Revised Management Program

Southwest Kansas Groundwater Management District Number 3 (GMD3)

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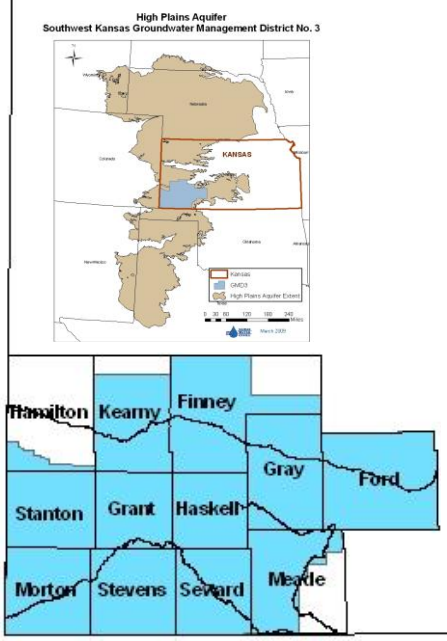
DRAFT May 2020

All policy and orderliness of thought and behavior expressed herein are proposed to be adopted for the southwest Kansas GMD3 management program to advise and assist all in management of water resources for SW Kansas. Other documents of GMD3 are posted on the website.



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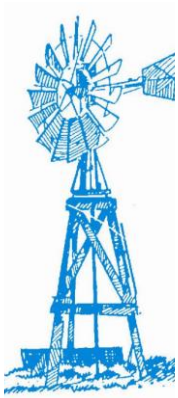

Southwest Kansas Working Water – Conserving Every Day Since 1976

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Water

GMD3 MANAGEMENT PROGRAM EXECUTIVE SUMMARY

The future of water for our communities and water values requires a management program orderliness of thought and behavior adopted locally and enforced collaboratively to secure a consistency of district water improvements and help each project manager address water risk so that together we determine our destiny regarding water use. This document presents the nature of water supply problems in Southwest Kansas and the thinking for policy and behavior adopted to address them. Revisions are included that reflect the current organizational values, extent of the district activities, changes that are consistent with how we have described the efforts of the management program and modifications that reflect the district's business practices. Implementation of this framework will ultimately enable water users, communities, government, and others to build well-performing plans and make strategic decisions and investments that achieve the vital goal of wise water use. Eight areas of program activity are reviewed with goals to protect and enhance the instrumental and intrinsic values for shared enjoyment of water resources.

Cost. Kansas water is at a premium in southwest Kansas as the driest region in the state. Investments are necessary to gain even the most basic water values in a healthy crop or a safe drink of water. Because water is so vital and unhandy, water cost is an inevitable fact of life in developing infrastructure for wise use or else suffer the lost opportunity costs. Getting more value from improving water conservation also requires investments. The investments come with elements of risk that require management attention. Physical supply realities, water regulation and the reputation of how water use is viewed by others are all elements of water risk. Southwest Kansas features some of the most fertile agricultural land in the United States. And like most western states, our area typically receives less rainfall than necessary to consistently grow the high-quality crops and animal agriculture that sustains our livelihoods and economy.

Wise decisions. Nearly three million acre-feet of developed annual withdrawal from abundant underground reservoir storage and a lack of sufficient water sources protected or developed to replenish it has created a depleting supply condition and a threatened water-based economy. At present, the annual deficit gap between consumption and replenishment for stable water levels is about 776,000 acre-feet. Significant opportunity exists to develop additional water conservation in our fields and in transient surface water annually leaving Kansas as river flow in amounts eight times what Kansas groundwater consumes each year. We must choose the pathways to our water supply legacy with reasoned foresight, reliable information, and responsible water governance. This can be difficult without good state government partners.

Challenges. The challenges we face from a declining water supply and water risk in decisions affecting our businesses and community livelihoods have exposed the shortcomings of a state legal regime largely beholden to the assumption that prior rights to use permanently declining water supply and new proposals to restore pumping capacity do not raise significant concerns for impairment of members prior rights and the public interest of the management program for southwest Kansas. The governing body of the Southwest Kansas GMD3 recommends a more dependable and informative hydrologic community review of water use proposals for state decisions based upon the best evidence available at the time of review to provide the information members need to make wise decisions affecting their livelihoods according to their values prior to state final action or expanding a regulatory state.

