

Missouri River to Western Kansas Transfer, Hydro Power Element

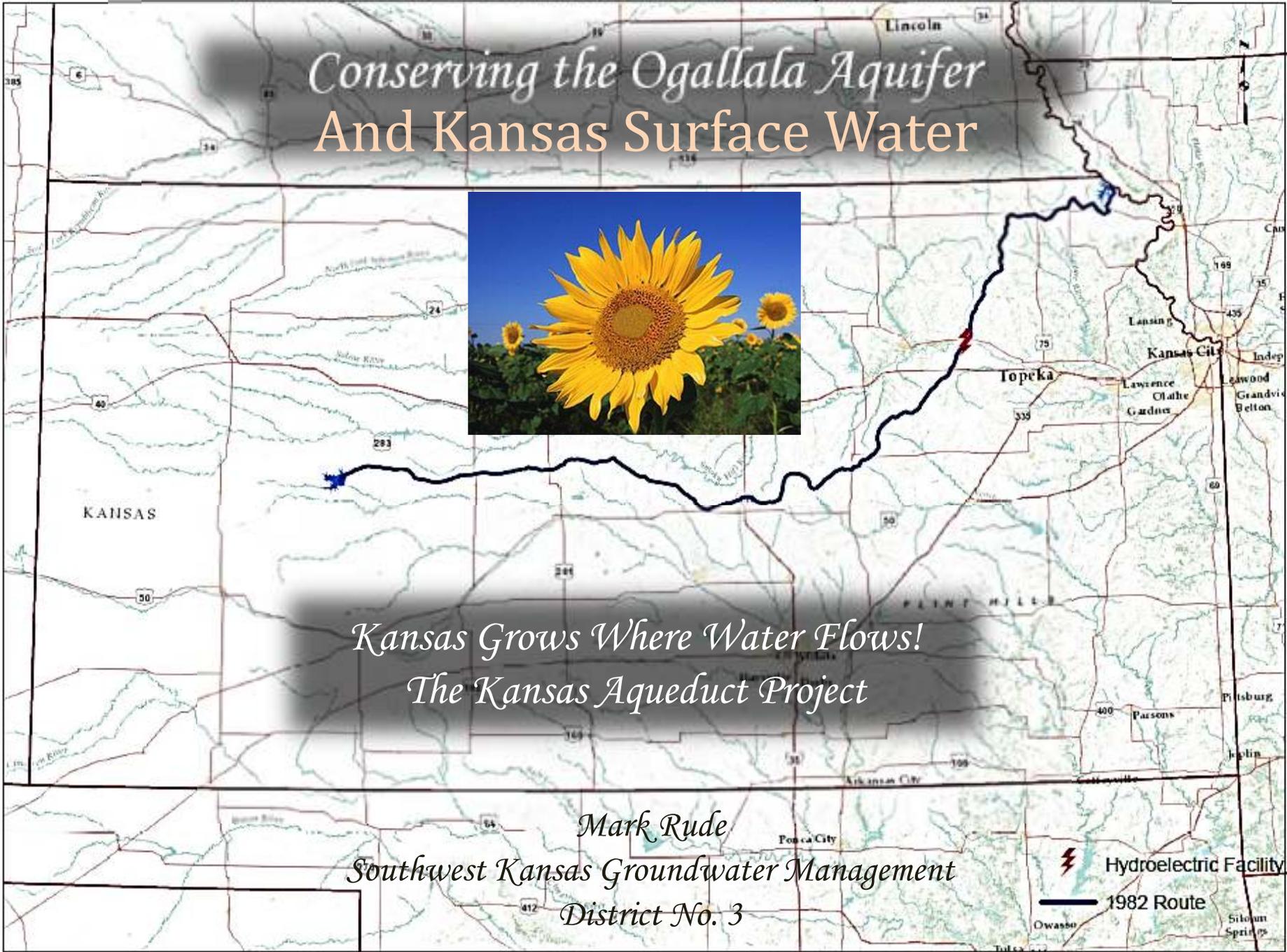
*Conserving the Ogallala Aquifer
And Kansas Surface Water*



*Kansas Grows Where Water Flows!
The Kansas Aqueduct Project*

*Mark Rude
Southwest Kansas Groundwater Management
District No. 3*

 Hydroelectric Facility
 1982 Route



Policy Challenge

What is the Kansas Vision?

- *What is the Kansas Water Supply outlook?*
- *Governor's call for a 50 Year vision for Kansas water is developing now.*
- *How can Kansas water management best position Kansas to meet the future global need for food and water?*

A Big Kansas Water Gap – Western Kansas

- SW Kansas - Very low natural aquifer recharge rates in Southwest Kansas of .41 inches per year.
- Modeling in SW Kansas indicates only nine percent of the two million acre feet used annually in southwest Kansas is sustainable.
- Irrigation linked agribusiness is the big economic engine and opportunity for Kansas.

Economic Activity Per Irrigated Acre

- One less irrigated acre will lead to an estimated loss of value to Kansas of
 - \$2,200 land resell value
 - 122.5 bu of corn* $\$6.78 = \831
 - 2 cattle on feed, approximately equal to 1,060 usable pounds of meat or a 2012 wholesale value of \$3,080
 - This is a yearly loss of **\$3,911**
 - There are **1,500,000 acres irrigated annually** in GMD3

*assumes an average price of \$2.90/lb. of beef (from KSDA presentation to Governors economic advisory council, Dodge City, 2013).

A matter of Kansas Public Interest

- delaying action by Kansans on a major water transfer project;
 - Until either the unyielding laws of hydrology naturally close the supply to demand gap
 - or the legal principles of priority and administrative regulation artificially reduce water use, to achieve a balance in supply
 - assures an inevitable devastation of Kansas communities and an exodus of families and investment capital from western Kansas.

Water Challenges

If we take no action in the next 50 years:

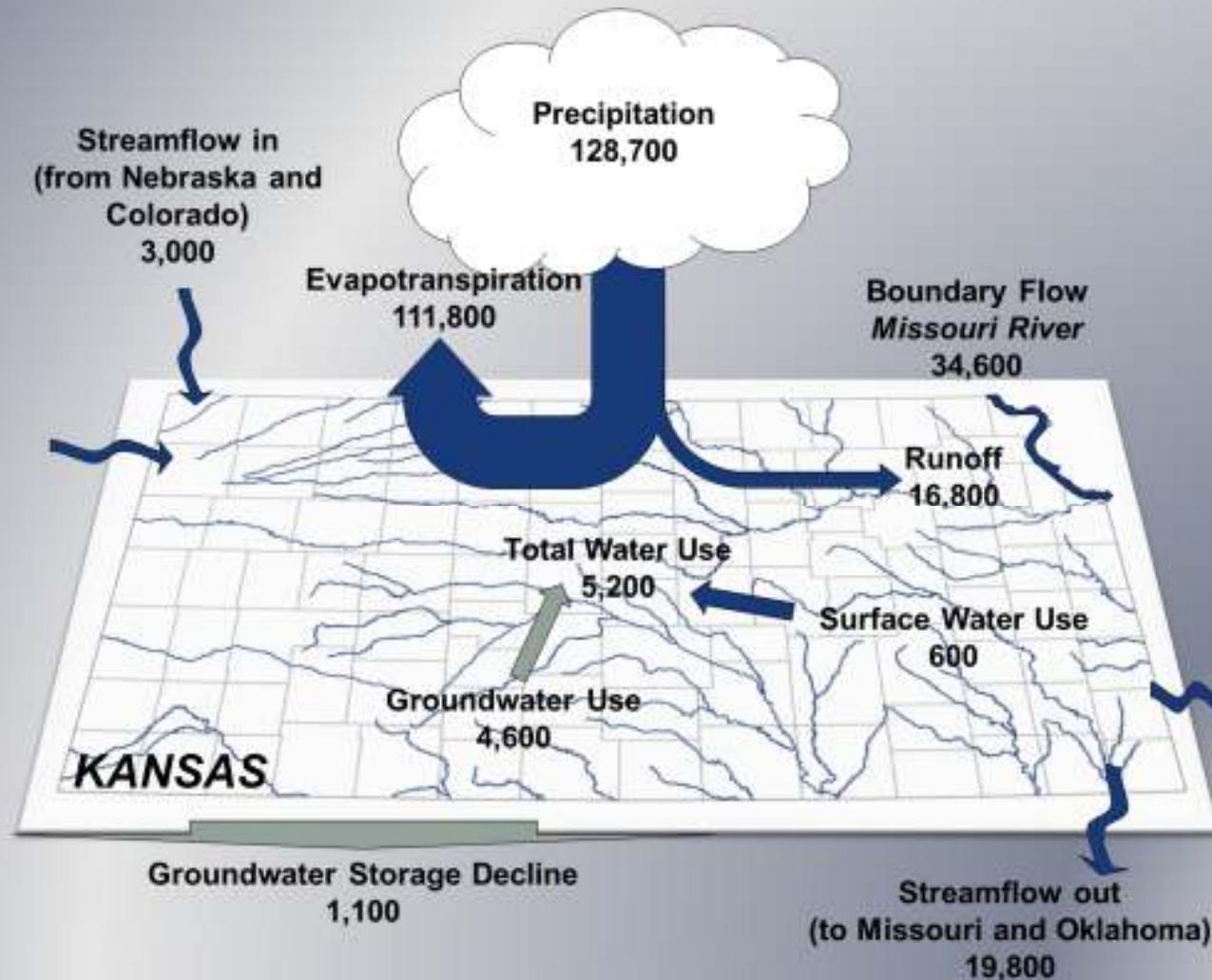
- The Ogallala will be 70 percent depleted
- Another roughly 40% of the area irrigated with Ogallala water won't support a 400 gallon per minute irrigation well
- Our water supply in federal reservoirs will be 40% filled with sediment
- Five of the seven basins in which reservoirs support our municipal and industrial water use won't be able to meet demands during a drought

