



Good Water Policy: Well evaluations in a GMD Program

2019 Summer Conference, Manhattan, KSU

Groundwater Management Districts

- A “special district” (K.S.A. 82a-1020) that is an independent, special-purpose governmental unit existing separately from other local governments with substantial administrative and fiscal independence to accomplish a set of explicit governmental functions, including:
 - for the proper management of the groundwater resources,
 - for the conservation of groundwater resources, and
 - to secure for Kansas a healthy water dependent economy ...
- They adopt and operate the local groundwater Management Program

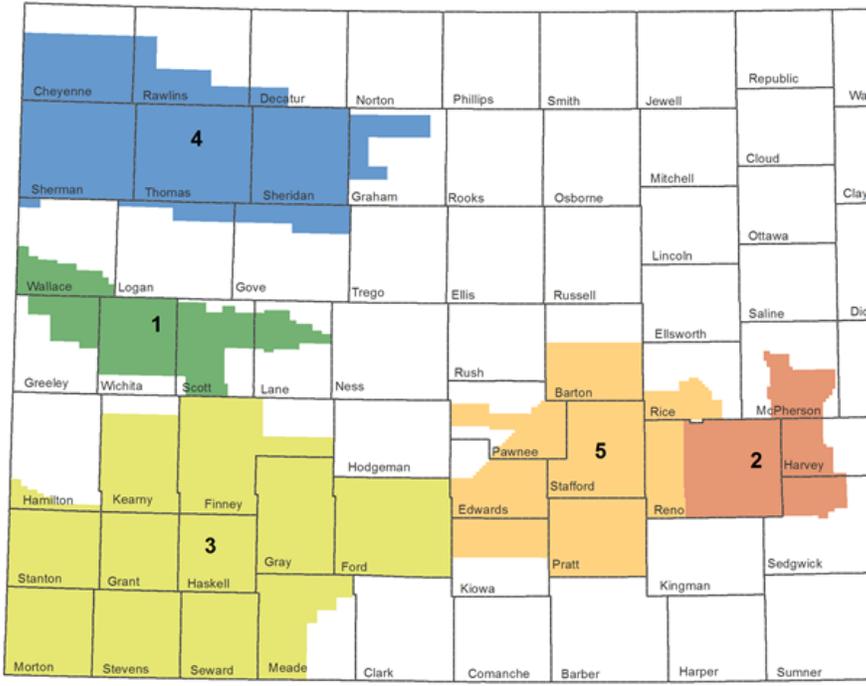
THE KANSAS GMD ARRANGEMENT

today results in 22.5 additional staff working full-time on groundwater issues, directed by 49 elected water user board members meeting regularly on key local issues, with access to nearly \$4.3 million of additional local monies to address their priorities each year.





Groundwater Management Districts



Collaboration of Local and State Officials

Basic Use Doctrine: First in time...

Kansas Water Rights Impairment Evaluations

- The chief engineer cannot grant an application to appropriate groundwater if the proposed appropriation will **impair existing water rights** (K.S.A.82a-711 & 82a-711a).
- Also, for:
 - **changing water rights** (K.S.A. 82a-708b)
 - **injunction request** - potential or actual impairment of prior rights (K.S.A.82a-717a)
 - **limited transfer permits** (K.S.A. 82a-743)
 - **WCA's** (water conservation areas) proposed pumping flexibility (K.S.A.82a-745)
 - **Rule waivers** of administrative rule and regulation (K.S.A. 82a-1904)



Kansas law does not define water right impairment.

- However, there is some policy:
- K.S.A. 82a-711,(c): **impairment shall include** the unreasonable raising or lowering of the static water level ... or the unreasonable deterioration of the water quality at the water user's point of diversion beyond a reasonable economic limit.



Kansas courts have a definition for impair.



- SW Kansas Case ...
- When that [water use] diminishes, weakens, or injures the diversions of water under a prior right. (Garetson Bros. v. Am. Warrior, Inc. ., 51 Kan. App. 2d 370, 389, 347 P.3d 687 (2014), review denied (Jan. 25, 2016)).

K.S.A. 82a-711a. express conditions of appropriations.

It shall be an express condition of each appropriation...

- relates to a specific quantity of water
- such right must allow for a reasonable [change] of water level ... at the appropriator's point of diversion:

Provided, That in determining such [change] of the static water level in a particular area, the chief engineer shall consider the economics of ... pumping water for the water uses involved; and

nothing shall prevent approvals later in time, **so long as the rights of holders of existing water rights can be satisfied** under such express conditions.

History: L. 1957, ch. 539, § 17; June 29.



GMD3 draft Management Program

August 2019 Kansas Water Congress

The Groundwater Management Program

Southwest Kansas Groundwater Management District Number 3 (GMD3)

2009 E. Spruce Street, Garden City, Kansas 67846 (620) 275-7147

URL: [HTTP://www.gmd3.org](http://www.gmd3.org)

All policy and opinion expressed herein are of GMD3 and not necessarily of other agencies
Proposed Revised 03/01/19 Draft to Chief Engineer w/edits to 07/18/19.



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Southwest Kansas Working Aquifers – Conserving Every Day Since 1976

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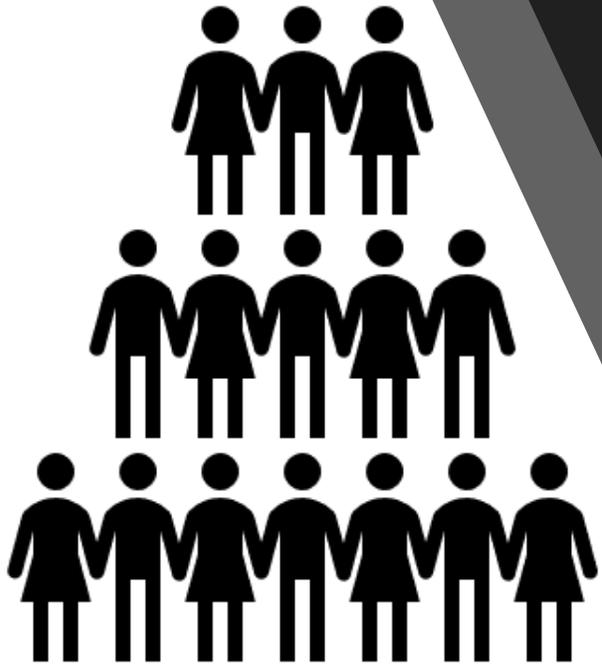
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GMD3 Water Rights Administration

(and the right to determine our destiny established in K.S.A. 82a-1020)

Provide requests, comments and recommendations of the management program, considering:

- A. Public and domestic drinking water.
- B. Water usability depletion.
- C. Maximum allowable rate of depletion.
- D. Well drawdown evaluations.
- E. Local source of supply.
- F. Water right priority contribution.
- G. Use of lessor quality water where feasible.
- H. Member agreements that agree with Management Program.
- I. Economy and use value.
- J. Alternate supply development.
- K. Better Inventory estimates and data.
- L. Water imports and distribution.
- M. New flexible use among wells and use rights.