PURPOSE FOR GROUNDWATER MANAGEMENT, SUMMARY (pages 12 – 13)

GMD3 is an independent, special-purpose, local governmental unit that exists separately from other local governments such as county, municipal, township or school districts, with substantial

administrative and fiscal independence to perform a set of governmental functions identified by the Kansas legislature. The legislature established policy where, in the public interest, it is necessary and advisable for groundwater management districts to form and adopt a local groundwater management program orderliness of thought and behavior (methods) to address the supply problems in the respective hydrologic community of interest. GMD3 works with members and partners to develop and adopt the management program consistent with legislative purposes, local needs and the public interest.

Public Interest. Under the declarations of the GMD Act (82a-1020 et seq.), the management program document and activities of the elected volunteer governing body of GMD3 (Board) are considered the local expression of public interest relative to groundwater management issues and associated endeavors. The appropriate solutions for the 12-county area of the district depend on social, economic, hydrologic and legal conditions. In more than 500 monthly meetings, the Board has identified water supply policy needs and deliberated on the methods (procedures and orderliness of thought and behavior) appropriate to address them with the assistance of other district members, professional staff, consultants, state officials and other partners.

State decision of program legality. The GMD Act requires that the Chief Engineer shall review and study the proposed district management program and, if he or she finds that it is compatible with article 7 of chapter 82a of the Kansas Statutes Annotated (Kansas Water Appropriation or KWA Act), and other state laws or policies, he or she shall approve it and notify the board of his or her action. A public hearing process is then conducted by the Board ahead of Board final adoption.

Management program modifications. The statute goes on to state that in the case of proposed modifications to a management program the Chief Engineer "*shall transmit a supplemental written report of the results of his or her study and investigation to the board, including his or her written approval or disapproval of the modified management program.*" K.S.A. 82a-1029. Then a similar process of hearing and adoption by the Board of directors occurs.

GMD3 MISSION, OBJECTIVES & PRINCIPLES – SUMMARY (pages 14 – 17)

MISSION: *Act on a shared commitment to conserve and develop water supply to grow the social, economic, and natural resources well-being of the district for current members and future generations in the public interest.*

GMD3 Water Vision. Management involves organizing water so that each member has enough and coordinating water sources, supplies and water treatment centers (and other equipment and logistics infrastructure relating to water) so that they work in the best possible way. Water use in the district occurs directly from precipitation or diverted from *waters of the state* according to water rights owned by members and established under Kansas law. For established legal purposes other than produced water associated with oil and gas exploration, water use is supervised in the district under the prescribed duties and powers of the Kansas Department of Agriculture's Chief Engineer and Division of Water Resources (KDA/DWR), assisted and advised by GMD3 to implement the groundwater management program.

GMD3 Values. Members find ways to tie their work and life to the Mission and Vision for managing water by aligning their efforts in various ways with five core values: Individual Responsibility, Fairness, Stewardship, Community, and Water risk. Different members emphasize some values more heavily than others. The public interest in the management program recognizes that incentives for conservation and wise water use may also become cultural barriers to conservation if they are not shared or otherwise adequately addressed when implementing the management program. Enforceable policy unique to the district may be

enforced by either KDA/DWR or GMD3. The GMD Act provides enumerated authority to GMD3 to advise and assist in all appropriate matters of concern to the district (K.S.A. 82a-1028(m)). GMD3 participation in review of water use proposals for state approval is "advice and assistance in the management" of groundwater in "storage" and "all other appropriate matters of concern to the district."

Economy Preservation and Development Summary (pages 36 – 39)

Water business. The business of water requires an understanding of public and private infrastructure investments and how they play a role in developing economy. We will continue work to protect river and groundwater supply for our agribusiness jobs and other area water benifits. The management program seeks planning for improving water supplies to meet current and future demands by avoiding the waste of limited stored water. Historically, management focused on reasonable project level supply without waste using water availability constraints. Demand management is best described as cost-effective strategies that assist members in managing water risk through reduced water demand. Both new development conservation and native storage conservation approaches work in tandem under this management program. Similar public resource commitments are envisioned for each approach to accept responsibility and confront water risk by engaging people on the best course of action.