The Kansas Aqueduct Advantage

- **Developing an infinitely renewable water supply system is as important for Kansas as it is a factor in sustaining our nation's ability to feed and fuel its people, especially during times of widespread national drought.**

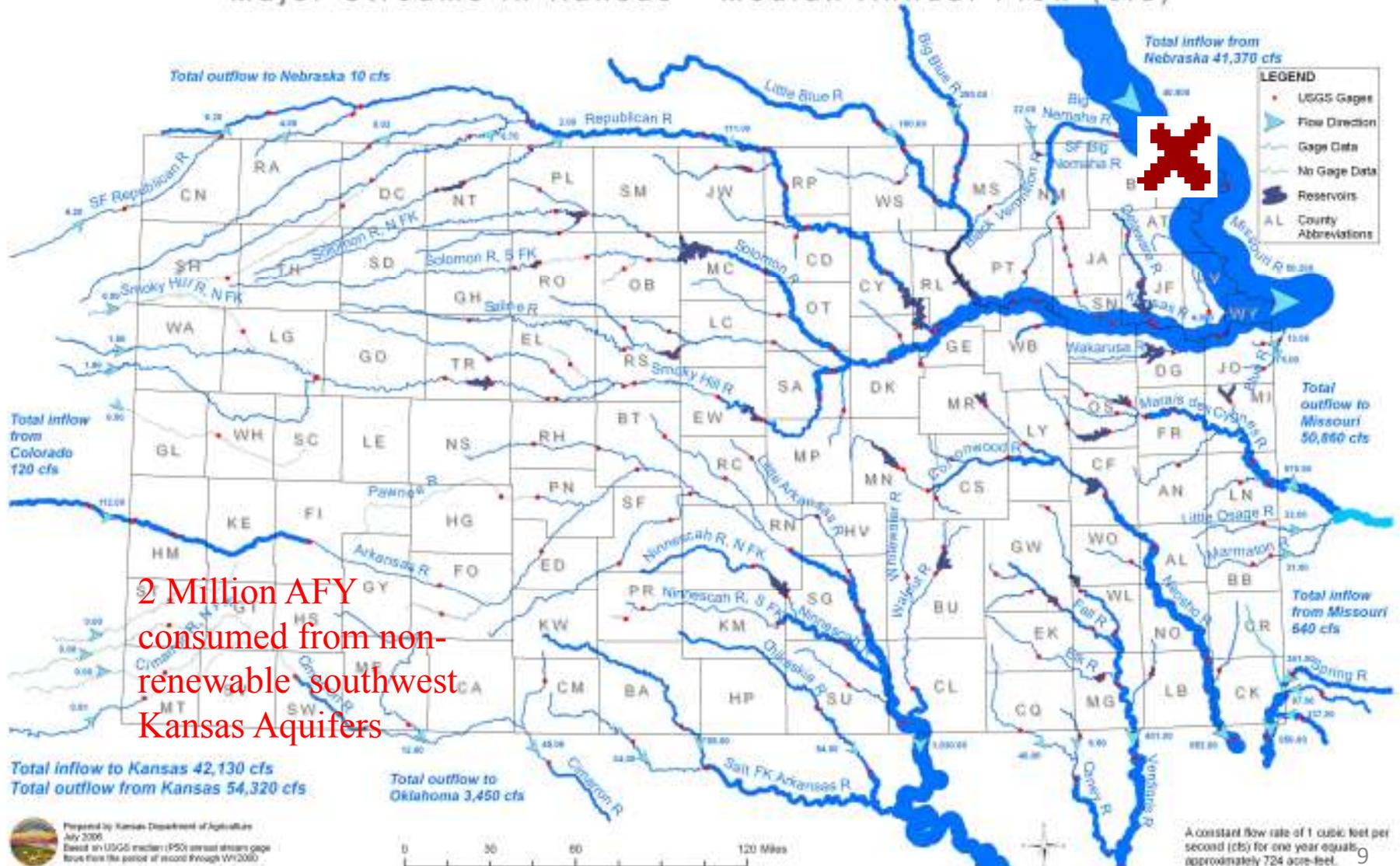
Kansas Water to Manage

From draft State Water Plan, October, 2013



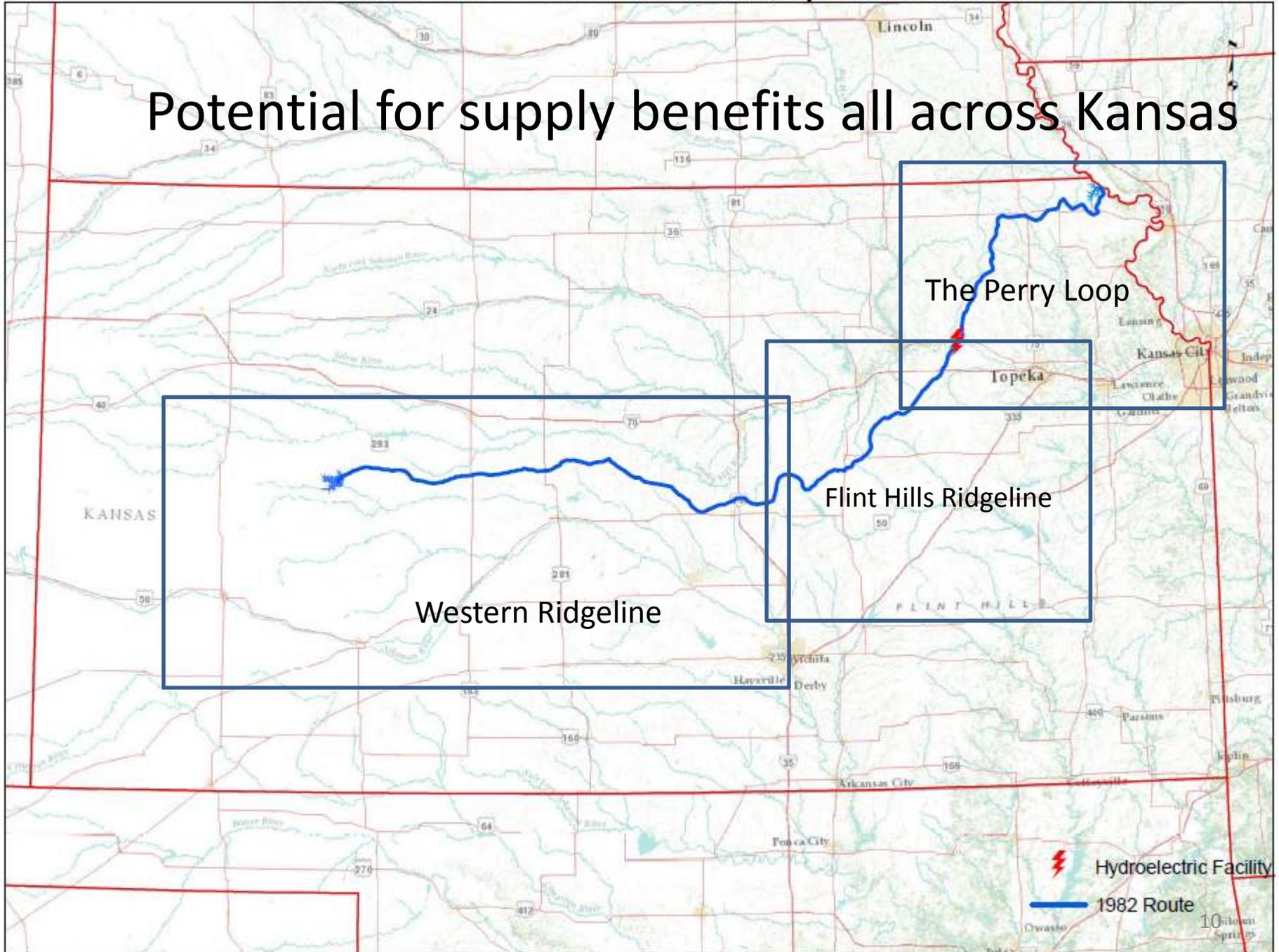
29.5 Million AFY by White Cloud Kansas

Major Streams in Kansas - Median Annual Flow (cfs)