GMD3 Water Rights Administration

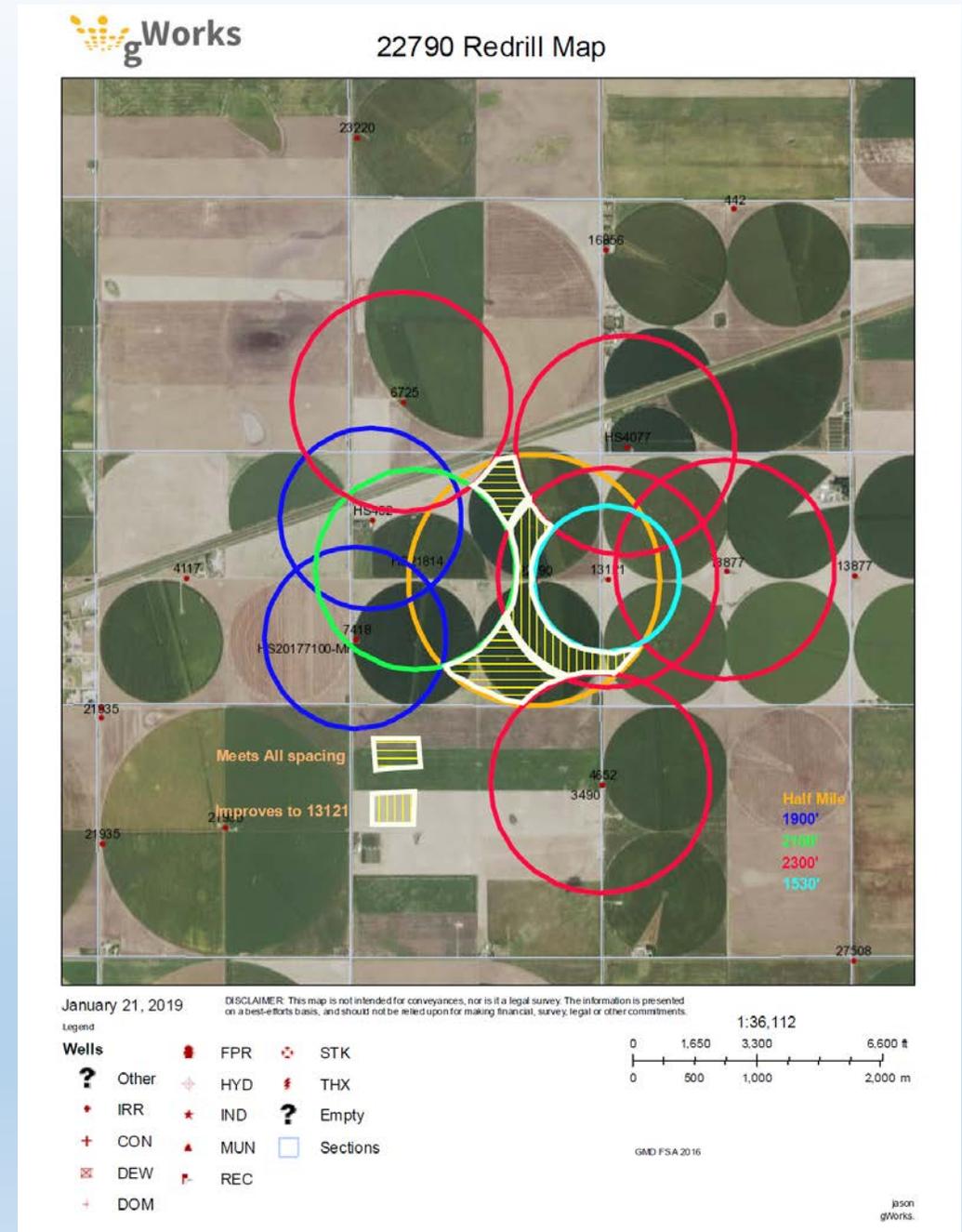
Guiding Principles

1. **Preserve basic use doctrine and the right** to manage use.
2. **Good record** for good decisions.
3. **Conserve and grow** supply.
4. **Closed aquifer dedicates native supply** to existing use rights.
5. **Good drinking water** is a priority.
6. **Contributions to future supply** should be recognized.
7. **Communicate** and exchange information and expert evaluations.
8. **Seek mutual benefits** and good will between members.
9. **Seek stability of supply** for investments.
10. **Promote free enterprise** for acquiring rights to available supply.



GMD3 Well Spacing Rules (circle) map:

- Good when plenty of groundwater.
- Maybe not enough in depleting supply or differing aquifer conditions.
- Provides no evaluation of supply or demand.
- Assumes satisfied prior rights.
- May meet spacing rule but fail statute prescription.
- Frustrated property interests must demonstrate they are impaired or are not impairing their neighbors.



GMD3 Water Rights Administration

- GMD3 needs criteria for managing aquifer declines and member interests.
- Members need information to manage their decisions in declining supply.



GMD3 will use well drawdown constraint guidelines to identify and consider critical wells with prior rights to available groundwater supply

1. Drawdown Allowance
2. Economical Drawdown Constraint.
3. Physical Drawdown Constraint.
4. Domestic wells.
5. Critical wells = have a high risk of water right impairment.



GMD3 Well to Well Evaluation Criteria

Trevor Ahring, P.E.

Kansas Water Congress Summer Conference

Legal Requirements

- K.S.A. 82a-708b requires water right owners seeking to change place of use or point of diversion to demonstrate to the chief engineer that the proposed change is reasonable and will not impair existing rights.
 - Traditionally has been assumed that well spacing rules provide some assurance that impairment is unlikely to occur.
 - Rules have exceptions and are sometimes waived.
 - Rules fail to account for new wells being stronger or deeper than existing wells.

What is impairment?

- Black's law dictionary:
 - To weaken, diminish, or relax, or otherwise affect in an injurious manner
 - Confusing to property owners who find themselves in the position of proving they are being impaired or not impairing their neighbors

How can we tell if someone is impaired?



How can we tell if someone is impaired?



• Critical well criteria

- Water table declines enough over 25 year time period that well will not be able to get adequate yield (physical drawdown constraint).
- Water supply to a well declines by more than 40% over next 25 years (economic drawdown constraint).
- Wells in these categories may or not be critical even without the proposed change.

Drawdown allowance criteria

- People still need the ability to relocate wells in poor aquifer areas.
- Drawdown allowance criteria established to allow for moves in areas with critical wells.
 - Criteria are not meant to define an unreasonable effect, but rather a negligible effect.

Drawdown allowance criteria

Average Aquifer Thickness (ft)	50 Year Theis Drawdown Allowance (ft)
0 – 50	1.0
>50 – 75	1.5
>75 – 100	2.0
>100 – 125	2.5
>125 – 150	3.0
>150 – 200	3.5
>200	4.0

• What is Theis drawdown?

- Theis describes radial flow in a uniformly thick horizontal, homogeneous, isotropic aquifer of infinite areal extent.
- Theis equation produces a curve that models the drawdown effect a well produces at any given distance.
 - Drawdown is dependent on pumping rate, pumping time, storage coefficient (specific yield in unconfined aquifers), and transmissivity.

How effects are calculated

- Nearby KGS monitoring wells are used to determine water table elevation. Drillers' logs are used to determine saturated thickness.
 - As a last resort, the GMD3 model may be used to determine saturated thickness.
- The GMD3 model is used to determine storage coefficient, S , and transmissivity, T .
- Average use and observed rate are used to calculate effects at current well location.
- Authorized use and rate are used to calculate effects at proposed well location.