Business water risk. For business to thrive, members need reasonably predictable water risks. All private and public institutions in GMD3 face four forms of water-related risk: the two physical realities of 1) water supply storage and 2) replenishment to storage; 3) regulations or lack of regulatory confidence; and 4) reputation in how their water use is viewed by the broader communities and markets. Water value at risk from those four dimensions drive development of coping strategies as land valuation declines along with declining water supply.

Water places. A thriving water-based economy must include public benefits in providing public water places that educate and elevate water awareness and water enjoyment. The management program advises regional supply systems and institutions to add public water places for improving water awareness and capacity for wise water decisions.

Looking ahead. Revisit the federal **High Plains Study** long view to year 2020 for new projections with federal assistance in using new data and economic realities to explore the new future of various water management strategies in the public interest of national food security, energy, and water.

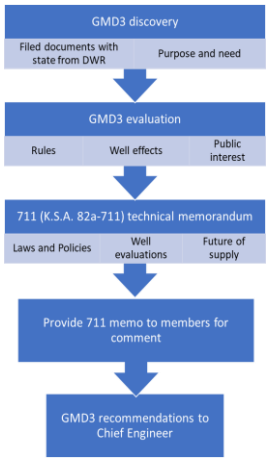
Economy Goals Summary

1. Develop evaluation projects to fulfill Kansas Water Vision additional supply section and all phases in the *ALLOW FOR THE TRANSFER OF WATER SUPPLIES BETWEEN BASINS WHERE FEASIBLE AND COST EFFECTIVE* to lower future water risk for the district and project partners.
2. Advise and assist local economic development and develop a smart device water management app.
3. Advise and assist business interests and management partners in strategy adoption to address all three elements of water risks and wise water investment.
4. Meet a portion of the agricultural supply/demand gap and seek strategies to develop water places.
5. Seek federal assistance in forward-looking updates to the “High Plains Study” purposes in identifying contemporary management elements and value investment opportunities to leverage existing natural and constructed infrastructure to add water and energy security and improve water risk.
6. Seek a systematic study and design process to capture and convert floodwater and other surface water leaving Kansas to send west to available storage before it is lost from benefiting future supply, drought resiliency, ecology and growth with lost opportunity cost projected annually to exceed $18 million.
7. Support work to provide member tools for evaluating opportunity costs and future water risk.

Water Rights Assistance Summary (pages 40 – 50)

GMD3 provides advice and assistance in fulfilling the laws, management objectives and basic use doctrines in decisions affecting member interests and the public interest. The customary employ of water use doctrines, not their mere codification, determine their meaning in practice. So, GMD3 activities that "*determine [member]destiny with respect to water use*" (K.S.A. 82a-1020) necessarily involves participation in state review for decisions affecting members. For nearly 50 years GMD3 well evaluations considered allowable groundwater appropriation under adopted constraints of maximum allowable depletion rate under policy that has evolved with new data and model tools for the district. "[A]*ll other matters pertaining to the question*" of public interest under the KWA Act (K.S.A. 82a-711(b)(5)) necessarily includes K.S.A. 82a-1020 and the GMD3 management program. GMD3 responds to KDA proposals affecting the district management program (K.S.A. 82a-1906) and approves conservation plans required by the Chief Engineer (K.S.A 82a-733). WCA's must also meet GMD3 rules and the management program (K.S.A. 82a-745(h).

GMD3 guidelines for evaluation of well drawdown estimates. Property right holders are entitled to seek injunctive relief from possible harm to their property rights. The competition that arises when the current uses and conservation of a permanently declining water supply become injured or supply starts to become unattainable is addressed in these guidelines. They include a consistent member neutral procedure adopted for well drawdown estimates that provide best evidence at the time to consider well pumping conditions found locally across the entire district. These guidelines allow all members and officials to identify and consider reasonable water table lowering and critical well conditions in a depleting supply. Evaluations for critical wells are considered 711 evaluations (K.S.A. 82a-711). The 711 evaluation is intended to advise and assist members in managing their water risk and serves to expose any objection or appeal of a proposal interposed for an improper purpose. A test period after 2017 when training was provided for DWR staff found a majority of applications met the guidelines and were recommended for approval.