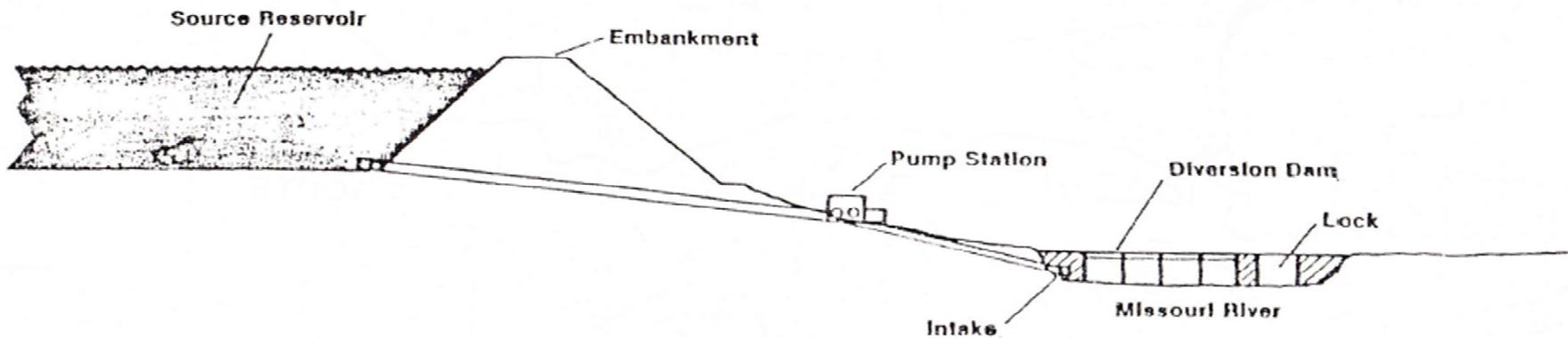


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Potential for supply benefits all across Kansas

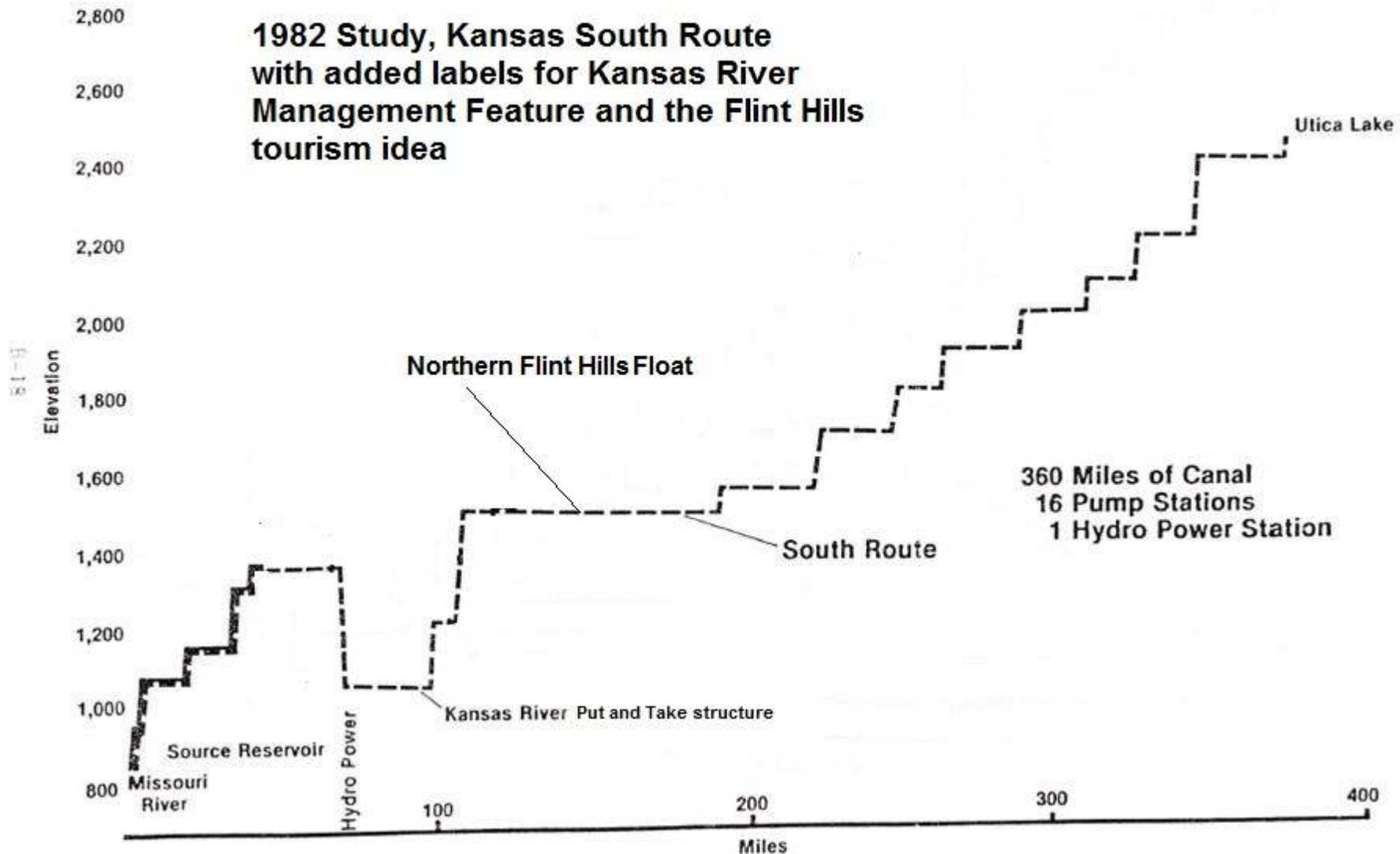


1982 study: Envisioned a river dam w/navigation lock, pump intakes and source reservoir.



Source Features

Kansas South Route preferred



1982 Study: water lifted west with 16 pump stations, and gravity flow between stations



Canal size or capacity may depend on the final project elements

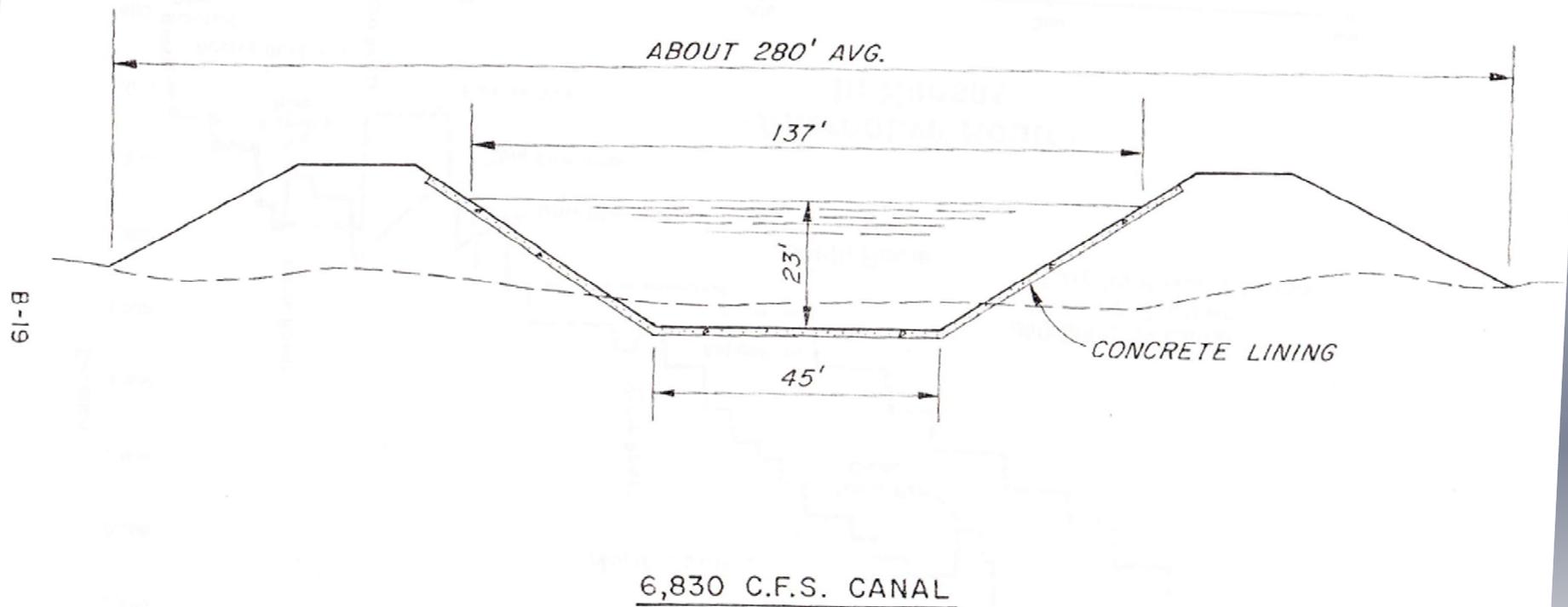
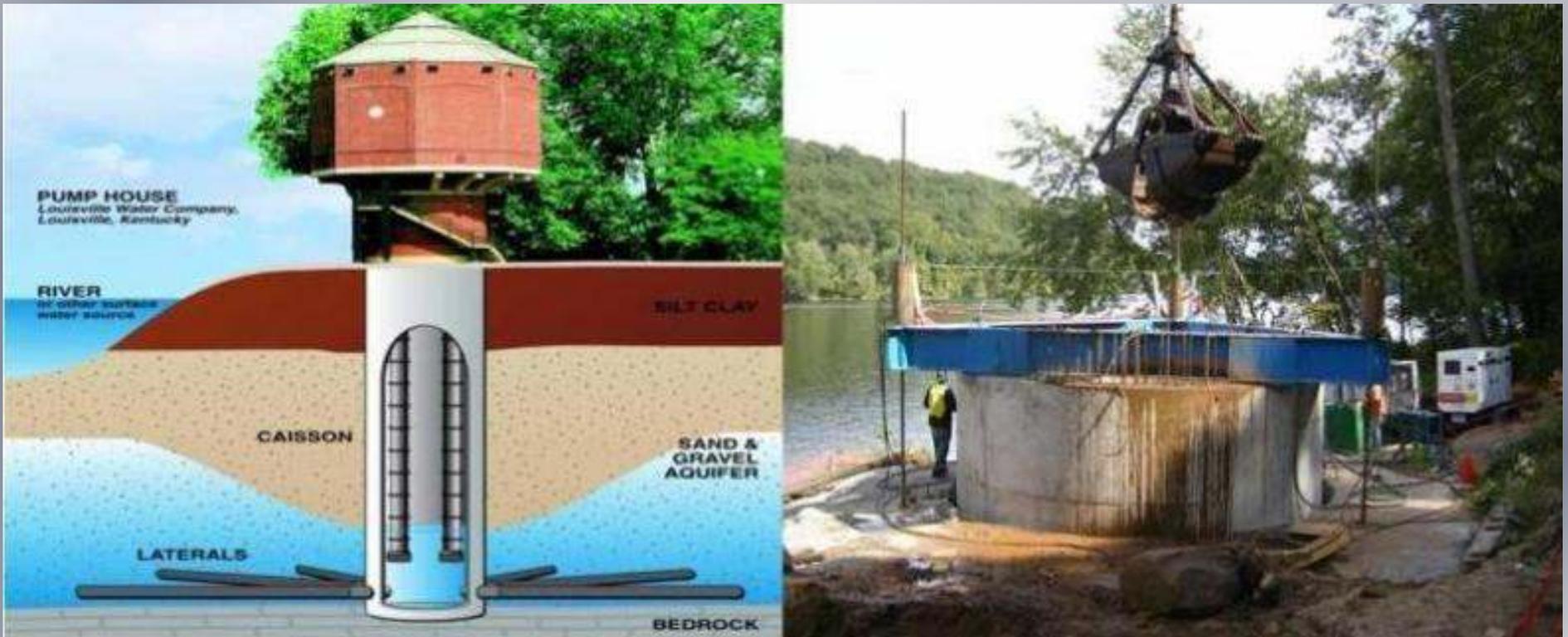