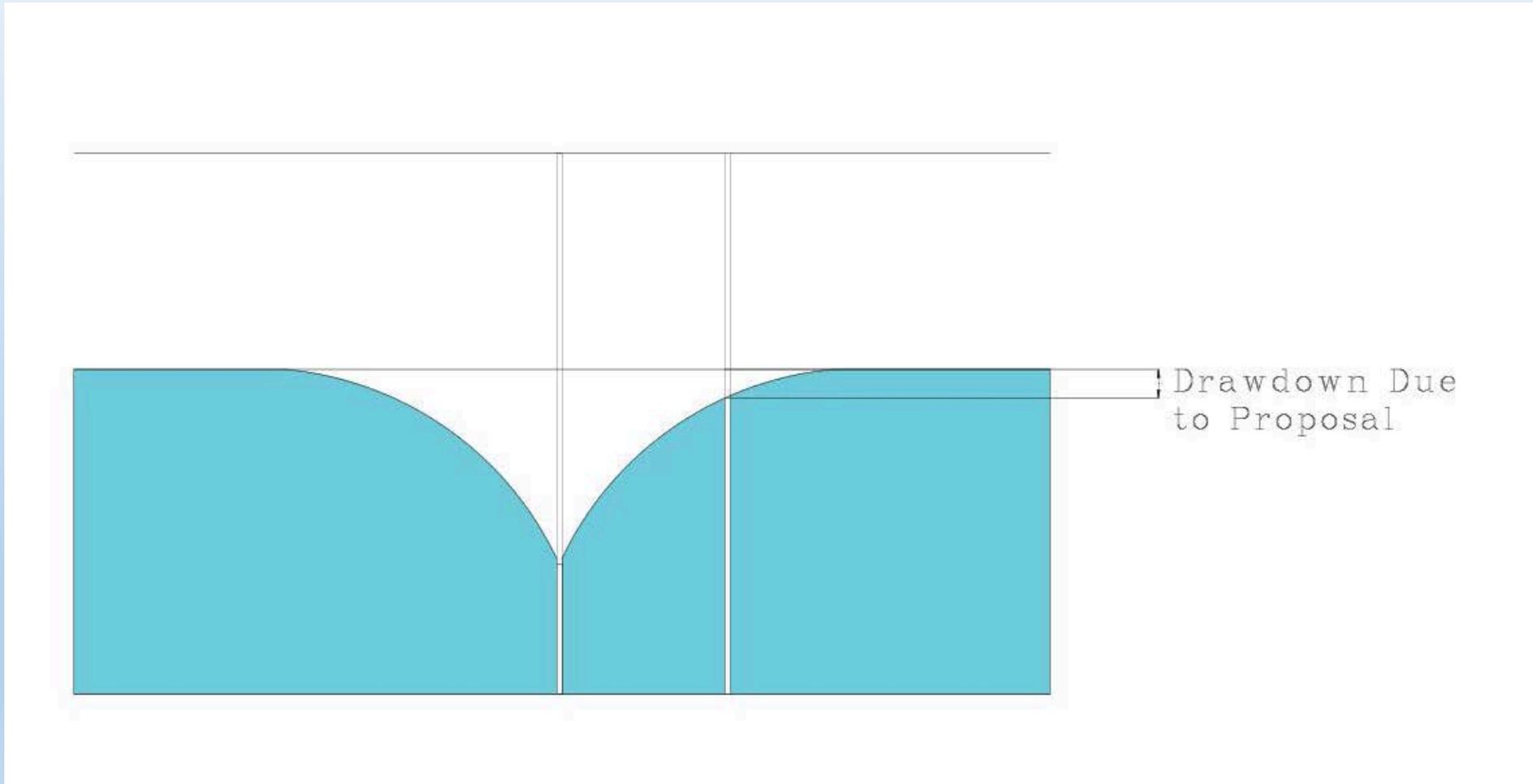
• Critical well analysis

- When the drawdown allowance criteria are exceeded, wells are determined to be critical or non-critical.
- Drawdown due to the proposal, drawdown due to existing pumping, and dynamic drawdown are added together to estimate pumping water level in 25 years.
- If the water column decreases by more than 40%, the well is critical under the economic drawdown constraint.
- If the water column remaining is insufficient for the well to reasonably operate, the well is critical under the physical drawdown constraint.

Drawdown due to proposal

- A 25 year Theis analysis is used to determine the well-to-well effect of the proposed change.
 - Current conditions are subtracted from proposed conditions.
- Results affected by distance, pumping rate, quantity pumped, storage coefficient, and transmissivity.
 - Reported quantity and observed rate are used to calculate current conditions.
 - Authorized quantity and rate are used to calculate proposed conditions.

Drawdown due to proposal



Drawdown due to existing pumping

- The GMD3 model completed by kgs in 2010 is used to estimate water level declines over the next 25 years.
- Effects of proposal are not accounted for.
- Not really drawdown in the same sense as Theis calculations.
- Static water level decline allows us to account for Theis effects being applied to a lower water table elevation than currently exists.

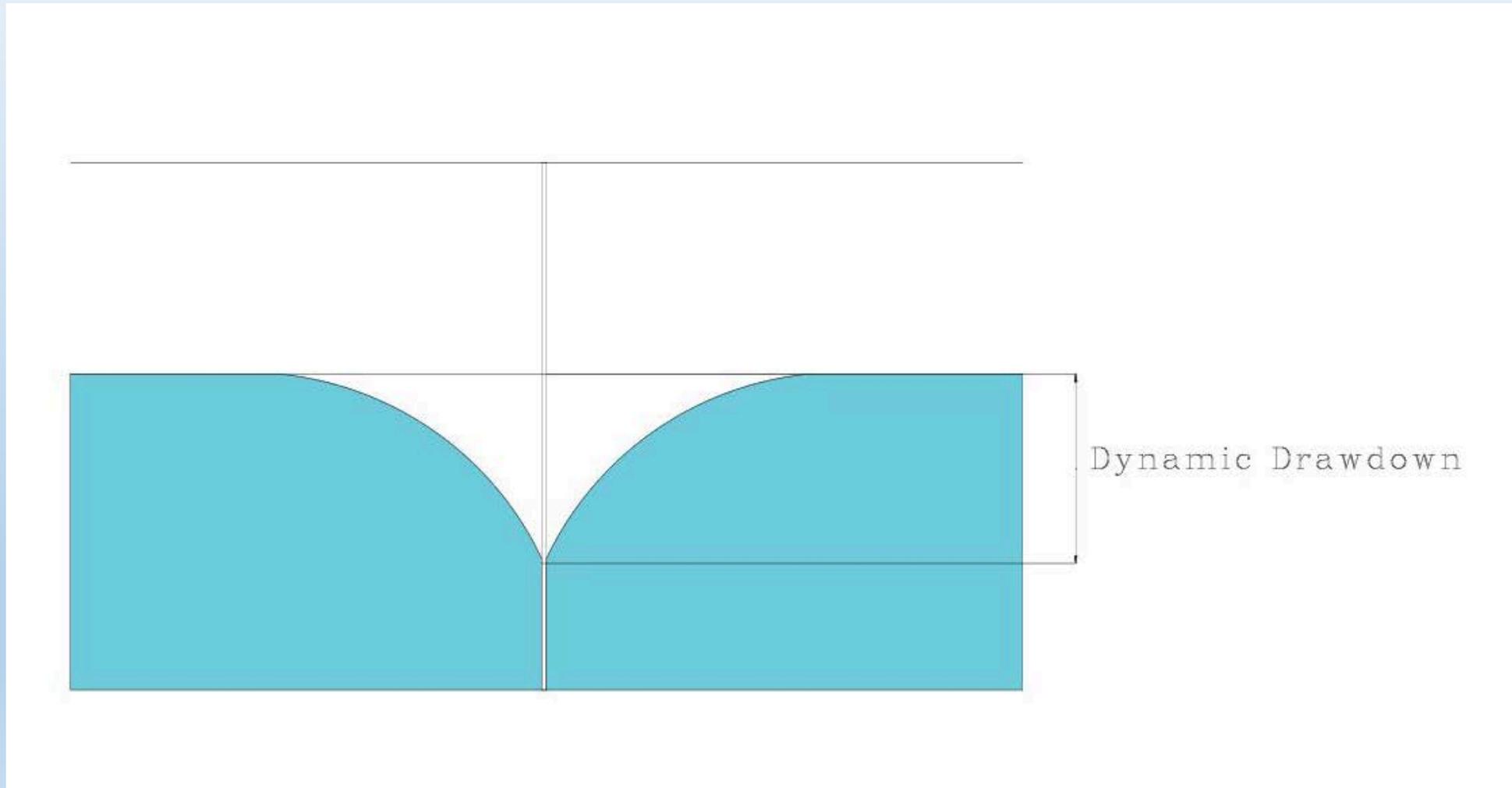
Dynamic Drawdown

- Dynamic drawdown is the amount of drawdown of the aquifer within the well when the well is operating.
- If available, specific capacity of the well and observed pumping rate are used to determine dynamic drawdown.
- More often, a Theis analysis at the well radius, using an estimated well efficiency of 70% is used.
- May be calculated differently depending upon the use made of water and typical well operation.

Dynamic drawdown

- For irrigation wells, drawdown at the end of the irrigation season is calculated assuming full time production during this period.
 - If pumping schedules can be reasonably approximated, operational well yield may be estimated.
- For stock/industrial wells, a 60 percent production time over one day is assumed.
- Dynamic drawdown is not calculated for domestic wells.

Dynamic drawdown



• Total drawdown

- Drawdown due to proposal, drawdown due to existing pumping, and dynamic drawdown are added together to calculate total drawdown.
 - Predicts the operating water level after 25 years.