Additional management considerations for advising water right decisions.

A. **Water usability depletion.** A lowering of quality, which depletes usability.
B. **Maximum allowable rate of aquifer depletion.** 40% in 25 years.
C. **Water right priority contribution**. Not claiming priority right is sharing water.
D. **Use of lesser quality water where economically and technologically feasible.**
E. **Member private property agreements in water use.** Agreements between private property right owners can be a method of resolving water supply disputes.
F. **Economy use value.** Favor use-values that grow economy and water value.
G. **Alternate supply.** Water imports or using poor quality water reclaimed to usable.
H. **Improved groundwater inventory data.** Adding data and model estimates.
I. **Flexible use of prior well allocations.** Favored for use efficiency subject to adequate evaluation to avoid adding critical well harm or water right impairment.

Water Rights Assistance Goal Summary

1. Promote free enterprise in acquiring use rights and resolving disputes over available supply.
2. Provide published guidelines for estimating well drawdown effects.
3. Achieve full consideration of the management program and board recommendations by state officials in the conduct of their duties involving the district groundwater resources.
3. Use Conserve-to-preserve accounting in use of "due consideration" and WCA policy.
4. Further define the bottom of local source of supply aquifers across the district.
5. Advise and assist review of water use proposals with best evidence available to identify critical well concerns, lesser quality water options and water risk ahead one generation (25 years).
6. No penalty for member water conservation.
7. Exchange expert evaluations and information among members, partners and GMD3.
8. Seek mutual benefits and good will between members.
9. Encourage investment confidence and intervene as needed to inform and protect public interest.

Water Conservation Activities Summary (pages 51 – 66)

Wise use. Water conservation is not so much about prohibiting or defeating consumption as wise water use.

Water Conservation recognized as two types: Type (1) Use efficiency, which is the amount of valued output per unit of water diverted. And, Type (2) Maintaining aquifer storage, which involves less native storage depletion and more put back replenishment for a net increase in future supply. In other words, action for demand reduction and water imports.

Unwise use and waste of water. Increase efforts to discourage unwise use as groundwater depletes. Wasteful practices or contamination of water stocks prejudicially and unreasonably affect the public interest and considered not consistent with the management program.

Conserve-to-preserve factor. Used in quantifying and reporting Type (2) water conservation, the conserve-to-preserve factor quantifies the result of an act to preserve future supply. It requires a separation of inevitable "no supply" non-use from "preserved supply" non-use to add future supply.

Groundwater Exploration and Protection (GE&P) Act. GMD3 will work with KDHE and other partners implementing the GE&P Act for safe lawful well drilling, data collection and water protection from contamination and wasteful water usability depletion.

Drought resiliency. The management program provides a GMD3 area Drought Resiliency Program based on the stored nature of district water supply available for drought response.

State mandated water conservation plans. Water conservation under Kansas Water Office water conservation plan guidelines focus on type (1) conservation for use efficiency defined as: "*The utilization of cost-effective water use efficiency practices to curtail the waste of water and to ensure that water use does not exceed reasonable needs.*" Many members have state mandated conservation plans as a condition of water use where GMD3 can provide advice and assistance.

Due consideration for past management or conservation measures. Statewide legislative policy in the KWA Act (K.S.A. 82a-744) requires "due consideration" to implemented management and conservation measures when the Chief Engineer implements new water right limits on a member.

Rivers flow to groundwater storage. GMD will work to protect and enhance flood and other river flows for Type (2) conservation; recognizing supply inflow preservation doesn't just happen.

Conservation storage in underground pore space. As waters of the state are declared a public good that is dedicated to the use of the people of the state subject to appropriation (K.S.A. 82a-702), aquifer pore space in geological formations with either natural or artificial recharge potential is a necessary consideration under the public good of groundwater management.

Groundwater conservation preparation for water imports. Available surface water flow in excess of prior rights presents opportunity to conserve rather than waste transient surface water. GMD3 will work to develop and organize new capture and water transportation projects utilizing available groundwater reservoir storage for more sustainable drought resiliency.