FIGURE 5 - TYPICAL CANAL DESIGN

Less river intrusive diversions: bank storage (collector) wells



Expensive pipeline alternatives solve some issues and create other



Kansans Financial Future

- The KAP must be vigorously pursued while production income, property values and the strong agriculture economic system are in place to support the project.
- The significant cost of Kansas water will have its effect on Kansans:
 - as an ebbing economy and lost opportunity cost,
 - Or, as an investment cost for a sustainable , growing Kansas economy.

Elements of the Kansas Aqueduct Project

- The work of the KAP is doing what must be done to grow and sustain future generations of Kansans.
- Missouri River high flows harvested to meet existing and foreseeable water demands.
- Put-and-Take structure in the Kansas River to improve water supply and management options.
- Benefits each area across Kansas, including social, food security, energy and environmental benefits.
- Use together with Kansas Aquifers and Reservoirs provides investment confidence and economic sustainability.
 - Replace dependence on depleting Ogallala/High Plains Aquifer.
 - No expansion of irrigated acres.
 - Integrates into concerns for Kansas reservoir sustainability

Kansas Water Appropriation Policy

- Kansas water law dedicates Kansas water to Kansans, and dictates that first in time is first in right.
- An act by Kansans to formally seek available Kansas water to meet existing Kansas needs should be viewed as an appropriate and necessary action under Kansas law.
- Key initial application elements for a Kansas allotment proposal:
 - Access to Point of Diversion from the supply
 - Filing Fee based on amount requested

Aqueduct Issues Continuum

One step at a time

- Initial Kansas water appropriation filing.
- Who's in?
- Studies; “Will this dog hunt?”
- Financing the benefits; who pays?
- Is there synergy in moving energy and water together?
- Support from indirect beneficiaries: tourism, recreation, habitats, etc.
- Concerns over eminent domain affects on private Kansans
- Concerns by neighbors outside the dedications of Kansas law
- Federal Thinking; The Nature of the “triple bottom line.”
 - The TBL is the new accounting framework adopted at the federal level to incorporate three dimensions of federal investment performance: social, environmental and financial.
 - Differs from traditional reporting frameworks as it includes ecological (or environmental) and social measures that can be difficult to assign appropriate means of measurement.
 - The TBL dimensions are also commonly called the three Ps: people, planet and profits.
 - Backlog of federal projects that are authorized but not funded may hold up federal involvement beyond study.
 - Sister states expressing concern in court over the effects of the project on their water supply and navigation.
 - Changing USACE administrative policies developed with other Federal agencies broadly applied with little local input or flexibility.

Need for Institutional Help

- Southwest Kansas GMD3 recognizes the problem of no sustainable water supply and is working the problem using the institutional tools available.
- Absent other options to existing legislative policy, GMD3 and partners will seek to secure an appropriation of water from the Missouri River early in the Kansas Aqueduct Project conversation.
 - A reasonable change to the nearly \$900,000 statutory filing fee is appropriate.

Need for Institutional Help

- Current Policy: dedicating Kansas Water to Use involves a “person” filing an application to appropriate available Kansas water.
 - 1) Consider a special legislative dedication of Kansas Missouri River Water to an Aqueduct Project in place of an appropriation priority filing by a person or coalition.
 - 2) Kansas should consider the existing provision in Kansas Law of special water districts and the Kansas Turnpike Authority and craft enabling legislation for a Kansas Aqueduct Authority.

Providing for a Kansas Aqueduct Authority

- would improve the acceptance of the effort by all Kansans as a project for all of Kansas
- would avoid specific up front water claims to specific areas of the state
- would assist in moving the Kansas interest and benefits forward as a necessary Kansas project.

YES on 4A is about accessing dependable sources of water. It's about protecting our local farms and ranches. It's about preserving our rural environment, open space and quality of life.

Central Colorado Water Conservancy District

YES on 4A

Secure Water Prevent Farm Dry-Ups Keep Ranches Working Protect Our Local Economy

A Recent successful \$60 million Bond Election campaign by the local Central Colorado Water Conservancy District to purchase senior water rights to assure water to local farms and communities.

Water Matters.

We need to act now to secure adequate water for our future needs before the opportunity is gone forever.

Central Colorado Water Conservancy District Field for by www.YesForWater.org
YES on 4A Yes for Water
 Secure Water • Prevent Farm Dry-Ups 801 8th Street, No. 228
 Protect Our Local Economy Greeley, CO 80632

Water is the lifeblood of farming and ranching. And both industries play a major role in our local economy and quality of life. Your YES vote on Measure 4A is critical.



“Thousands of jobs are tied to farming and ranching in our community. Without additional and reliable water supplies, we’re literally sunk. That’s no exaggeration. To ensure a strong economic future for our children and grandchildren, please vote YES for 4A.”

— Weld County Commissioner David Centony



YES on 4A is about accessing dependable sources of water. It’s about protecting our local farms and ranches. It’s about preserving our quality of life.



Printed by
Yes for Water
801 6th Street, No. 220
Golden, CO 80402

www.YesForWater.org



Secure Water



Prevent Farm Dry-Ups



Keep Ranches Working



Protect Our Local Economy

Water Matters.

Your YES vote on Measure 4A will secure water for the long term and protect our local economy.

The Problem...

Water is becoming more scarce. And without water, our local economy is going to be hit even harder.

- Denver Metro area cities and water providers are purchasing senior water rights within our district and drying up valuable, productive farm land, hurting our local farmers and ranchers.
- Municipalities in Arapahoe and Douglas counties are becoming more aggressive in reclaiming reusable water, drastically reducing flows to the South Platte River.
- Productive farm land across the South Platte River basin will dry up if we are not active in securing additional water supplies now.
- Impact of water shortage on local farmers and ranchers is even worse with devastating drought conditions.

The Solution...

We need to act now to secure adequate water for our future needs before the opportunity is gone forever.

Your YES vote on Measure 4A will provide funding to address critical water projects in Weld, Adams and Morgan counties, including:

- Participating in the Chatfield Reservoir Reclamation Project
- Securing senior surface water rights
- Developing groundwater recharge facilities
- Developing water storage projects in strategic locations within the district



Measure 4A is a small investment with a big return for our local economy...

- The estimated monthly tax impact of Measure 4A is \$1.12 per \$100,000 of a home's market value.
- Measure 4A protects the fertile area within the Central Colorado Water Conservancy District, land which provides thousands of jobs in Weld, Adams and Morgan counties.
- Farms in our community not only produce billions of dollars in agricultural products, but they also preserve our rural environment, open space and quality of life. And they allow Coloradans to buy locally-grown food rather than importing it.



Secure Water



Prevent Farm Dry-Ups



Keep Ranches Working



Protect Our Local Economy

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Thank you!