• Allowable economic drawdown constraint

- If total drawdown exceeds 40% of the water column, the economic drawdown constraint is exceeded, and the well is classified as critical.
 - Based upon long-standing GMD3 policy that identifies water declines exceeding 40% in 25 years as problem decline areas.
- If information shows a well will lose economic viability at a value less than 40% in 25 years, that value may be used to set a different criteria for that situation.

• Allowable physical drawdown constraint

- If total drawdown causes loss of the required well yield due to excessive water level decline, the physical drawdown constraint is exceeded.
 - For non-domestic wells, the lowest practical pumping level is assumed to be 60 ft above the base of the water column.
 - For domestic wells, the lowest practical pumping level is assumed to be 20 ft above the base of the water column.

Procedure overview

- Estimate existing water column.
- Multiply by 0.4 to obtain allowable economic drawdown.
- Calculate allowable physical drawdown by subtracting 60 ft from the water column (20 ft for domestic wells).
- Estimate drawdowns due to existing water rights.
- Estimate drawdowns due to proposal.
- Estimate dynamic drawdown.
- Add results from each drawdown estimate to obtain total drawdown.
- If total drawdown exceeds allowable economic or physical drawdown, the well is critical.

GMD3 Water Right Proposal Review: Evaluation of a Neighboring Well (Non-Critical)

This is not a critical well because total projected drawdown over 25 years does not exceed allowable drawdown.

Blue = Allowable Drawdown
(Lesser of Economic or Physical Drawdown Constraints)

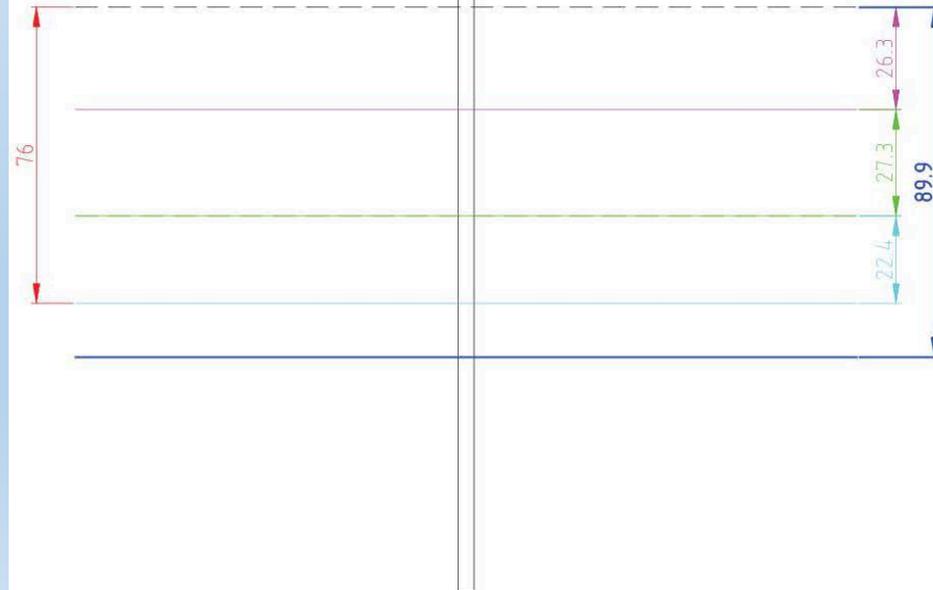
Green = Existing Drawdown
(Existing Water Level Decline)

Magenta = Proposed Drawdown
(Added Effect Caused by the Proposed Change)

Cyan = Dynamic Drawdown
(Drawdown within the well while operating)

Red = Total Drawdown

Water Table



GMD3 Water Right Proposal Review: Evaluation of a Neighboring Well (Critical)

This is a critical well because total projected drawdown over 25 years exceeds allowable drawdown.

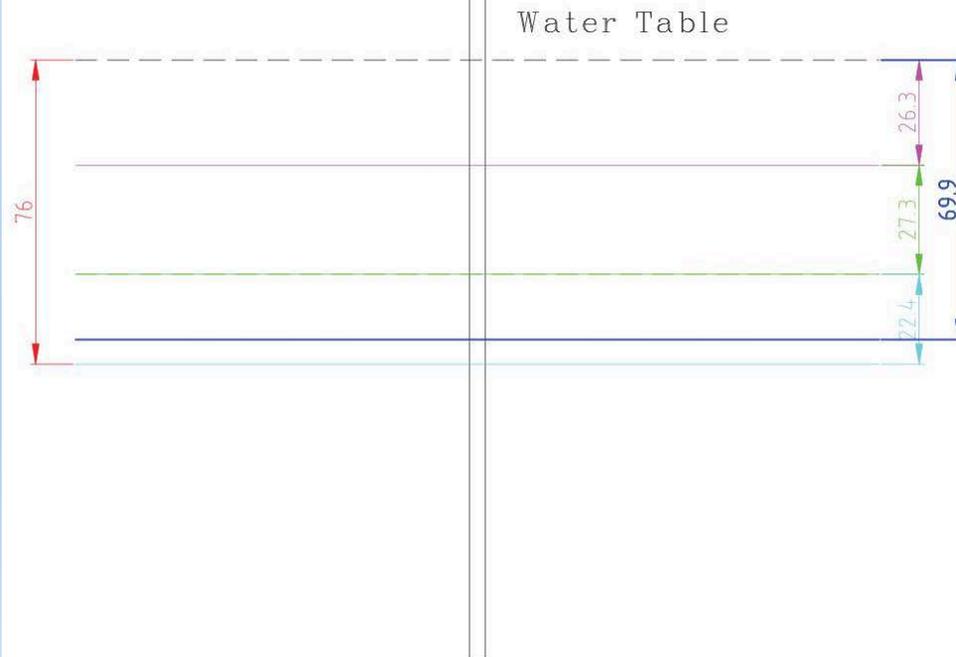
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(Added Effect Caused by the Proposed Change)

Cyan = Dynamic Drawdown
(Drawdown within the well while operating)

Red = Total Drawdown



• Exceptions

- Wells improperly constructed
 - Not deep enough
 - Not screened properly
- Old wells that can go deeper
- Agreements made between landowners

Recommendations

- If the proposed well creates well-to-well effects that do not exceed the drawdown allowance, or there are no critical wells, GMD3 staff recommends approval of the application.
- If there are critical wells and the drawdown allowance is exceeded on one or more wells, GMD3 staff recommends approval at a reduced rate/quantity so that either the drawdown allowance is no longer exceeded, or no wells are critical.

• Notifications and Reporting

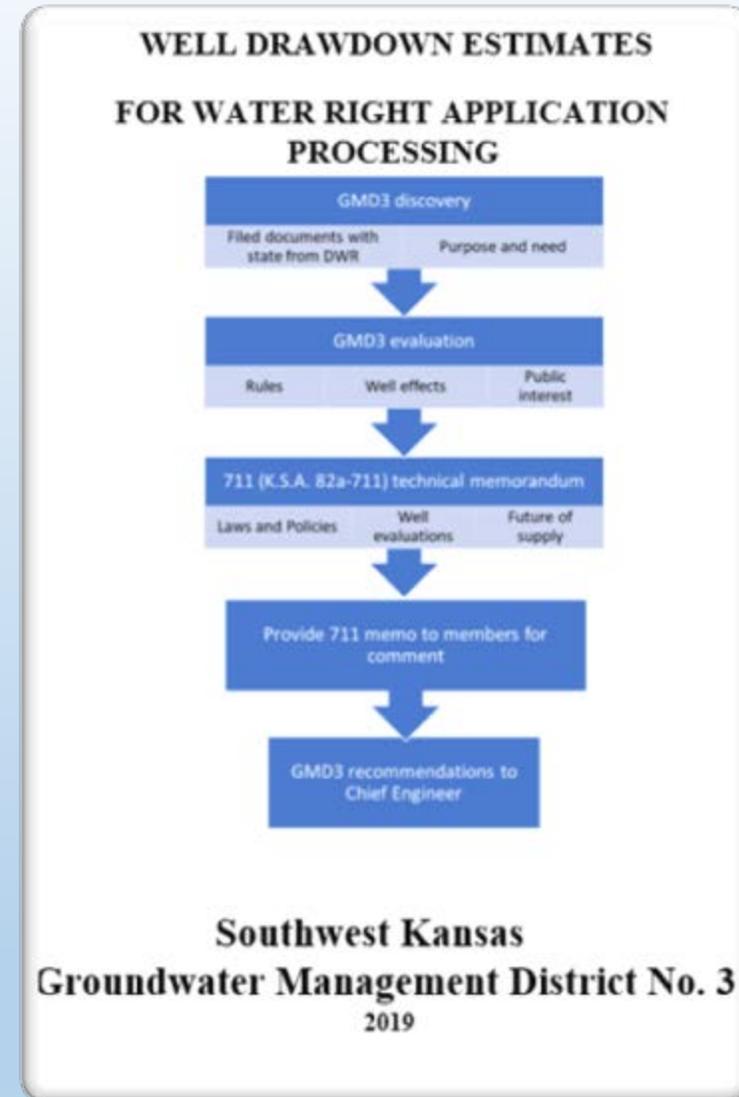
- All water right owners within 1 mile of proposal are notified of change and given a report detailing drawdown calculations.
- Neighbors are given adequate time to respond to the report.
- Applicant typically can't get a rules waiver without being limited to the recommended rate and quantity in the report.