Additional wells vs. supplemental wells and "chasing water." Additional wells may be necessary to allow a partial sale and change of water right use. Adding depletion capacity in shared declining aquifer supplies raises concerns for causing a disproportionate local rate of groundwater depletion, anti-Type 2 water conservation locally and a **"chasing water"** to eventual complete depletion of supply to all. Well testing guidelines will be developed for testing wells and aquifers. A "**standby well"** is a water source security condition under the terms and limits on a lawful primary well, should catastrophic failure occur. A standby well should: 1) meet well spacing from other domestic and primary non-domestic wells; 2)be limited to 60 days of emergency pumping, and 3) be exempt from spacing to its primary well.

Targeting designated Groundwater Management Areas (GMA). Management activity to accomplish special private, corporate or governance purposes uses uniquely targeted tools.

GMD3 Upper Arkansas River IGUCA. The Upper Arkansas River IGUCA was requested by the GMD3 Board in 1984 as a GMA replacement of the requested 1977 moratorium on new appropriations. GMD3 will seek to advise and assist in each IGUCA review.

Corrective control. A corrective control is a type (2) conservation action to add future supply.
GMD3 LEMA plans. GMD3 staff assist members and partners in developing LEMA plan proposals to be recommended to the GMD3 Board for adoption as a priority GMA with infrastructure development and corrective controls requested for acceptance by the Chief Engineer.
Adopting or changing WCA plans and agreements. GMD3 will encourage Type (2) water conservation corrective controls in a Water Conservation Area (WCA) and avoid adding impairment risk to other member wells not part of WCA agreements to implement member water risk mitigation strategies and protect property rights and the management program public interest.
Multi-well use flexibility in GMD3. Multi-well use flexibility allows a "stacking" of existing allocations from other wells onto preferred source wells for more water use. Even when certain changes to local well limits have a zero-sum net effect constraint for participating wells, more well use may create water risk to non-participating member wells in declining supply conditions. Well evaluation guidelines provide a water conservation component to limit "**paper water**" on poor wells (incapable of providing the water) from moving to better wells (a concept termed "**chasing water**") with a tool to demonstrate no hardship to well capital investments and protect voluntary water conservation. Guidelines can expose when objection may be interposed for any improper purpose.

Water Conservation Goal Summary

1. Assist all members in evaluating and adapt their existing and proposed water use systems to meet their water supply and risk management needs with feedback on use compared to similar projects.
2. Develop new annual conserve-to-preserve calculation and recording tools.
3. Advise and assist KDHE in implementing the groundwater exploration protection (GE&P) Act.
4. Support Type (1) and emphasize Type (2) water conservation.
5. A conserve-to-preserve calculation be used as an option implementing the MYFA past conservation alternate calculation and seek update legislation allowing recent appropriations to participate.
6. Evaluate Master Water Manager pilot project to promote the EMAWC (page 53) activity and be an extension of ongoing demonstration programs in the Ogallala High Plains (OHP) Aquifer.
7. Develop policy to advise and assist "due consideration" of past conservation per K.S.A. 82a-744.
8. Protect and enhance surface water flow infrastructure to secure and enhance Type (2) conservation.
9. Maximize conservation storage of surface water and develop criteria for any necessary easements to use aquifer pore space in rock formations under private ownership.
10. Distinguish additional wells for dividing property vs. supplemental wells for more depletion rate.
11. Have standby well: 1) meet well spacing from other domestic and primary non-domestic wells; 2) be limited to 60 days of emergency pumping, and 3) be exempt from spacing to its primary well.
12. Participate to advise and assist in each IGUCA review or revision.
13. Define corrective controls as new type (2) water conservation that add future groundwater supply.
14. Encourage LEMA plan proposals recommended by members that further manage supply with infrastructure development and other corrective controls.
15. Emphasize the need for Type (2) water conservation corrective controls in each voluntary WCA.
16. Investigate, develop and update GMD3 water conservation plan guidelines for type (2) conservation.
17. Evaluate WCA multi-well use flexibility wells for members to determine if type (2) conservation will occur without risk of adding unmitigated critical well concerns to supply of prior rights.
18. Apply GMD3 well evaluation guidelines to: 1) manage the stacking of "paper water" from poor wells onto better wells; 2) protect past Type (2) water conservation; and 3) limit new hardship and risk.
19. Encourage policy development to allow conditional appropriation of waters otherwise lost to Kansas for conservation storage or enhanced management. A strategy of intra-state surface water interbasin transfers, importing water into the High Plains Region in accordance with State Water Planning.
20. Seek 2016 Legislative Session HB 2059 conference committee addition to the KWA Act.
21. Develop testing guidelines for additional wells in GMD3 declining aquifer areas.

