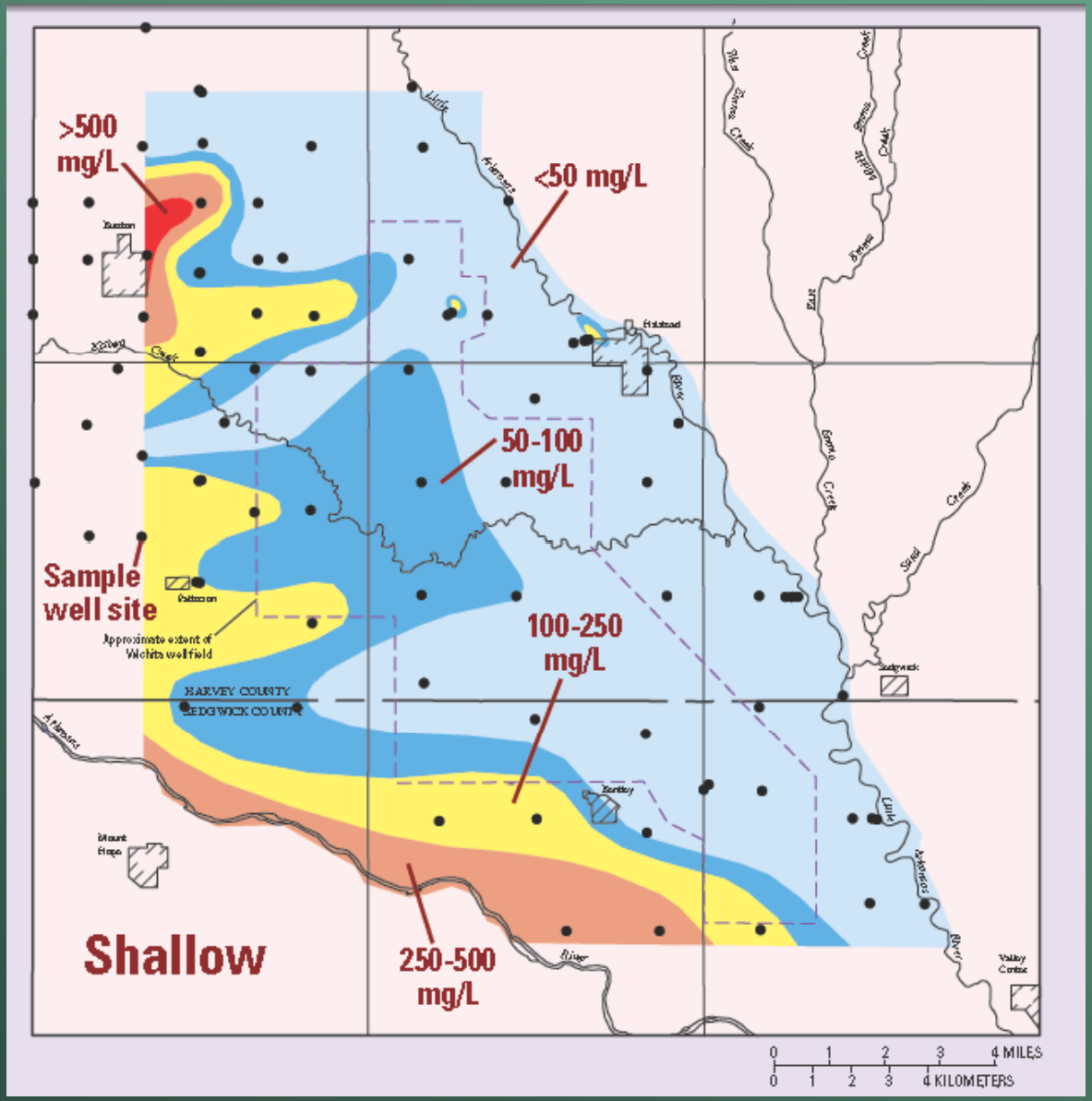

Chloride concentrations exceeded the SDWR of 250 mg/l in less than 8% of the shallow and deep parts of the aquifer.

Concentrations larger than 500 mg/L were found near Burrton, where previous oilfield brine disposal occurred.

Large concentrations of chloride from the Arkansas River are moving into the aquifer because of ground water declines caused by agricultural and city pumping.

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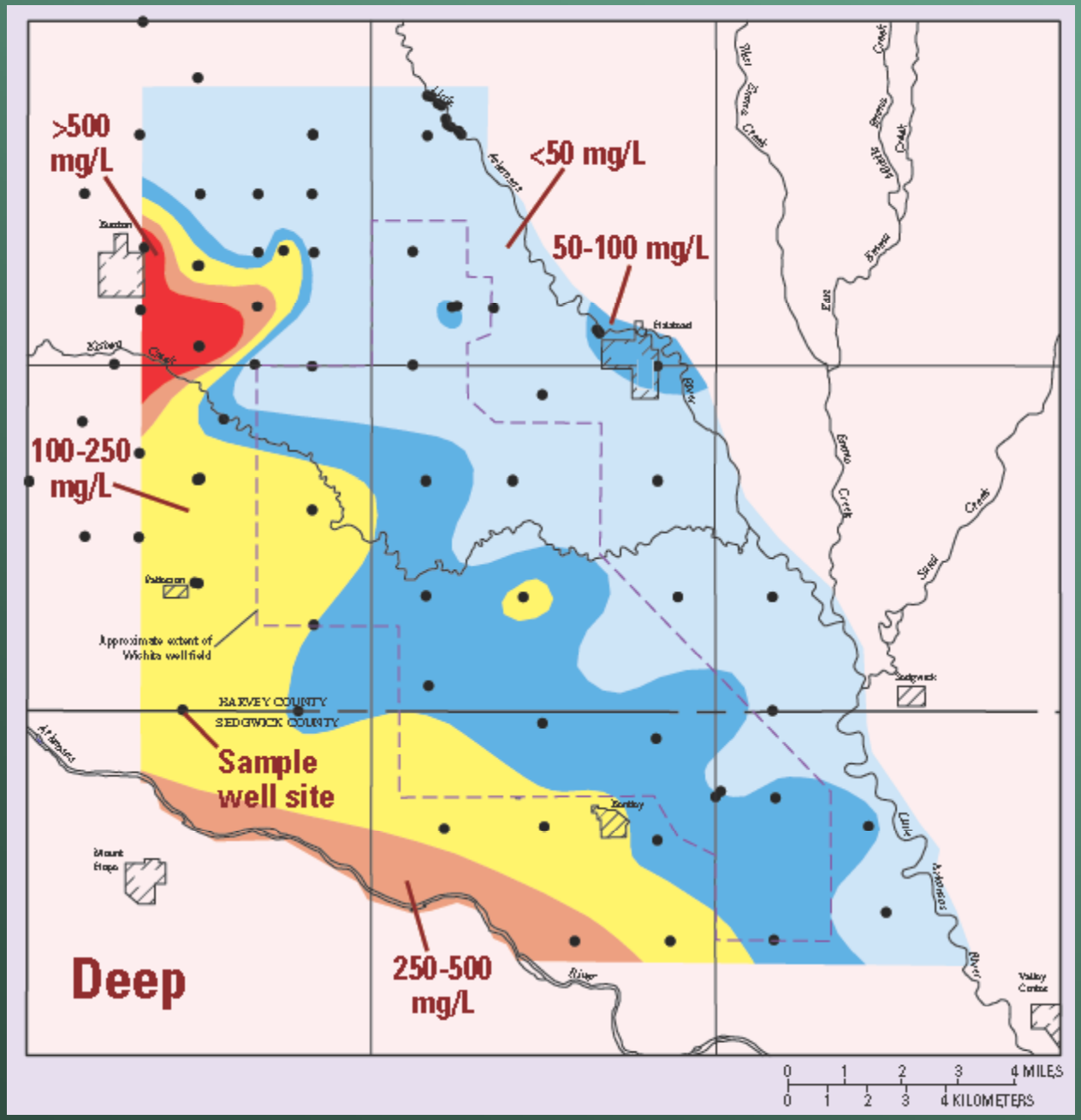

