1981-2010 Normal Precipitation

Source: National Oceanic and Atmospheric Administration (NOAA)
Average Reported Use Made of Water

[Map showing water usage in Kansas with breakdowns for recreation, municipal, irrigation, stockwater, industrial, and other categories.]
Source of Water Supply

Groundwater
Surface Water
The High Plains Aquifer
The High Plains Aquifer in Kansas

Kansas Geological Survey

Ogallala

Equus Beds

Great Bend Prairie
Water Right Development in Kansas

- Water Information Management and Analysis System (WIMAS)
- Kansas Department of Agriculture, Division of Water Resources
- Water Rights
  - Authorized Annual Permits/Certificates
  - Historic Reported Water Usage
Measuring Wells in Kansas

- Water Information Storage and Retrieval database (WIZARD)
- Kansas Geological Survey
- Wells measured by GMDs 2 and 5, KDA-DWR, USGS, and the KGS
- Cooperative Water Level Network
  - Focused on High Plains aquifer
  - Annual measurements by the KGS and KDA-DWR
  - Regional aquifer characterizations
Depth to water ranges:

- At or near the land surface
- Over 400 ft (Haskell County)
- GMD1
  - Averages 141 ft
  - Ranges from 50 to 270+ ft

Water Table Elevation, Kansas High Plains Aquifer

- Follows land surface
- Flow paths are generally west to east with some local variations
- Linear flow velocities
  - Range from 1 ft per 1 to 4 days
  - 10 to 20 years to go a mile
Aquifer Thickness, Kansas High Plains Aquifer

- Ranges from 0 to 500 ft (Seward County)
- GMD1
  - Averages 30 ft
  - Ranges from near 0 to 170 ft
- Variability driven by underlying bedrock surface
Water-Level Change vs Reported Water Use

Water Level Change

1996 to 1997

Groundwater Usage

Density Distribution (2-mi radius) of the Average Reported Ground-Water Use, 2009-2018, in the Kansas High Plains Aquifer Region

How far out of whack are we?
Kansas Index Well Program

- First wells installed in 2007 through the Kansas Water Plan Fund
- Continuous, real-time water-level recordings
- Characterizations at the local scale
End-of-season recovery is similar regardless of past pumping or climatic conditions.

Water Volume Change in Aquifer = Net Inflow - Pumping
Reductions in Average 2009 to 2018 Reported Water Use Needed to Stabilize Water Levels

[Map with overlaid data points and a graph showing a linear relationship between groundwater use and average annual water level change.]

GMD1

$R^2 = 0.84$

Q Stable Reduction = 24.9%
Local Enhanced Management Areas (LEMA)

Provisions of a LEMA
- Locally generated plan within a GMD
- State says “Yes” or “No”
- Plan has a set lifetime (~ 5 years) but can be renewed
- Typically provide added flexibilities in water use in exchange for use reductions
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Active LEMA Areas
- Sheridan 6
- GMD4

Areas Under Discussion
- Wichita County
- Rattlesnake Creek
Proposed Wichita County LEMA, 2009 to 2015

- Average annual water level change, ft
- Reported groundwater use, acre-feet

- $R^2 = 0.8503$
- Q Stable Reduction = 21.3%
Questions???

Kansas Geological Survey
1930 Constant Ave
Lawrence, KS 66047
785-864-2118

Visit our site at
http://www.kgs.ku.edu
GMD4
Sheridan-6 LEMA
2002-2005, 2008-2012, R^2=0.74
2002-2005, 2008-2019, R^2=0.86

pre-LEMA: Q_m = 29.9 \times 10^3 \text{ ac-ft}
ΔWL_{ac} = -2.00 \text{ ft}

LEMA: Q_m = 17.2 \times 10^3 \text{ ac-ft}
ΔWL_{ac} = -0.27 \text{ ft}

Annual water use, thousand acre-ft

PRISM annual precipitation
2002-2012, R^2 = 0.62
2013-2019, R^2 = 0.97

PRISM precipitation, inches