Ark River Management Summary (pages 67 – 74)

The management program includes concerns of the Arkansas (Ark) River natural and constructed water infrastructure and supply. Authority for GMD3 Ark River Management activities are included in the right declared in the GMD Act and the list of district powers in K.S.A. 82a-1028 in paragraphs (g), (i), (m), (n) and (u).

GMD3 Upper Ark GMA. The portion of the basin above Garden City to the Colorado and Kansas Stateline that includes the IGUCA, ditch service areas, Hamilton County paleo river channel and tributary underflow affecting supply to GMD3 is considered the GMD3 Upper Ark Groundwater Management Area (GMA) under the management program.

GMD3 Lower Ark GMA. The Ark river reach from the Garden City river gage to the east Ford County line and adjacent areas of the IGUCA and tributary system is the GMD3 lower Ark GMA.

Resource crisis from water usability depletion. Mounting water quantity and usable basin supply decline shared with Colorado includes very low-quality river water directly used or deep percolating and contaminating GMD3 groundwater. Water contamination reduces its usability, reducing crop yields and creating drinking water public health and welfare concerns.

Managing for pre-compact water right supply. Existing vested rights (pre-1945) and pre-compact (pre-1949) water rights in the GMD3 lower Ark GMA below Garden City are authorized over 200 cubic feet per second (CFS). GMD will continue use of a 200 CFS at Garden City and flow at Dodge City administrative threshold practice to advise and assist management of river flow supply to members in the GMD3 Upper and Lower Ark GMAs during wet river conditions for type (2) conservation, ecological, recreation and other river services to advise interstate supply and reservoir spill administration.

River navigability for title. Title of the bed and banks of the Arkansas River up to the "normal high water mark" was granted to Kansas from the federal government at statehood, but with obvious effect on any use of "normal high-water mark" measure of property boundary used in other continuous flowing navigable streams. This measure assumes no alteration by man's activity, which has occurred extensively in the basin and along the normally dry or intermittent Ark River. One cannot manage what is not defined.

Managing GMD3 Ark River GMA's for conservation storage. Records indicate the GMD3 Ark river system can inflow to groundwater storage space about 200,000 acre-feet per month in the district. So, big opportunity exists to supply natural storage infrastructure and provide ecology restoration in the Ark River GMA's with basin imports and enhanced conjunctive surface and groundwater management.

Local leadership. The 2008 Kansas Legislature provided the Western Water Conservation Projects Fund (WWCPF, more than $9 million) to GMD3 fiduciary care to protect the purpose of public funds from legislative budget sweeps, creating an efficient tool implementing Fund purposes. GMD3 will continue the successful program in seeking funding for additional activities outside the general fund to maintain the purposes of the WWCP Fund and advisory committee and implementing the management program.

Ark River Goal Summary

1. Further consider adding Hamilton County Ark River lands to the district managed area.
2. Seek federal and basin states assistance to encourage steps to augment Ark river basin supply shortages and mitigate usability depletion from contaminated river inflows.
3. Continue a 200 CFS measurement at Garden City and flow at Dodge City as the threshold practice for pre-compact rights are satisfied to advise river basin operations for members in the GMD3 Upper and Lower Ark GMAs, including during wet river conditions and reservoir spills.
4. Propose river management boundaries with assistance of management program partners.
5. Develop the natural storage and ecology restoration opportunities across the Ark River GMA's.
6. Continue pursuing funding options for river projects outside the general fund to extend purposes and success of the Western Water Conservation Projects Fund and advisory committee.
7. Develop water user needs of the state Ark River interstate team and compact administration.
8. Grow river management activity to enhance natural and ditch area infrastructure use and value.
9. Evaluate ongoing Colorado groundwater development in the Southern High Plains Hydrologic Unit and connectivity to Stateline flow.
10. Develop proof-of-concept projects to advise and assist implementing the management program.