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Feeding a Growing Population

in a Resource-stressed World



Feeding a Growing Population

Every Day:

- We add **180,000** more people to our planet
- **Over 20,000** people die of hunger related illnesses

<http://www.overpopulation.org/solutions.html>

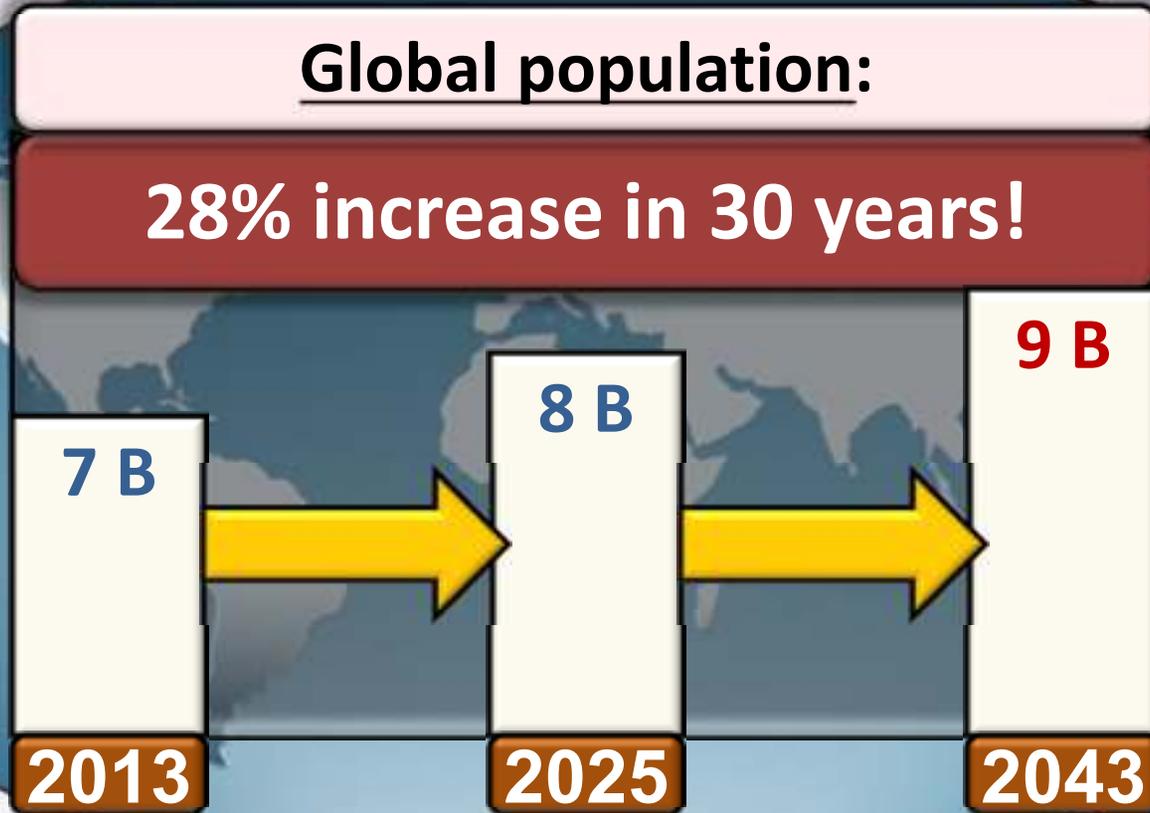
Feeding a Growing Population

Since one year ago:

- **We added 75,700,000 more people to our planet**
- ***Almost 10 more New York Cities in the previous year!***

<http://www.overpopulation.org/solutions.html>

Feeding a Growing Population



<http://www.census.gov/main/www/popclock.html>



Food Security Challenge

- **FAO**: need to increase food production by 70% over next 25 years
- Increase area under cultivation or increase productivity?
- **FAO**: 90% of increase will come from intensification of production systems
- Many nations will remain unable to achieve food self sufficiency

Feeding a Growing Population

Intensified Production

Genetically uniform high yielding varieties

Fertilizers & Pesticides

Irrigation**

****70 % of earth's fresh water goes to agriculture**

Water & Food Nexus*

- **~70%** of all fresh water use is for agriculture (mostly for irrigation)
- Only **~23%** of the world's cropland is irrigated
- Irrigated agriculture produces **40%** of all food
- Irrigation increases the yields of most crops by **100% to 400%** (FAO 2009).

Food-Water Nexus

- *“There is no new land or water to develop so we have to make more use of what we have...”*

Food Security – National Security

- Without dramatic improvements, many high-population Asian nations will lack one-quarter of the grain they need to feed their people by 2050 (Mukherji, A. et al. 2009)

THE WATER and FOOD nexus: trends and development of the research landscape (2012)

Food-Water Nexus

- The South Centre: ...“as oil conflicts were central to 20th century history, the struggle over freshwater is set to shape a new turning point in the world order.”
- “half the world’s population will be living in areas of high water stress by 2030...”
- Over 1 billion people will remain hungry

THE WATER and FOOD nexus: trends and development of the research landscape (2012),
Nourishing the Planet BY SOPHIE WENZLAU, Worldwatch Institute (2013)



Food Security Challenge

- **FAO**: need to increase food production by 70% over next 25 years
- Increase area under cultivation or increase productivity?
- **FAO**: 90% of increase will come from intensification of production systems
- Many nations will remain unable to achieve food self sufficiency



Ecosystem Assessment

- Agricultural production systems are the single biggest cause of environmental degradation
- Intensification of production systems cause the most damage
- Ecological community is calling for a complete transformation of agriculture

Frankham et al. 2010. Conservation Genetics, p 4.

Science 329:1278-1280 *Stack - 14 September 2011*

Need Informed & Balanced Policy

Policy Challenge

- *“... the long-term rise of civilization and living standards throughout the world is largely a story about increasing agricultural productivity”*
(Huffman and Orazem 2007)

The Big 3 World Food Producers

- Aquifer depletion now threatens harvests in China, India and the USA

Together, they produce half of the world's grain.

The question is not whether water shortages will affect harvests, but rather when they will do so.

ESRI Map of US Irrigated areas

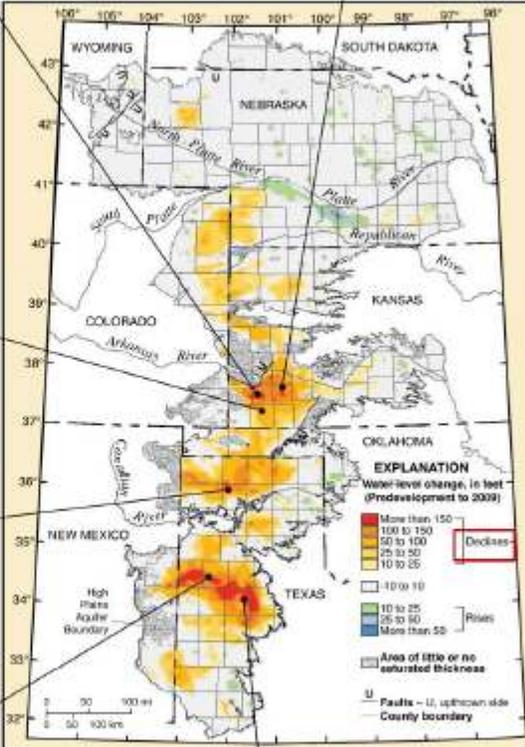
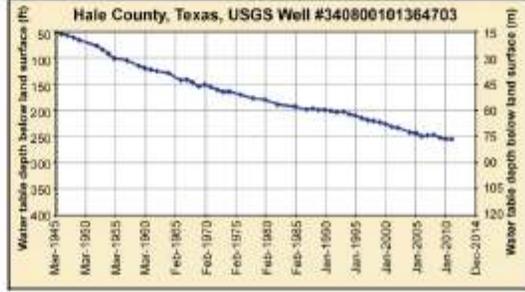
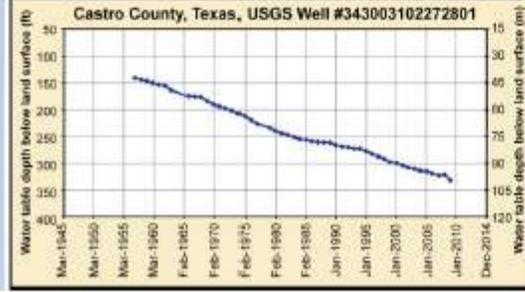
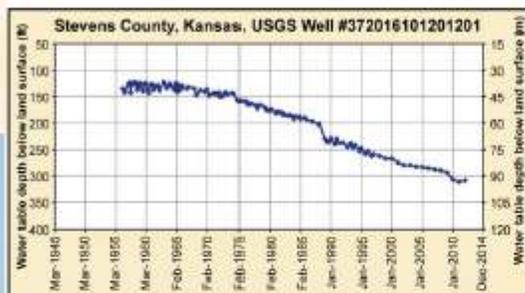
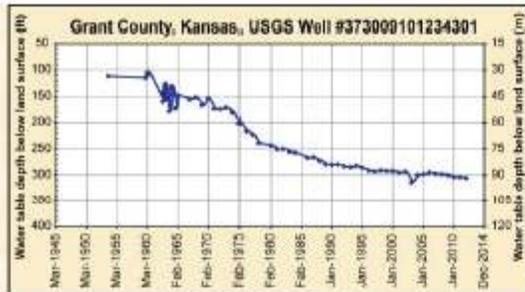
Darker blue = more irrigation