Challenges and Limitations

- GMD3 model was created using data from 2006 and was finished in 2010.
 - Data projecting current and future saturated thickness can be inaccurate.
- GMD3 model does not produce aquifer characteristics beneath the Ogallala Aquifer.
- Domestic wells can be drilled anywhere and then everyone else must maintain 660 ft spacing from them after the fact.
 - Not all domestic wells are identified in a database.
 - Some wells that we do identify are no longer active.

Questions?

<http://www.gmd3.org/what-we-do/well-to-well-analysis/>



GMD3 draft Management Program update highlights

August 2019 - Kansas Water Congress

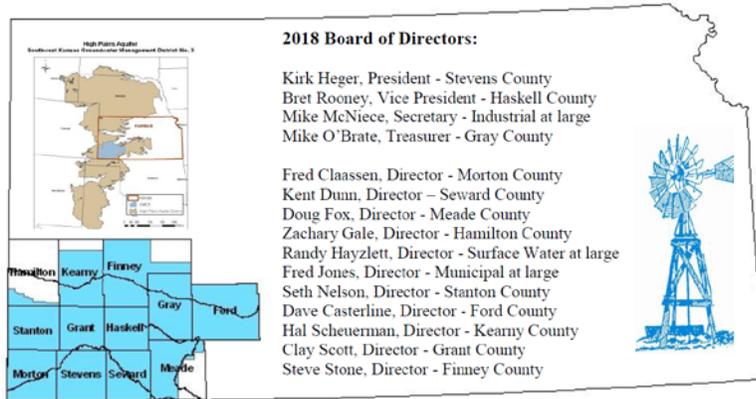
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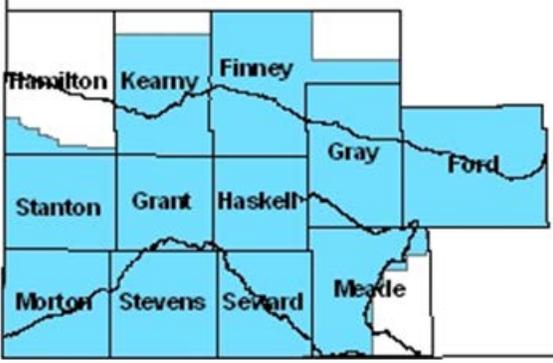
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Rivers and Aquifers
flow from other states.

Some Interstate compacts



Colorado Ground Water
Commission



Actions depleting supply
from other states.

GMD3 Interstate Waters Coordination

GMD3 draft Management Program

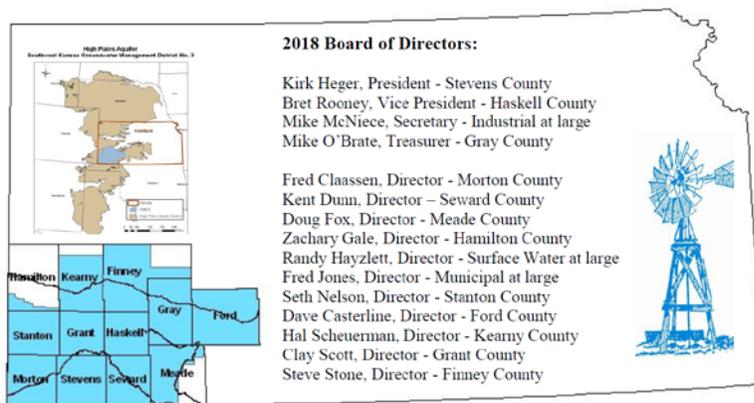
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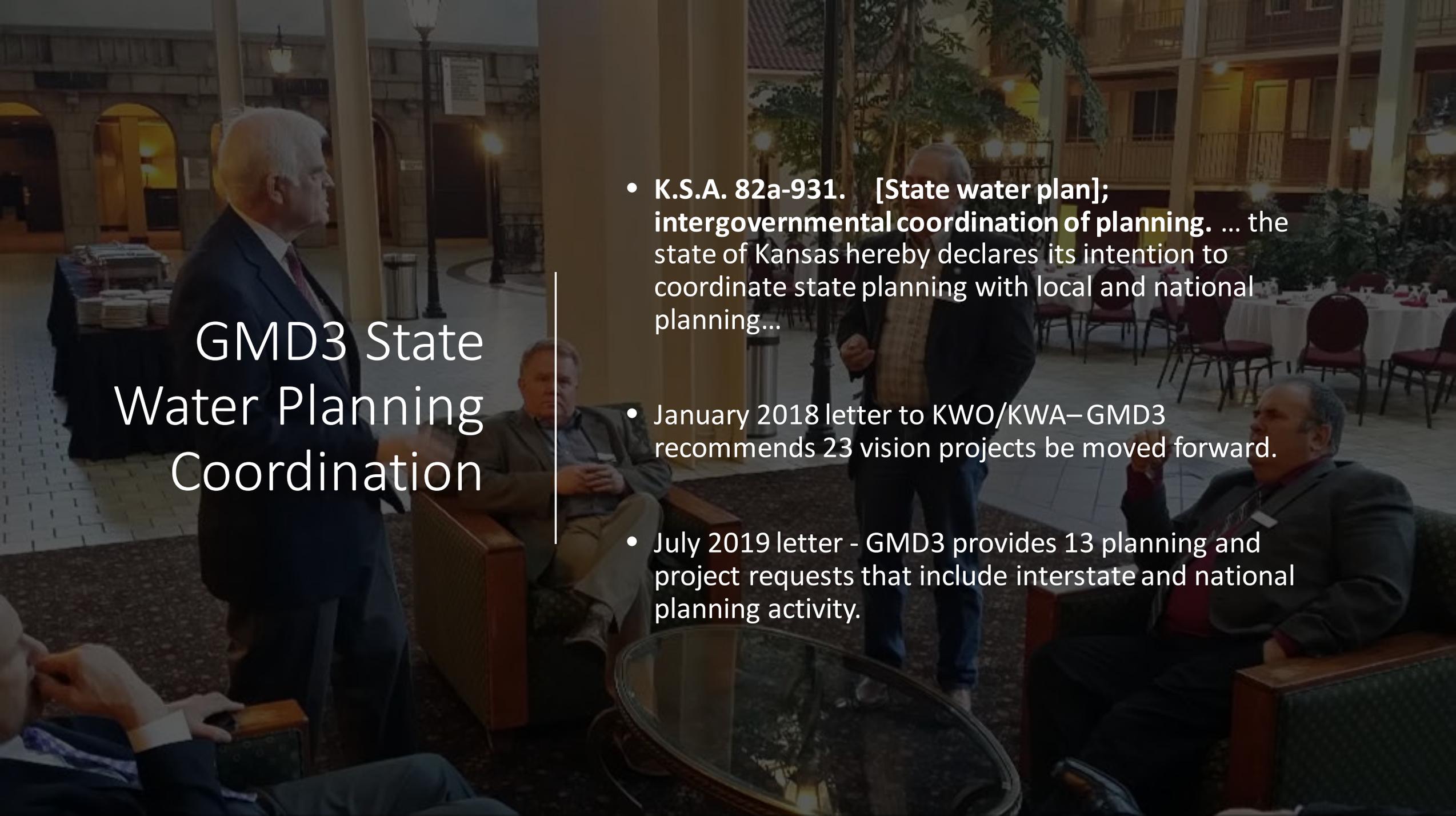
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GMD3 State Water Planning Coordination