Chloride in deep Index Wells 2001-2005

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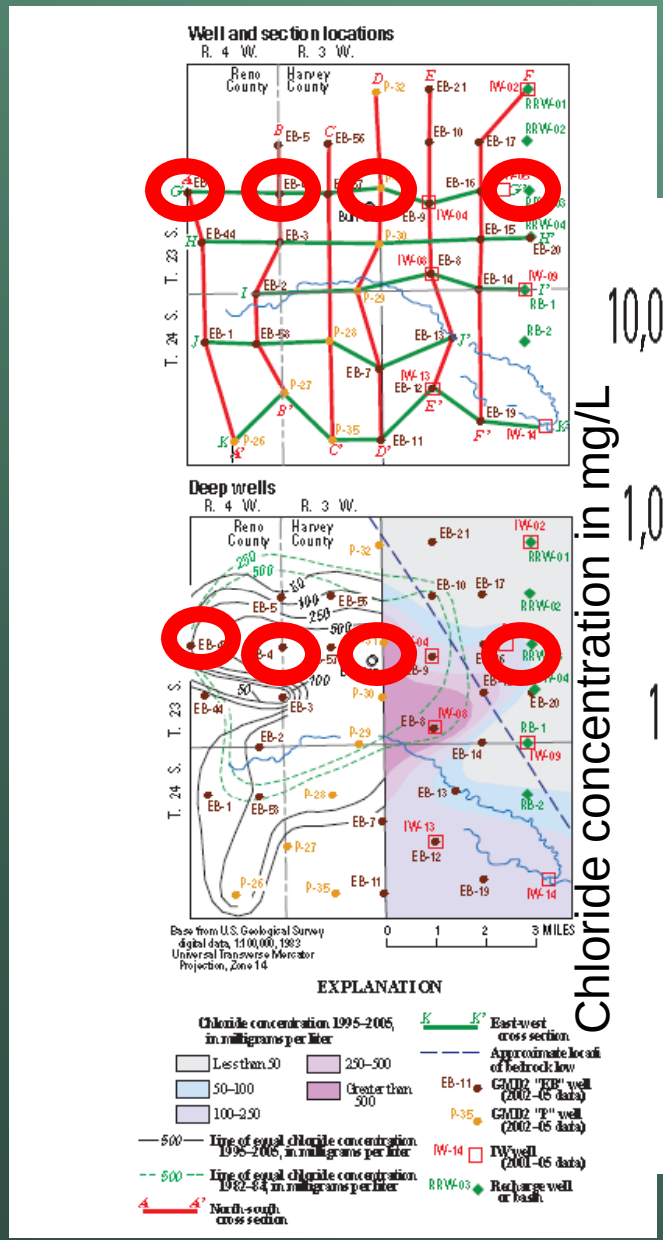
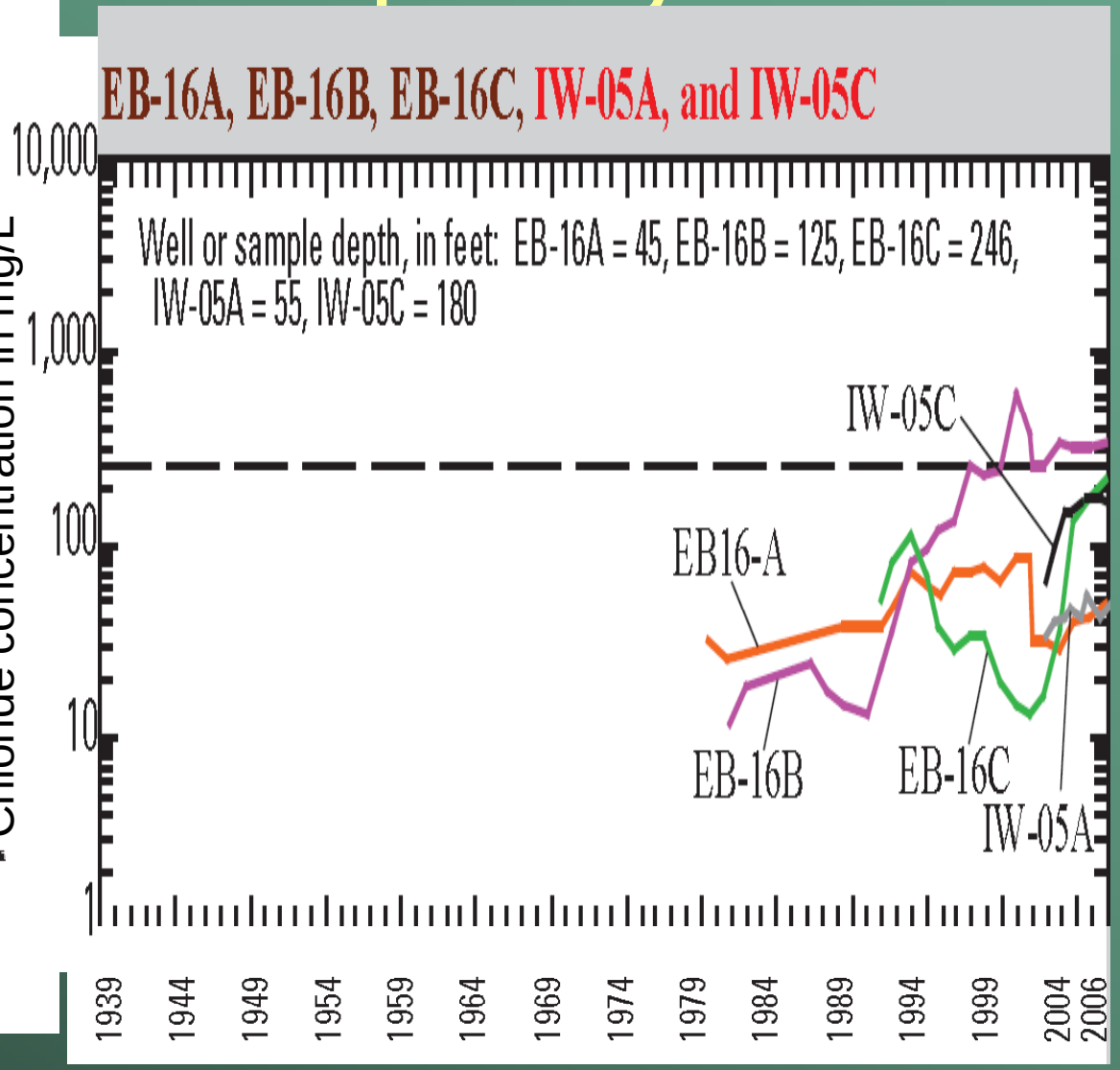
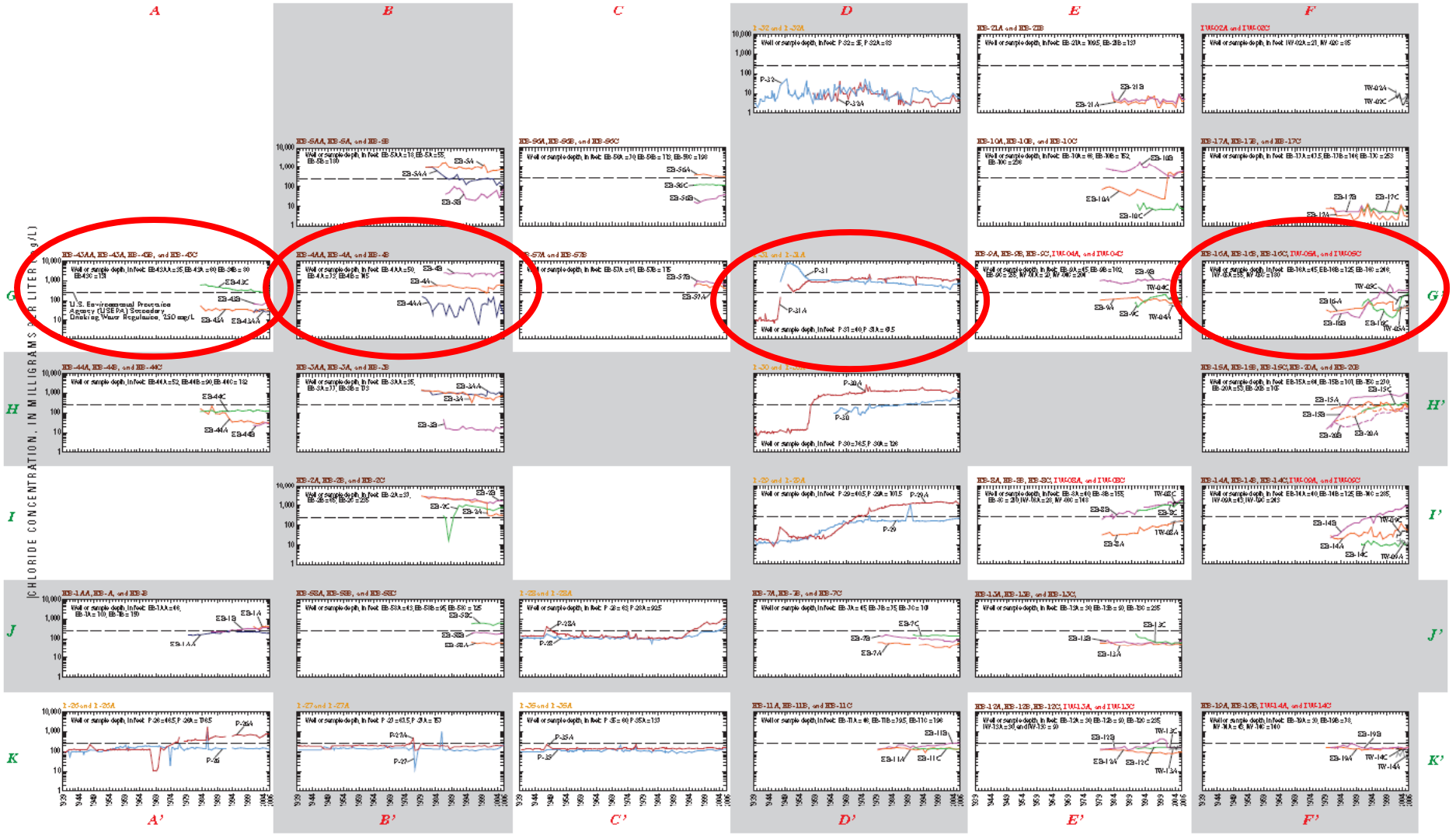
Chloride has moved about 3 miles in past 40 years





Chloride concentrations have increased about 20-50 mg/L/yr near the Phase 1 recharge areas in the last 15 years

Chloride from Burrton has moved about 3 miles in the last 40 years



USGS Chloride concentrations have increased about 20-50 mg/L/yr near the Phase 1 recharge areas in the last 15 years