The water-level decline of the High Plains-Ogallala aquifer is the largest single water-management concern in the US

1945-2012 ground-water-level hydrograph declines

(Modified from Sophocleous, 2010)



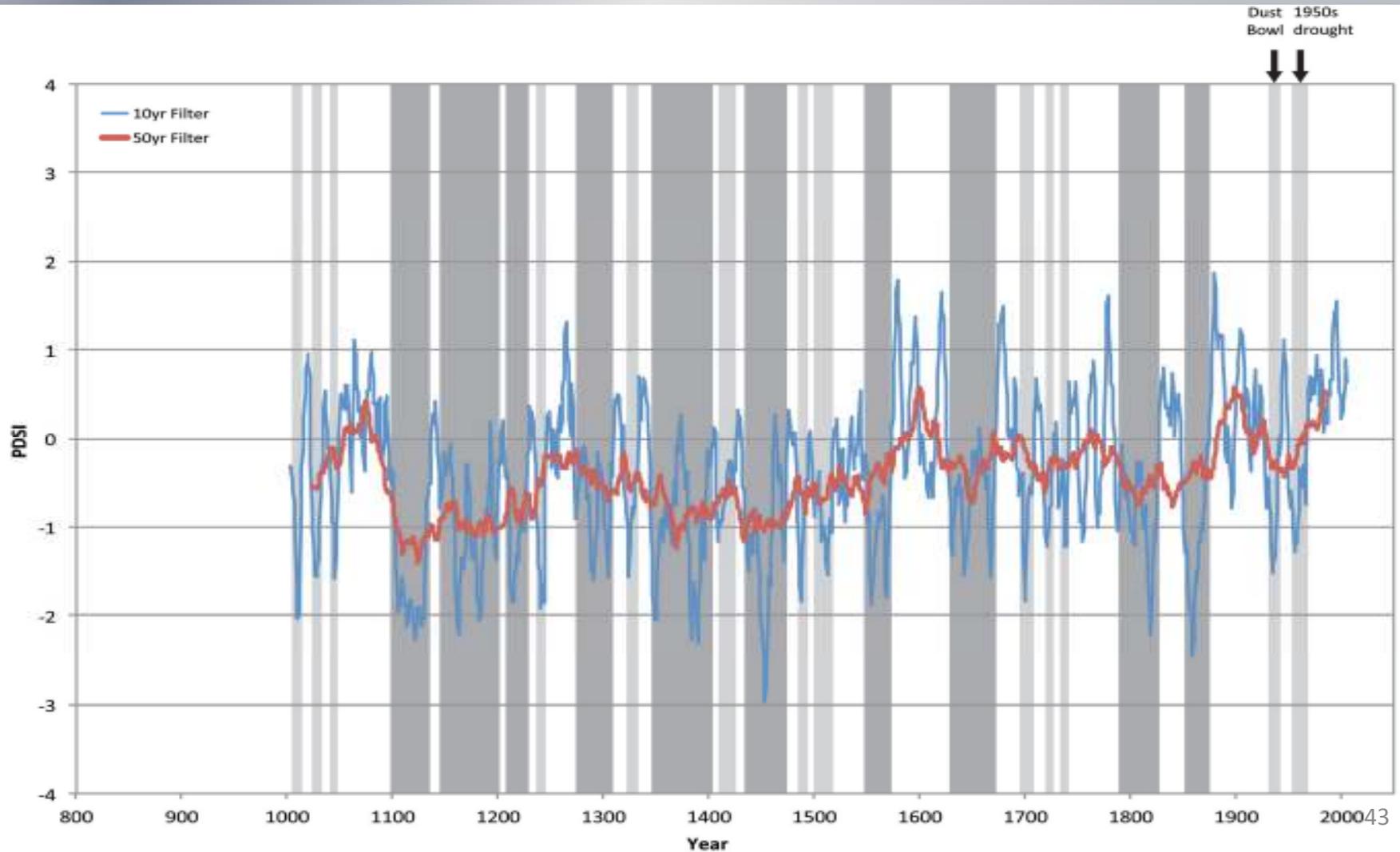
Groundwater-level changes: Predevelopment to 2009

(McGuire, 2011)

From USGS Presentation to GMDA, 2013

NE Kansas Climatic Variability

Anthony L. Layzell, KGS. PDSI = Palmer Drought Severity Index



Climate Variability

GMDA - 2013 Summer Conference

Climate Change and Groundwater

A presentation by Bruce Bacon, AMCI
Golden, Colorado

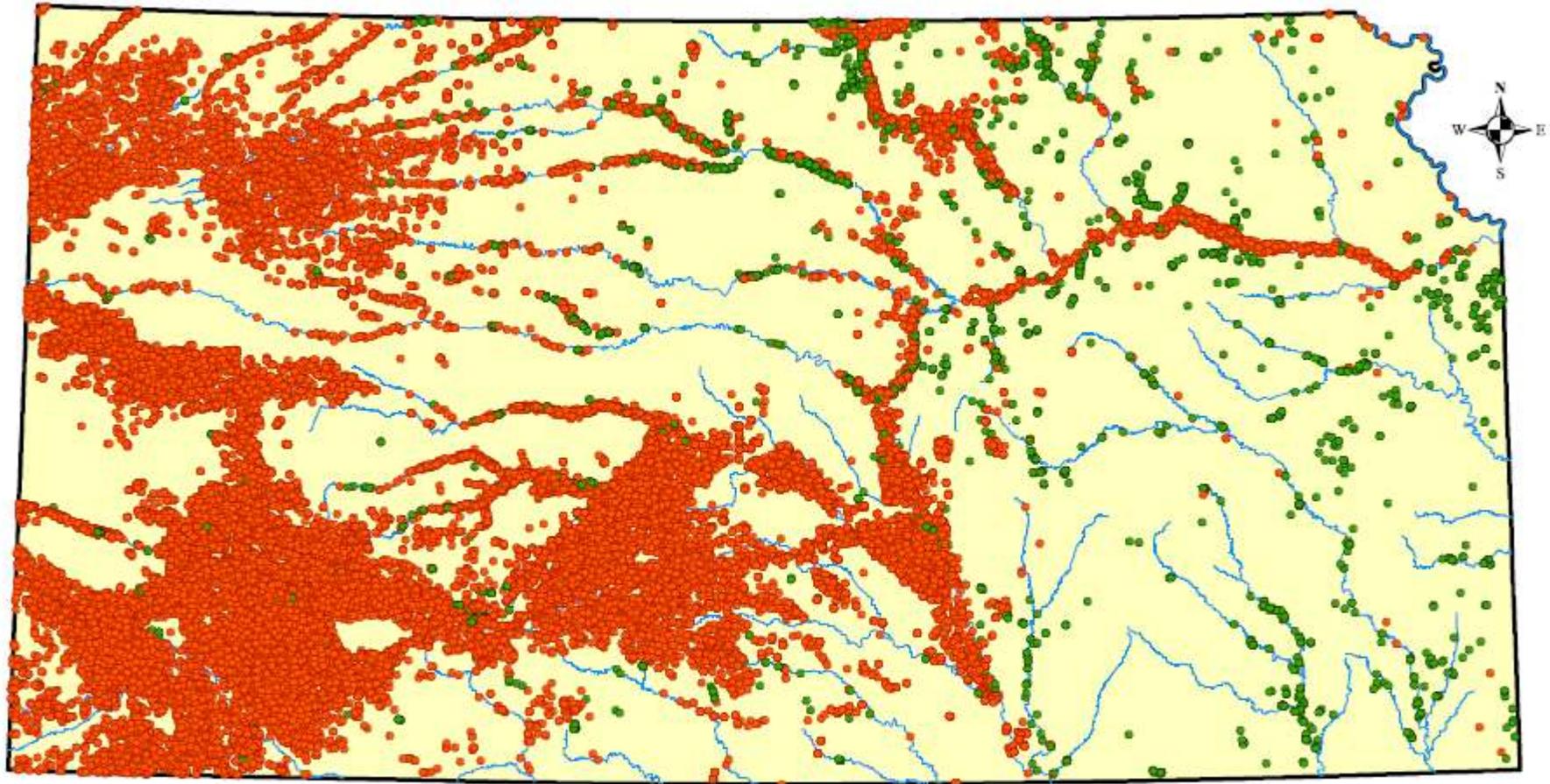


Takeaways

- * Water supplies in the west will diminish.
- * Conjunctive surface water and groundwater management as part of an overall adaptation strategy is critical.
- * Increased monitoring and study of aquifers and groundwater dynamics is critical for prudent management.