- In formulating the state water plan per K.S.A. 82a-907, the Kansas Water Office shall consider:
 - (a) The management, conservation and development of the water resources of the state for the benefit of the state as a whole;
 - (h) the alternative plans, programs and projects [for those activities];
 - (j) the use of waters to augment the flow of surface streams ... ;
 - (m) plans, projects and recommendations of public corporations, the federal government and state agencies prepared pursuant to statutory authority;





GMD3 State Water Planning Coordination

- **K.S.A. 82a-931. [State water plan]; intergovernmental coordination of planning.** ... the state of Kansas hereby declares its intention to coordinate state planning with local and national planning...
- January 2018 letter to KWO/KWA–GMD3 recommends 23 vision projects be moved forward.
- July 2019 letter - GMD3 provides 13 planning and project requests that include interstate and national planning activity.

GMD3 draft Management Program update

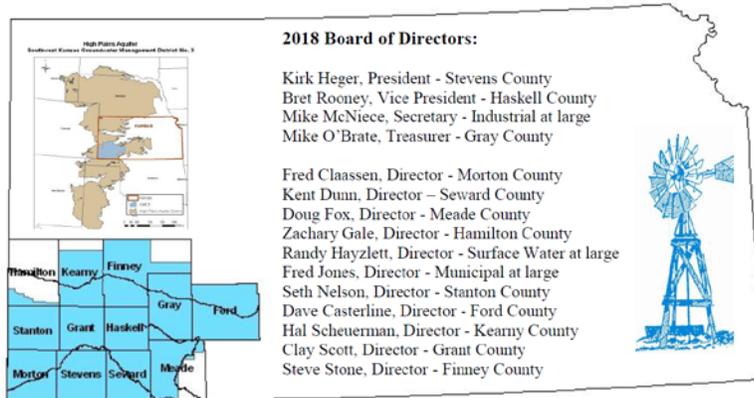
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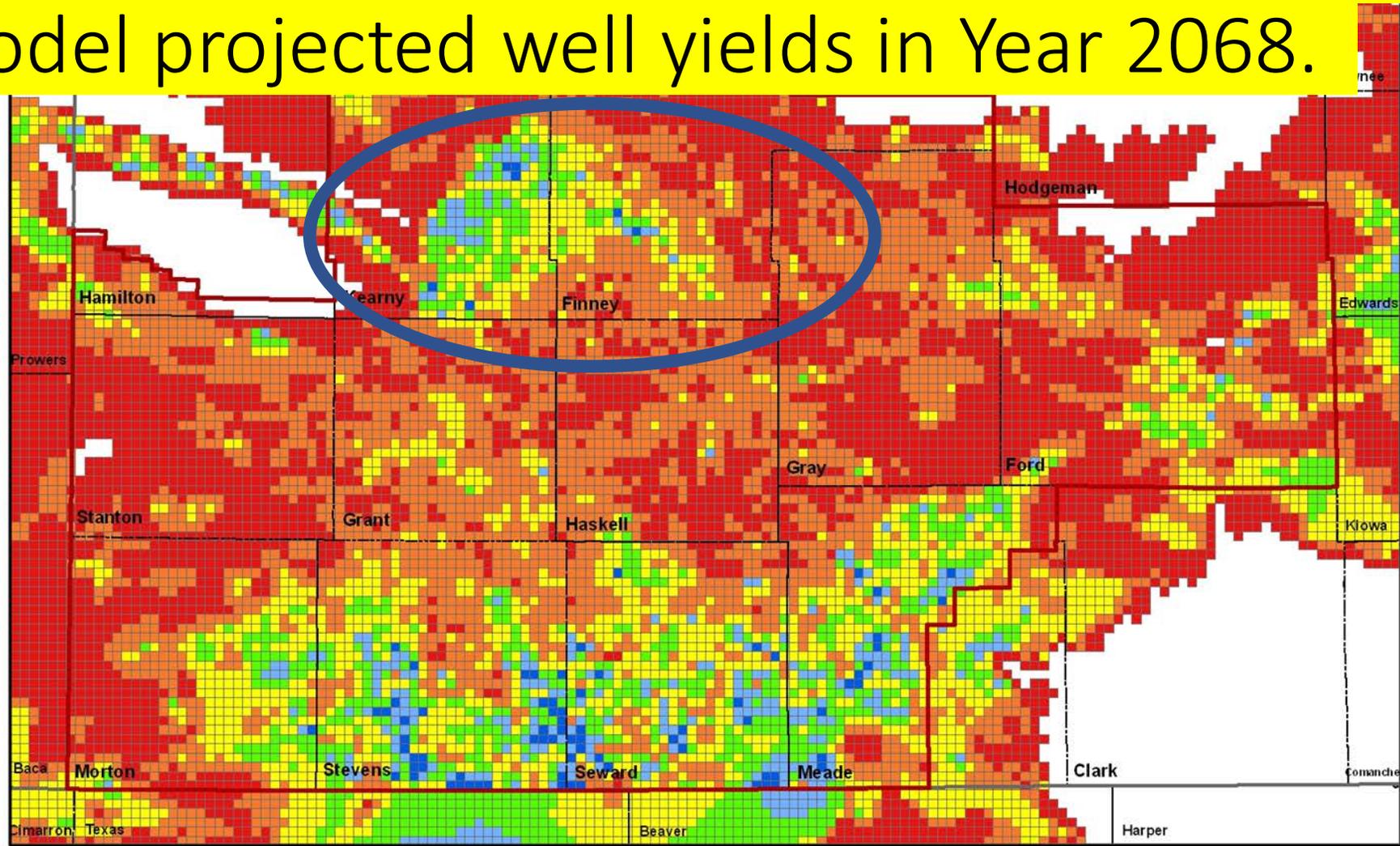
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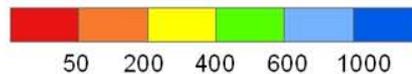
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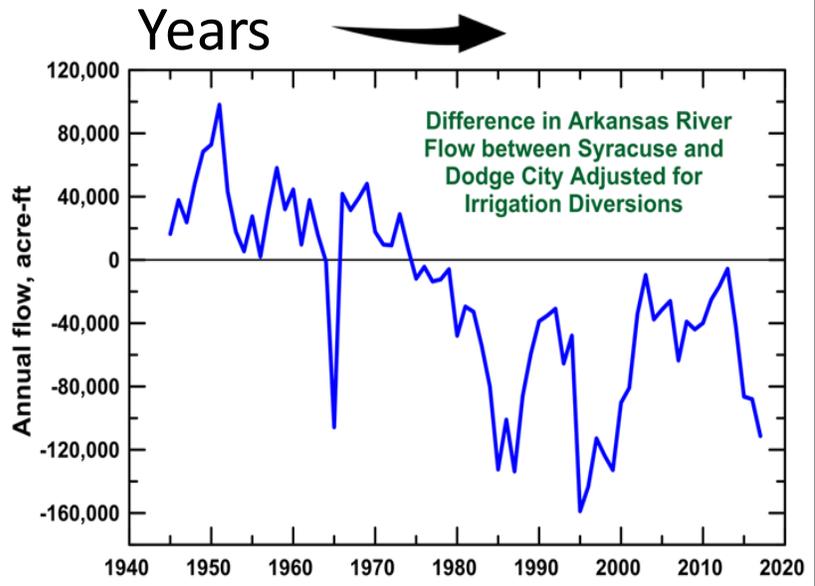
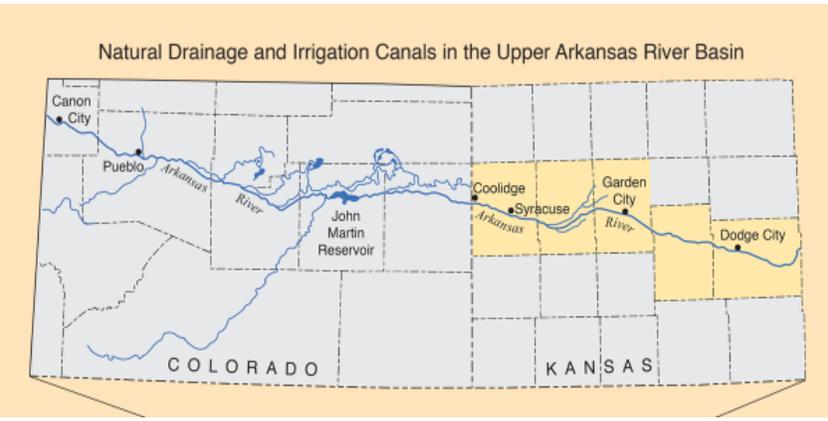
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Aquifer recharge from Ark River benefits GMD3
Model projected well yields in Year 2068.