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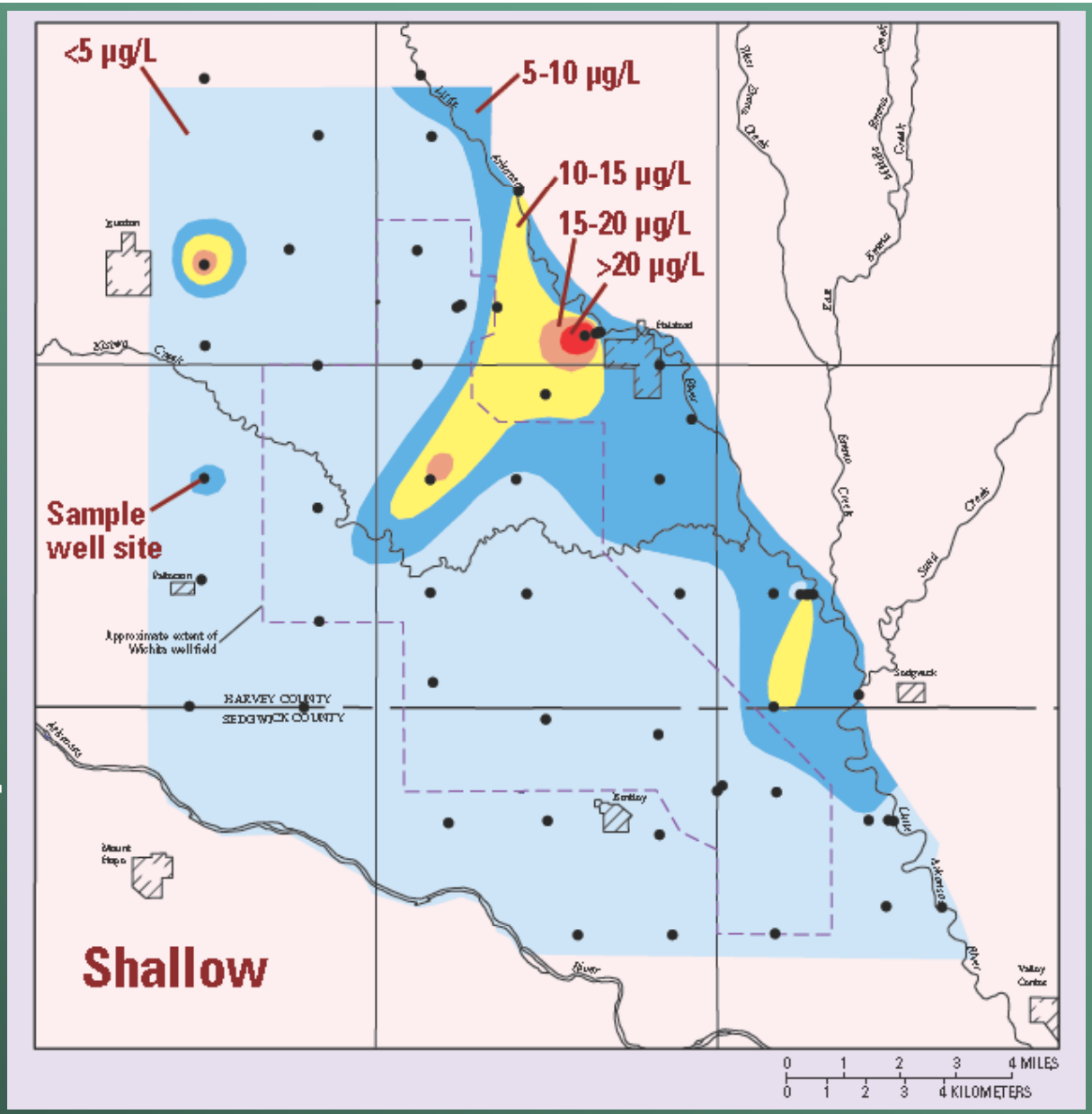
Arsenic in Shallow wells through 2005

Concentrations exceed 10 ug/L in 6 percent of shallow aquifer



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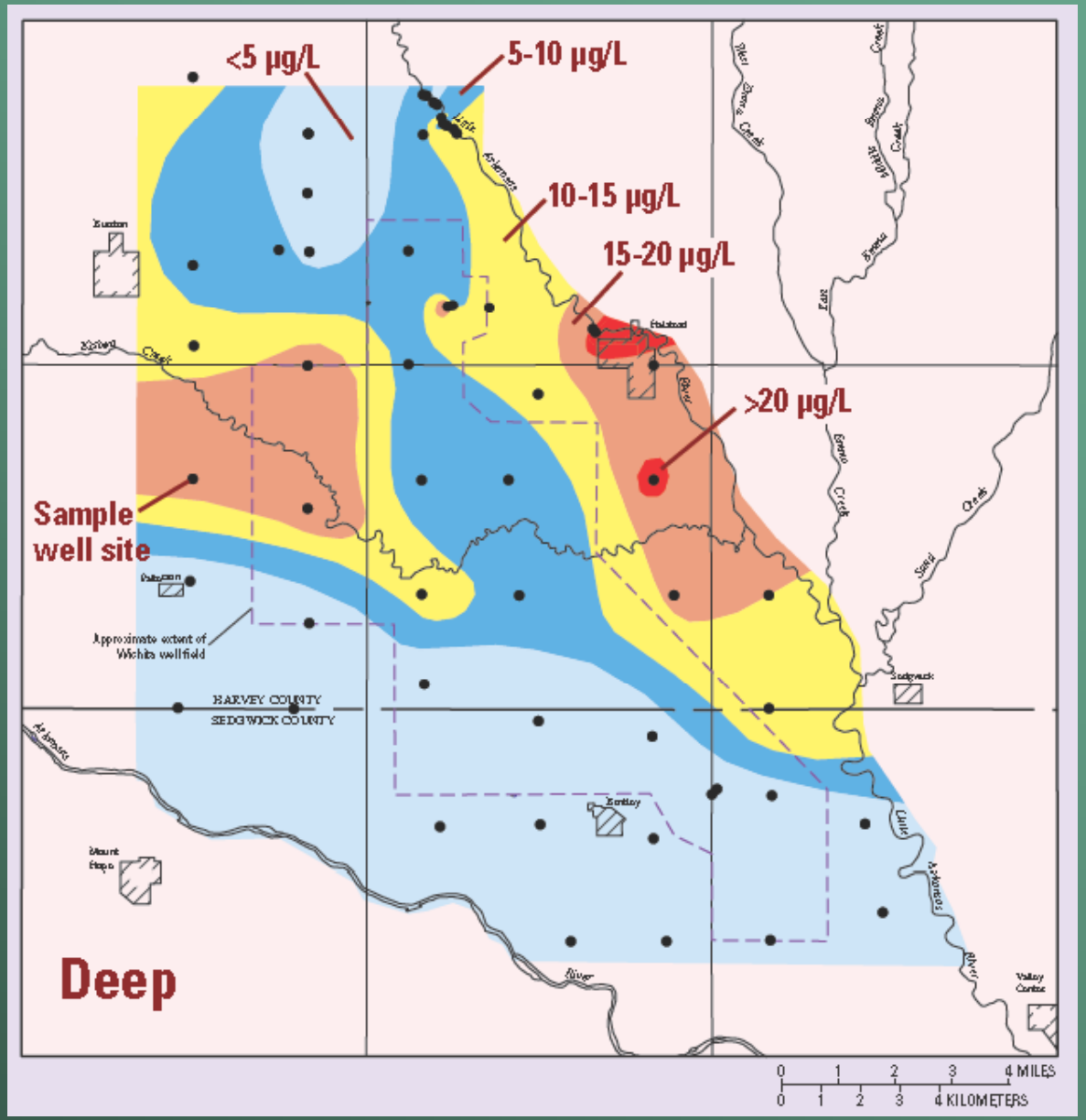
Arsenic in deep wells