Kansas

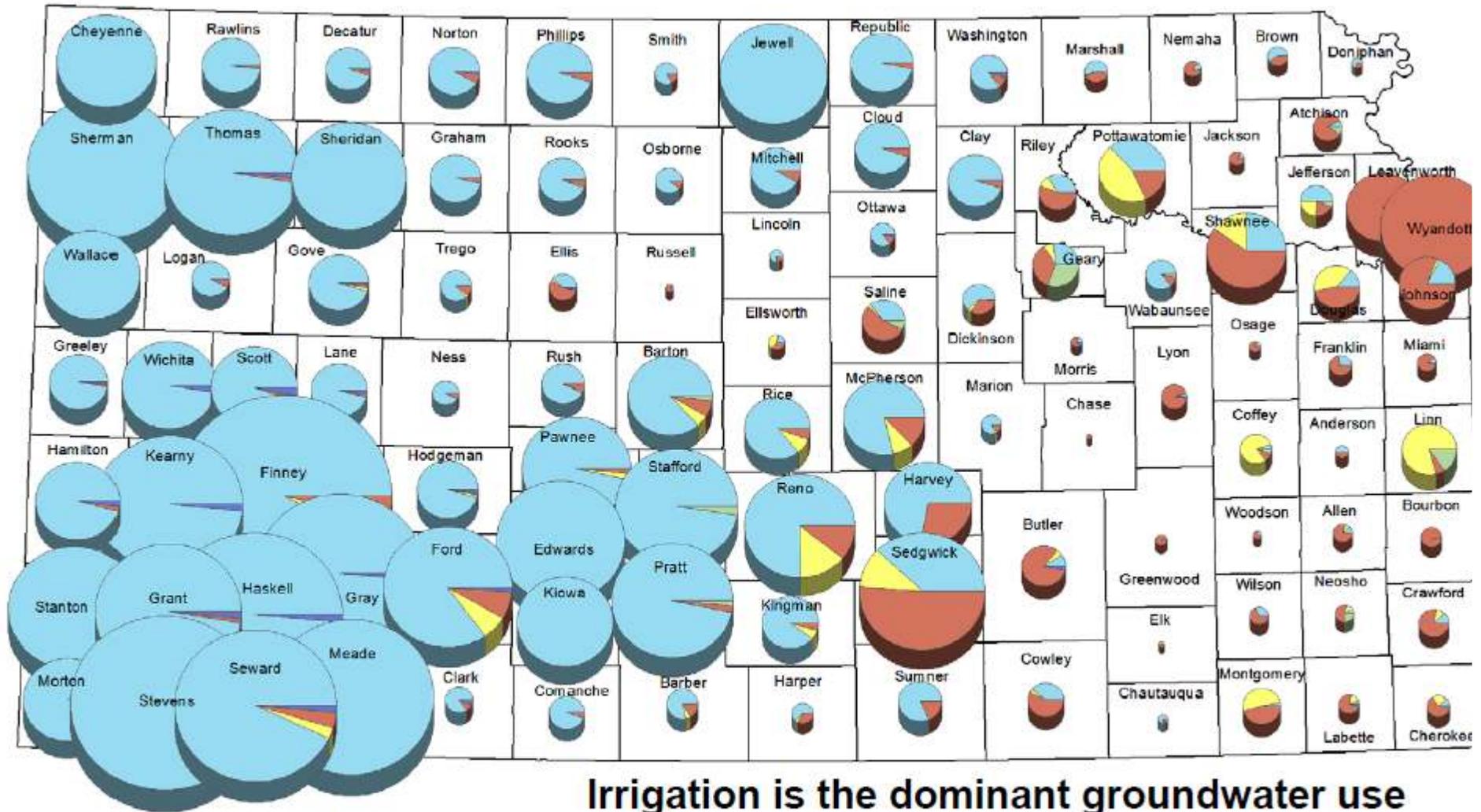
Irrigation Points of Diversion



● Surface Water ● Ground Water



2012 Reported Water Use for Kansas Counties

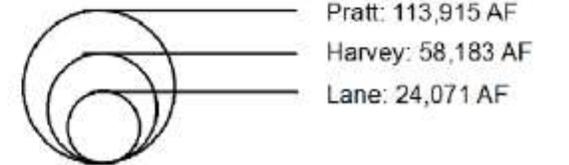


Disclaimer: Features on this map represent conditions as of the date of the map and are subject to change. The user is referred to specific policies, regulations and/or orders of the Chief Engineer.

Percentages of 1.5% or less do not show up in the pie charts.

This map is intended for planning purposes only.

Kansas Department of Agriculture
Division of Water Resources
Water Use Unit



0 25 50 100 Miles

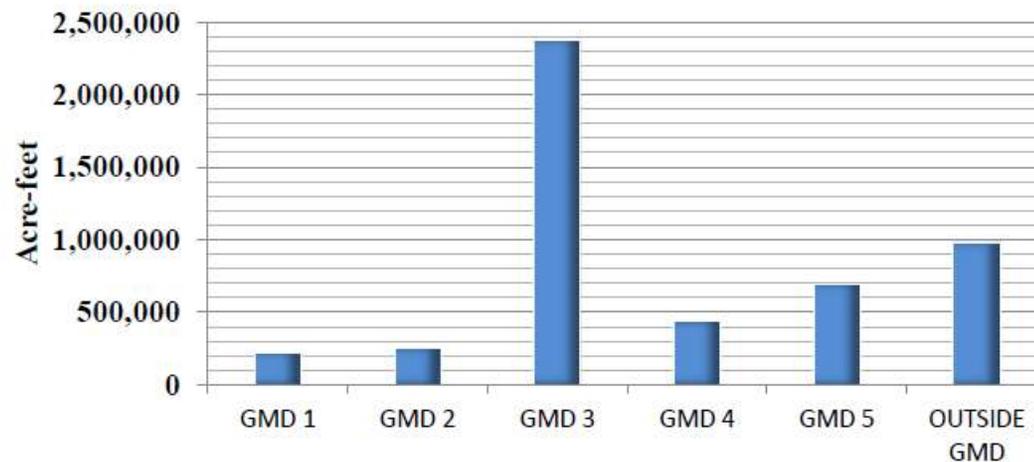
2011 Kansas Total Water Diverted



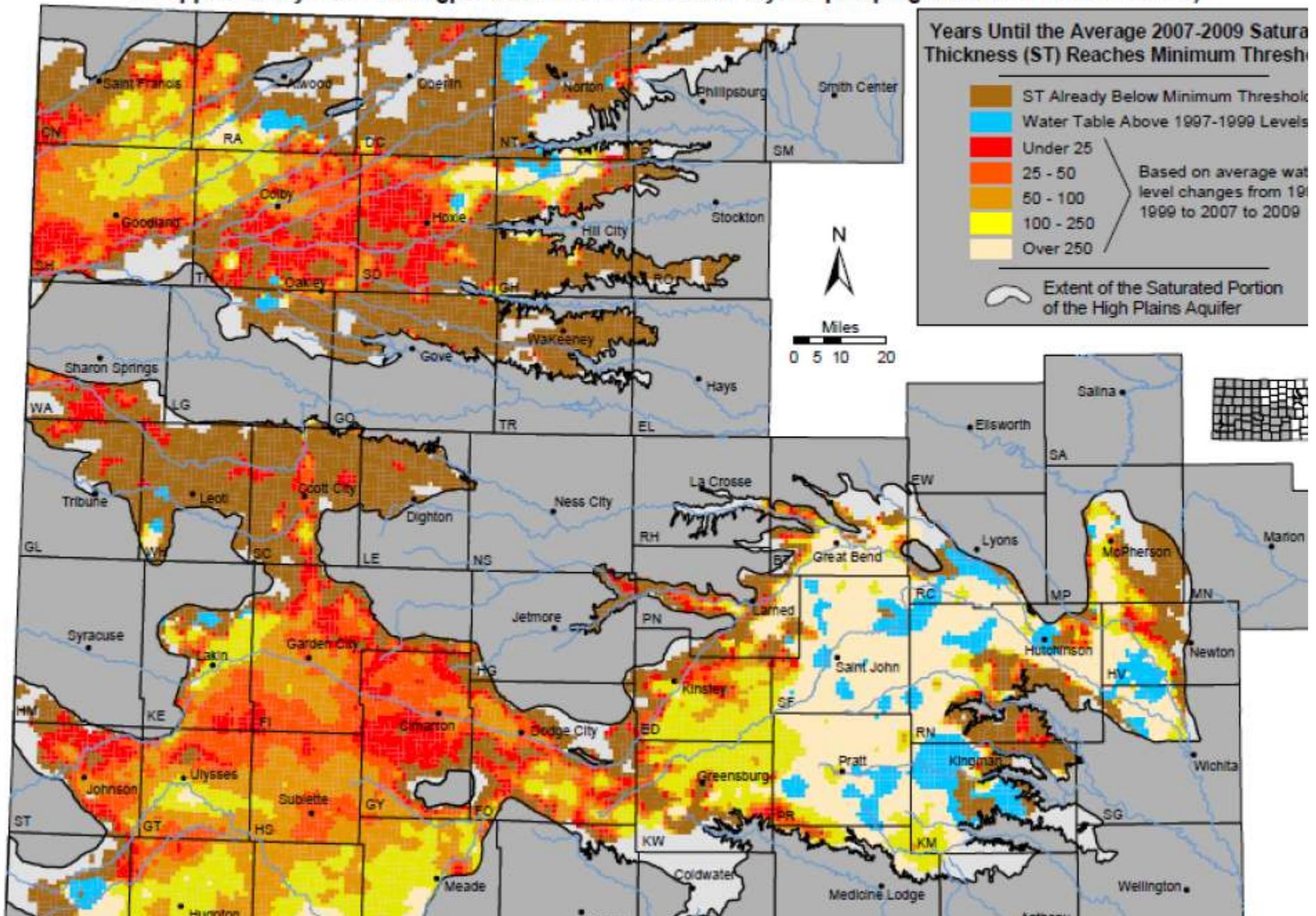
by Groundwater Management District
and outside GMD
All uses; all quantities in acre-feet