Well Yield in GPM



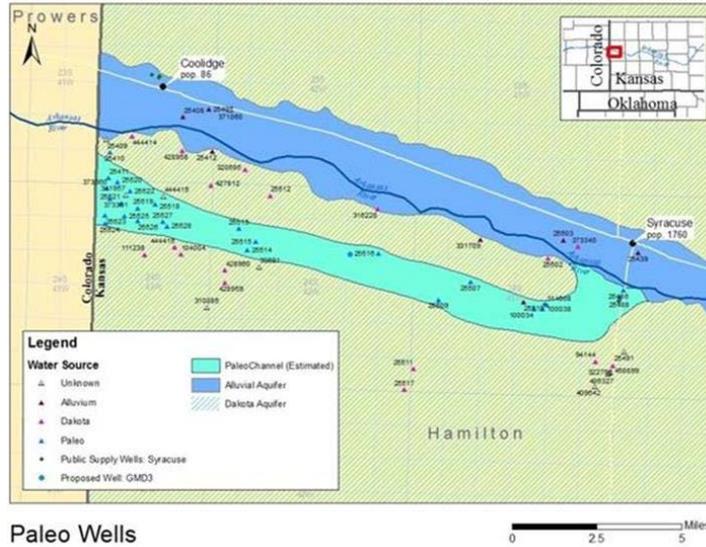
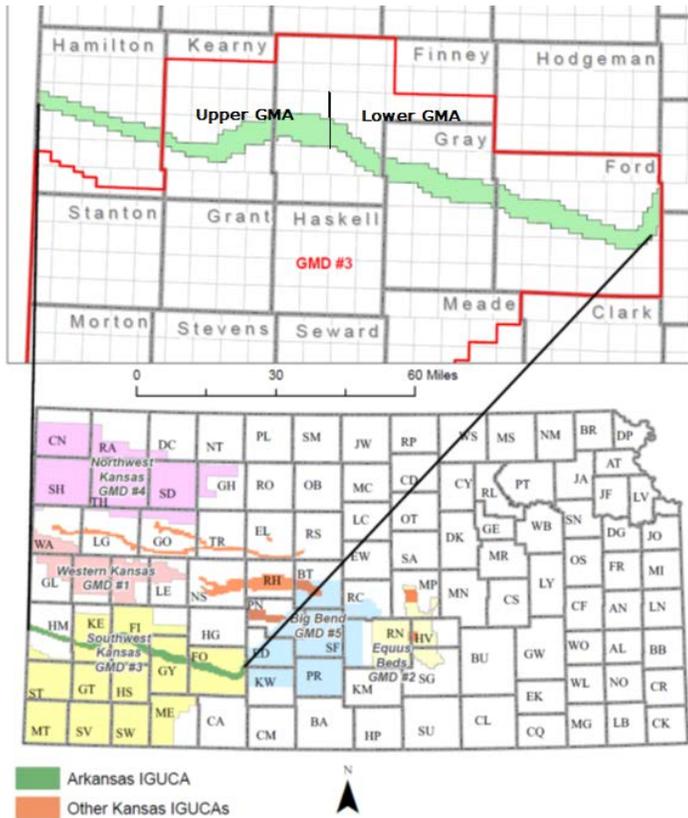


Flows enter but don't leave GMD3



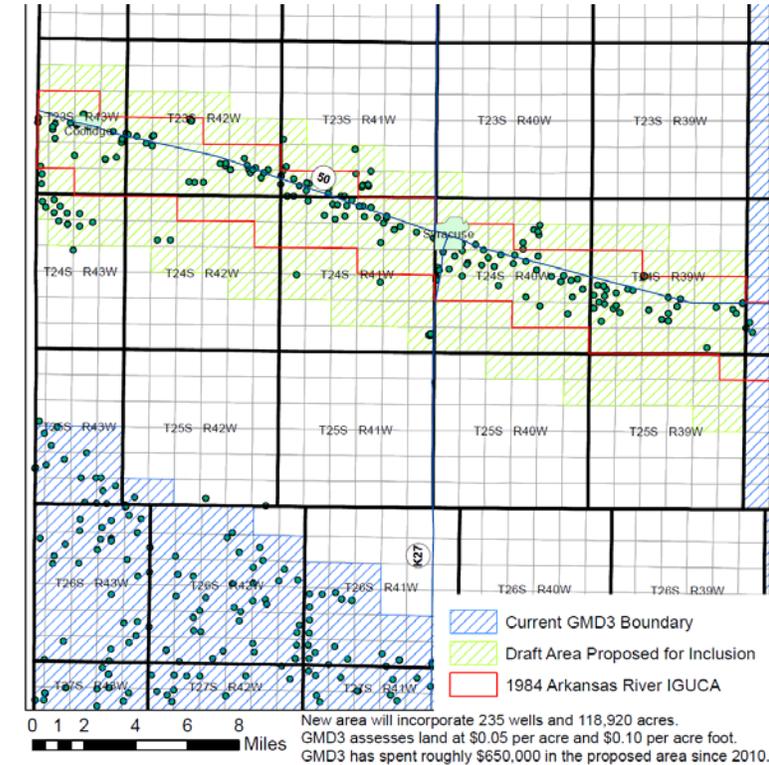
2019 - HR 6018 & SR 1729

GMD3 Ark River Management Program



Paleo Wells

Paleo river channel Aquifer.
2014 drinking water study w/KWO
and Bureau of Reclamation



New area will incorporate 235 wells and 118,920 acres.
GMD3 assesses land at \$0.05 per acre and \$0.10 per acre foot.
GMD3 has spent roughly \$650,000 in the proposed area since 2010.

GMD3 Ark River Management

**2019 Legislative Report on
GMD3 2018 Western Water Conservation Projects
Fund Grant Activity and Related Concerns**

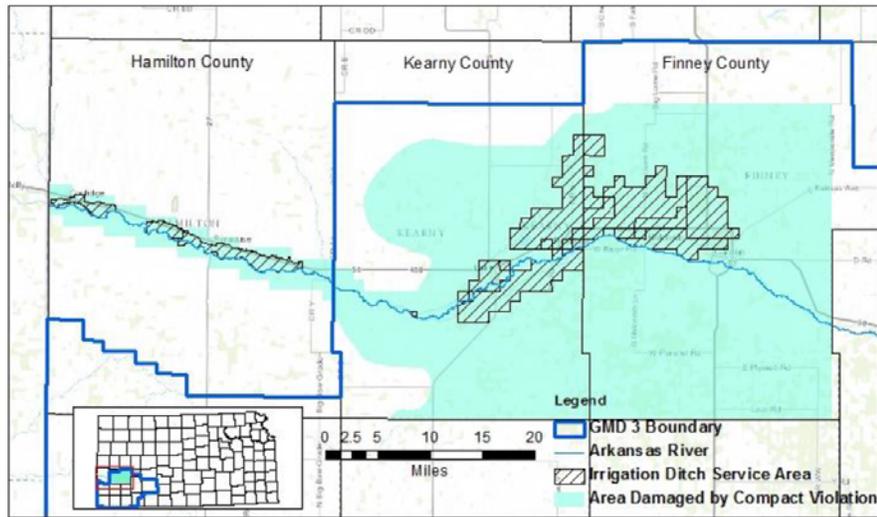
Returning a fraction of the Cash Damage Award from KS vs. CO
to the area affected.