35% of aquifer exceeds 10 ug/L

High concentrations generally associated with clay rich parts of the aquifer



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Continued Baseline water quantity and quality for ASR Phase 1 and 2 monitoring (1995-2015+)

- Annual sampling of 38 shallow and deep index well locations to define current and after recharge conditions (2001-present)
- Continuous streamflow and water-quality monitoring to define water quality of source water and to assist with design information (1995-present)
- Passive recharge well monitoring at RB-1 (2008-2009)
- Monitoring of ASR water quality before and after– Phase 1 results (2006-present)
- Phase 2 begins 2010+

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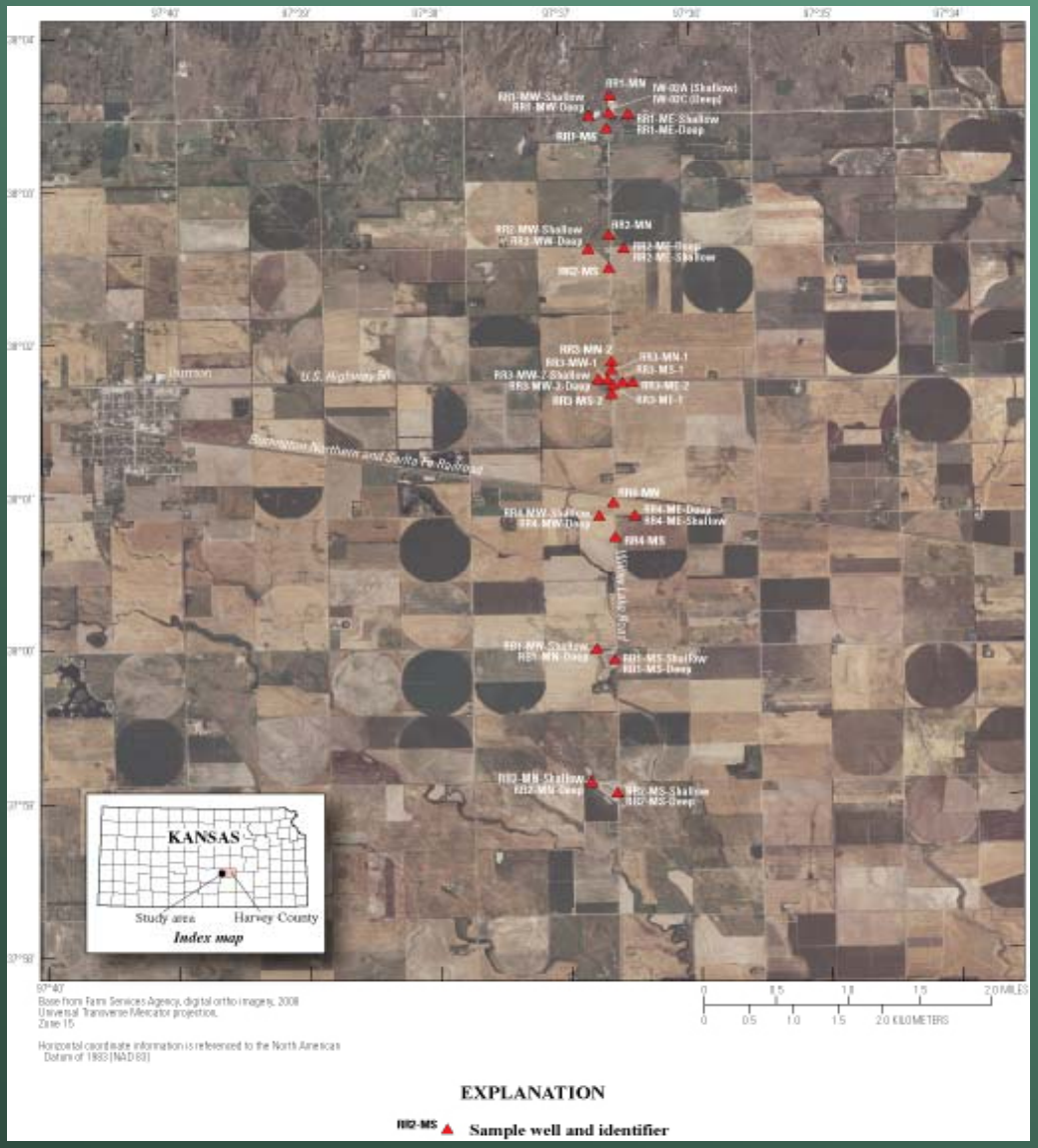
Phase 1 recharge water quality results 2006-2008



- Monitor 30 wells associated with 4 injection wells and 2 recharge basins
- Monitor domestic wells within ¼ mile of an injection well or recharge basin
- Conduct annual source-water monitoring