2011 Water Use by Groundwater Management District		
GMD 1	216,456	4.38%
GMD 2	246,978	5.00%
GMD 3	2,376,591	48.13%
GMD 4	434,545	8.80%
GMD 5	687,511	13.92%
OUTSIDE GMD	975,902	19.76%
Total	4,937,983	100.00%

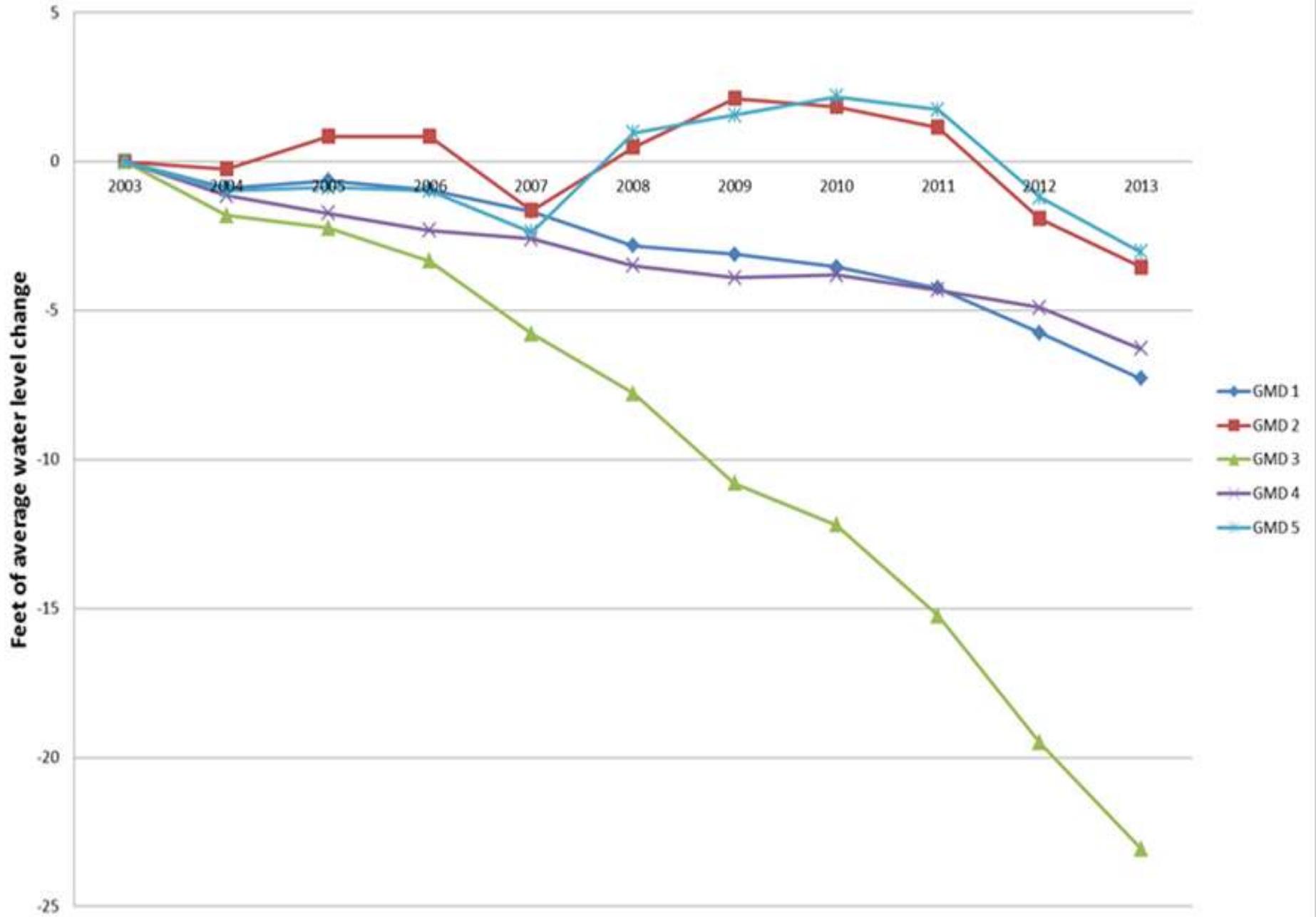
2011 Total Water Diverted by Groundwater Management District



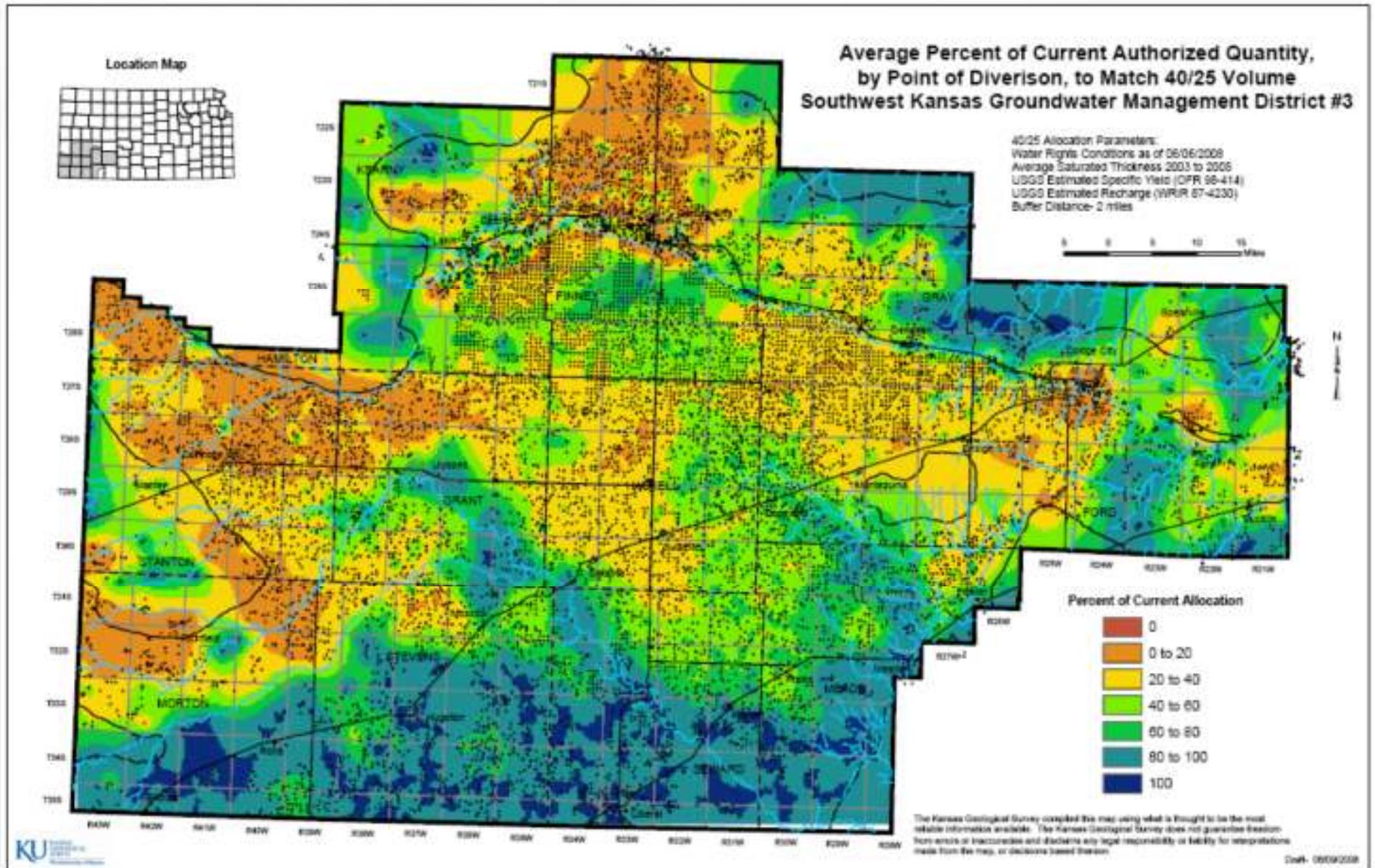
Estimated Usable Lifetime for the High Plains Aquifer in Kansas
 (Based on ground water trends from 1999 to 2009 and the minimum saturated thickness required to support well yields at 400 gpm under a scenario of 90 days of pumping with wells on 1/4 section)



Accumulated average water level change by GMD, the last 10 years



Areas exceeding target aquifer budget



Groundwater Areas Closed by Rule or Order



Kansas Department of Agriculture
Administrative Services GIS
February 8, 2011

Legend

- DWR Field Office Boundaries
- Closed Areas *
- GMD Boundaries
- County Boundaries
- DWR Basins



* Western Kansas Groundwater Management District No. 1 has requested rules and regulations to close the Ogallala and Niobrara formations within the district to new appropriation of water. A moratorium is in place while the rules and regulations are in the process of being adopted.

KGS Groundwater Model decline projections Scenario 1a Storage Budgets – SW KS Counties