Submitted by:

**The Southwest Kansas Groundwater Management District
Number 3 (GMD3)**

Kansas Water Office Contract Number 08-0129

This report posted at: <http://www.gmd3.org/about/special-meetings-and-committees/>



Area of locally directed WWCP Fund activity.

Financial Statement for 2018. The Western Water Conservation Projects Fund (WWCPF) of GMD3 began year 2018 with \$3,032,558.69 and ended the year with \$2,679,771.41. There were expenditures totaling \$390,004.98 and income of \$37,218. Expenditures include a 3% fiduciary and management expense of \$11,152.07 paid to GMD3. The 2018 Audit Report for GMD3 has been completed and found secured investments consistent with municipal investment law and acceptable expenditure procedures.



**Field Day at the Roth water technology farm includes bubbler nozzle efficiency.
One of two water technology farms in Finney County with support from WWCP Fund.**

GMD3 Ark River Management

For drone footage, see: https://www.youtube.com/watch?v=1fine_ZTApkQ



Aerial photography showing the river breach and transmission tower.

WARNING



Groundwater Protection Area

Groundwater in this area will
become your drinking water.

Call 9-1-1 for hazardous spills.



GMD3 Ark River Management

GMD3 draft Management Program

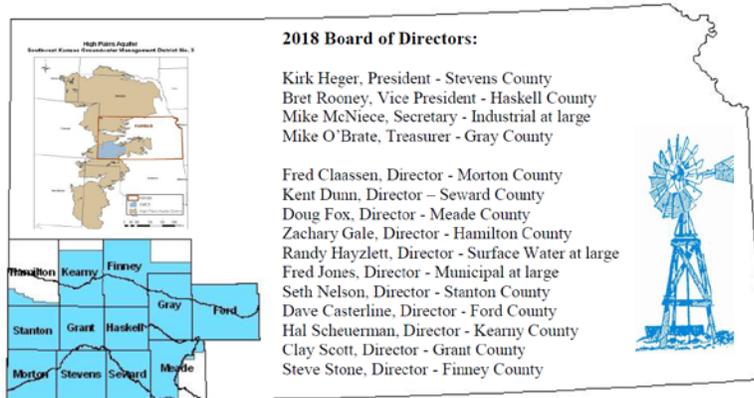
August 2019 Kansas Water Congress

The Groundwater Management Program

Southwest Kansas Groundwater Management District Number 3 (GMD3)

2009 E. Spruce Street, Garden City, Kansas 67846 (620) 275-7147
 URL: [HTTP://www.gmd3.org](http://www.gmd3.org)

All policy and opinion expressed herein are intended only as that of GMD3
 Proposed Revised (Draft to Chief Engineer), 01/16/19



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Southwest Kansas Working Aquifers – Conserving Every Day in Every Way

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GMD3 Water Conservation

- **Water Conservation.** Under the GMD3 management program, water conservation has two types of activity:
 - (1.) **Use efficiency**
 - the amount of valued output per unit of water consumed.
 - efficiency alone will not correct aquifer depletion.
 - (2.) **Maintaining aquifer storage**
 - preserves and/or replenishes future useable storage.

GMD3 Water Conservation Program



Water conservation factor described.

- **A calculation** of new conservation for new benefits.

Water conservation factor accounting.

Water conservation reporting

State mandated water conservation plans under K.S.A. 82a-733.

- Hundreds of irrigation conservation plans in GMD3 - intended to encourage type (1) efficient use water conservation.
- **Plans are not reviewed or enforced at this time.**

GMD3 Water Conservation



- **Due consideration for past management or conservation measures.**
 - K.S.A. 82a-744 was added to WAA in 2015.
 - **Opinion of GMD3** - this provision means the Chief Engineer should sit down and think about public interest considerations that include:
 - priority of right;
 - changes in groundwater use practice improvements;
 - condition of the local source of supply;
 - guidance of the management program and GMD3; and
 - **decide** how to implement the new program in the GMD3 area in a manner consistent with state law, including the management program, or any proposed revision per K.S.A. 82a-1042, which requires notice to GMD board and board action.

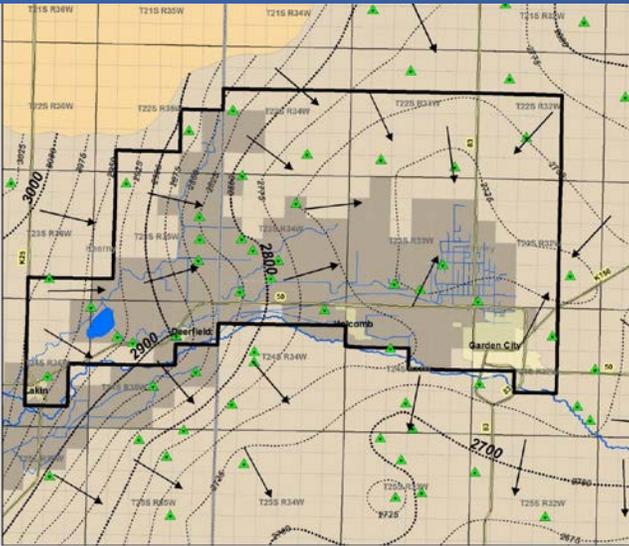
GMD3 Water Conservation



- **Corrective controls** - New action to correct water waste and/or supply decline problems.
 - Necessary in IGUCA's, LEMA's and WCA's
 - Addition to present use constraints to benefit future supply.
 - Supply problems of K.S.A.82a-1038 in the GMD Act exist across the entire GMD3 area for the OHP Aquifer that are currently perpetuated in the routine WWA water right administration decisions in the GMD3 area.
 - Enhanced water right administration – Apply Kansas data to application review to conserve and protect supply of senior rights (WAA) as a direct tool for corrective control provided to GMD's and the state.

GMD3 Water Conservation

- Local Enhanced Management Area
- **LEMA** plan option – A tool for local groundwater management leaders and the GMD3 governing body to address local groundwater quality or supply decline.



- LEMA plans proposed to the Board for adoption shall include:
 - 1) A clear groundwater management goal;
 - 2) A basis for the proposed boundaries;
 - 3) Evidenced multiple alternatives considered for **setting corrective controls** on member water rights, including use of the principle of prior appropriation;
 - 4) Reasoning for the use or rejection of alternatives;
 - 5) The recommended strategy for determining the will of the eligible voters of the district having property rights within the proposed LEMA area.
- Board also considers impacts of goals and corrective controls to evaluate effects on present and future property valuations and economy.

GMD3 Water Conservation



- **WCA's** – empowers DWR and GMD members as a voluntary conservation tool where any water right owner or group can develop a water conservation plan for consideration and agreement with the Chief Engineer and the management program under the WAA.
 - **voluntary conservation and corrective controls.**
 - **consideration** of past management and conservation
 - **goals** for corrective controls.
 - **be consistent** with the public interest,
 - including the **GMD3 management program** and governing body.
- GMD3 reviews each proposed WCA, change or extension per the GMD Act and provide recommendations to the chief engineer in a manner consistent with the norms and practices for WAA applications and the GMD3 management program.

GMD3 Water Conservation



- Legislative policy in K.S.A. 82a-745 (WCA's) assures the Chief Engineer can consider the GMD management program and board comments to guide implementation of WCA's in the district area under the GMD Act based on paragraph "(m)."



- "(m) Notwithstanding K.S.A. 82a-1039, and amendments thereto, nothing in this section shall be construed as limiting or affecting any duty or power of a groundwater management district granted to such district by the Kansas groundwater management district act."

GMD3 Water Conservation



GMD3/USDA Conservation Innovation Grant, mobile drip



Regional Conservation
Partnership Program

GMD3 \$2.4 M RCPP: advanced irrigation water mgmt.

Board of Directors of the Southwest Kansas Groundwater Management District No. 3



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