Water-Quality Trends after recharge

- **Downward Trends in several constituents at most wells**
  - **Calcium**
  - **Sodium**
  - **Chloride**
  - **Sulfate**
  - **Dissolved Solids**
  - **Iron**
  - **Arsenic**
- **Most notable in wells from southern part of recharge area where initial concentrations were largest**

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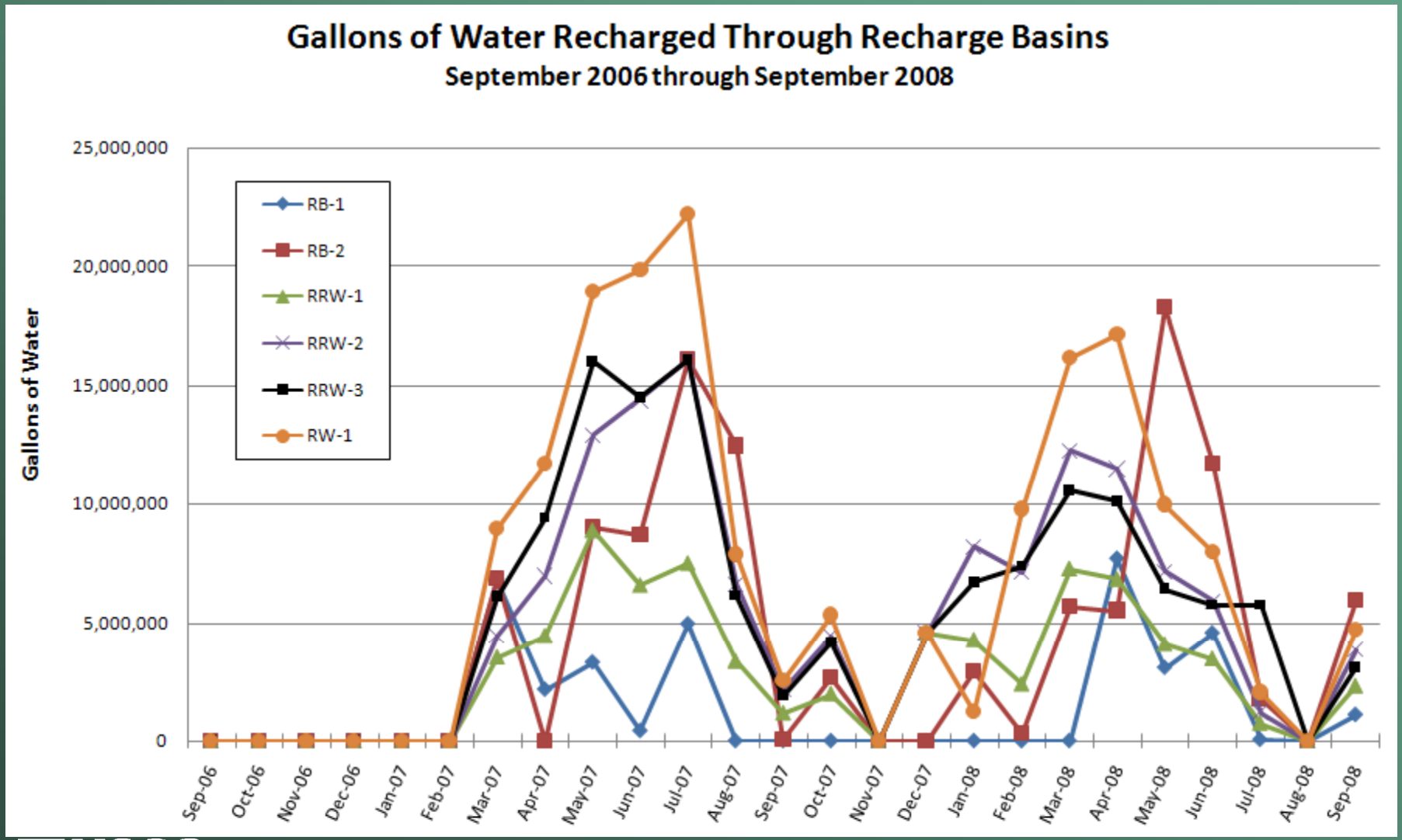
Gallons of water recharged 2006-2008



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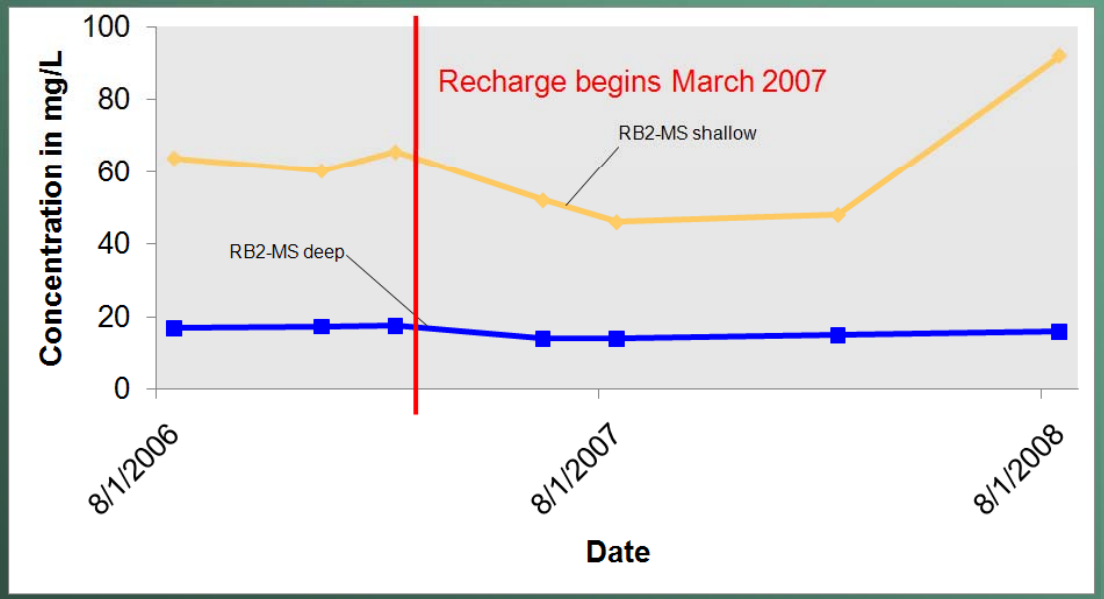
Monitoring Wells – RB-2

Chloride – Is recent increase the arrival of the shallow chloride plume?



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Source recharge water chloride concentrations average 12 mg/l and range from <5 to 60 mg/L

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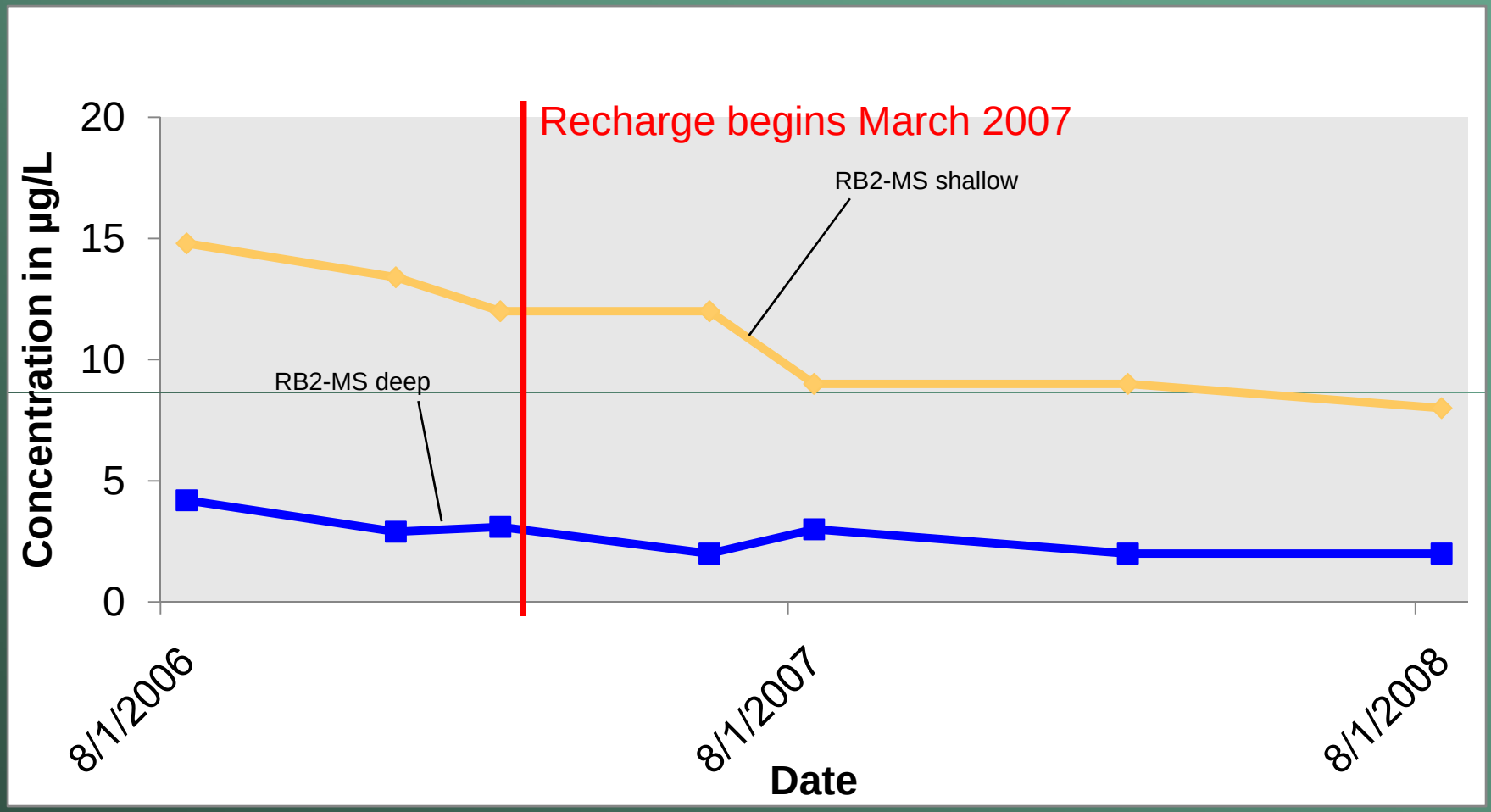
Arsenic



Recharge water for RB1 and RB2 average arsenic concentration is <1 ug/L
Recharge water arsenic concentrations for RRW-1-4 average about 7 ug/L

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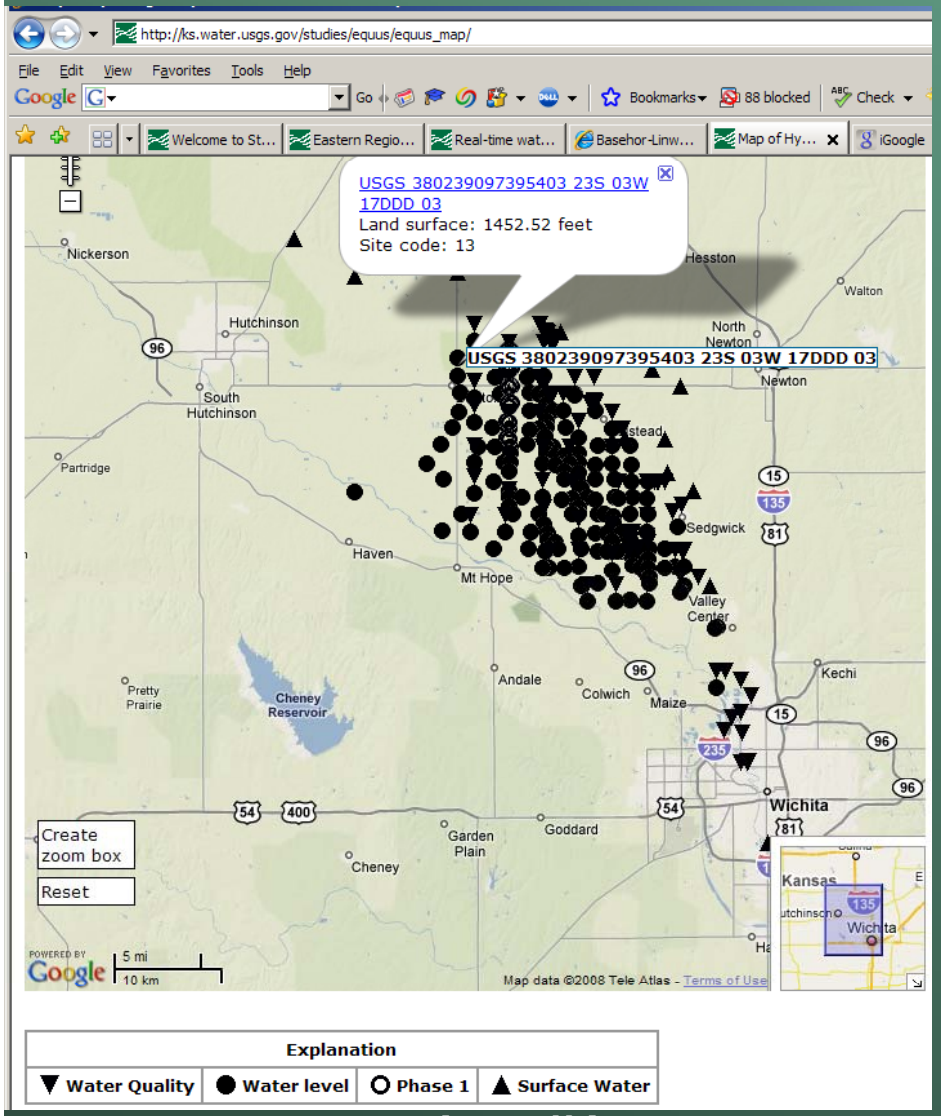
How do you get data or information?



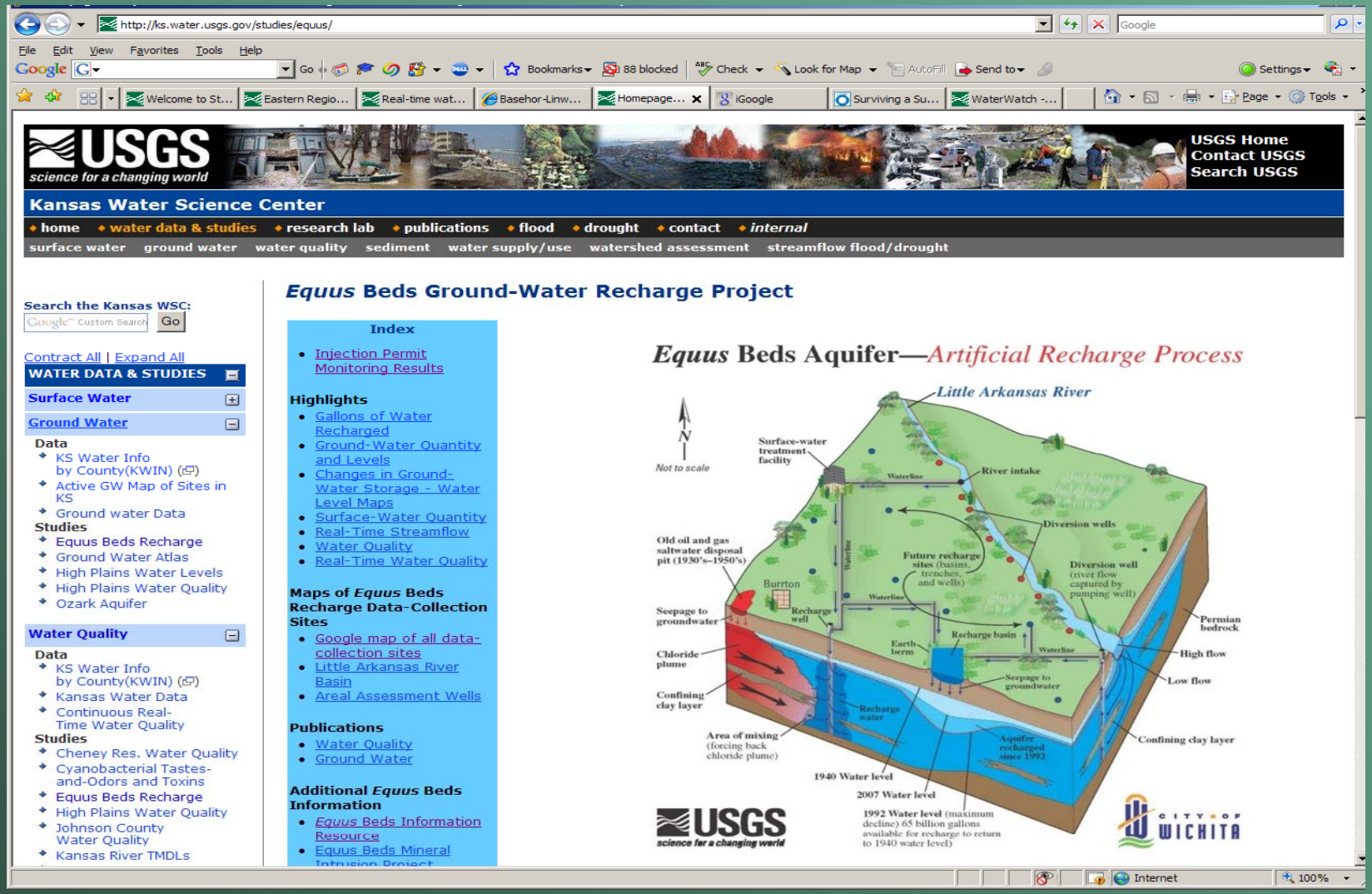
Highlights of *Equus* Beds Ground-Water Recharge Project

Gallons of Water Recharged Through Recharge Basins

RB-1, RB-2, RRW-1, RRW-2, RRW-3, and RW-1

	Calendar Year		
Month	**2006**	**2007**	**2008**
January	---	0	23,359,000
February	---	0	27,007,300
March	---	36,670,000	51,928,000
April	---	34,700,000	58,824,500
May	---	69,010,000	48,955,400
June	---	64,386,000	39,416,600
July	---	82,828,300	11,567,800
August	---	36,488,600	0
September	0	7,838,100	---
October	0	18,587,500	---
November	0	0	---
December	0	18,265,700	---
Sum	0	369 MG	630 MG

http:// ks.water.usgs.gov/studies/equus/ **OR**



CALL or email me:
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http:// ks.water.usgs.gov/studies/equus/

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