State Water Planning Coordination Summary (pages 76 – 79)

GMD3 identifies water planning, funding needs and program development and seeks other local, state and federal partners for coordinated advice and assistance. This must include activity in state water planning that supports both state long term goals (K.S.A. 82a-927) and goals of the management program. Members pay over three times the amount paid to run the district activity annually through various state fees into the State Water Plan Fund. Expenditures of the State Water Plan Fund can utilize performance-based budgeting to aid in implementing the management program.

State Water Planning Goal Summary

1. Per K.S.A.82a-928(p), GMD3 will seek encouragement and partnerships with the Kansas Water Office, Water Authority and their Regional Advisory Committees (RAC's) to meet the needs of the management program and have it recognized in the State Water Plan.
2. Advocate to update the long-term goals and objectives of the legislature, state water plan and district management program funded by a 1/10 cent sales tax dedicated source of funding.
3. Work with RAC members and advisors across the state to enhance understanding of any differing perspectives of common long-term water supply interests and concerns.
4. Work with legislative and other partners to enhance understanding to achieve a consistent and informed perspective on proper GMD Act implementation.
5. Build partnerships for statewide water transfer systems and cost/risk analysis.
6. Advocate for an interstate water management assistance fund for needed study information to inform interstate water partnerships affecting Kansas future water supplies for all time.
7. Provide annual state water plan project requests and funding needs to the KWO & KWA.
8. Seek planning and funding support commensurate with funding paid into the Water Plan Fund.
9. Advise and assist in improvements to the Water Plan Fund budgeting process that produces equitable response to program and budget requests needed to implement the management program from GMD3 annual requests. (e.g. July 22, 2019 letter and spreadsheet at: http://gmd3.org/pdf/State_Water_Plan_FY2021_Budget.pdf)
10. Planning to call excess reservoir future use storage into service to meet basin needs and conservation transport to streams and underground storage, maximizing Kansas water storage.
11. Develop district focused conservation plan guidelines and accounting tools.

Interstate Water Management Assistance Summary (pages 80 – 81)

GMD3 invests resources to meet member needs from interstate supply and the management program. Communicating a fact-based mutually beneficial approach will provide system improvements and good will to all basin and aquifer stakeholders and advise and assist government officials in the respective states.

Interstate Water Goal Summary

1. Advise and assist in fulfilling the 2019 legislative resolutions for improved interstate water quality.
2. Develop preferred supply protection policy and practices for the Ark River and paleo-river aquifer, Cimarron River alluvial aquifer and OHP Aquifer systems.
3. Advise and assist sister state water administration directly and through members and partners.
4. Seek establishment of a Kansas interstate water management account to aid interstate management and communicating of renewable supply needs.
5. Provide leadership seeking a multi-year and multi-state cooperative marketing development study.
6. Seek equitable balance in developing new interstate water management tools and agreements.
7. Advise implementation of Public Law 90-537 to include GMD3 needs as the Secretary of the Interior conducts investigations to plan for future western US water needs and reports to congress.

Models, Research and Development Summary (pages 82 - 86)

Groundwater management requires specialized calculations and models for evaluating effects of well pumping and conservation at local and regional scales. New effort is advisable to update analytical and numeric models for use in informative common-sense application of statute and enforceable policy in GMD3, including use of "Guidelines for the Assessment of Well Drawdown Estimates for Water Right Application processing" posted at GMD3.org.

Models, R & D Goals Summary

1. Update GMD3 area Ogallala/High Plains Aquifer model with a graphics user interface tool.
2. Support partner R&D for tools to help members evaluate opportunities in variable local renewable-energy to power flex-scheduled water treatment and ammonia fertilizer production.
3. Work with partners to provide water use feedback and conservation reporting.
4. Collect additional data on hydrology, member testholes and water conservation data.
5. Develop and update economic models and other water value economic tools.
6. Research Water marketing and transfer projects for conservation and importation of supply.
7. Develop practical programs that advise and assist members to optimize their wise water use.
8. Develop GMD3 RCPP participation for enhanced irrigation water management.

Water Quality Protection Assistance Summary (pages 87 – 88)

Water quality is both a water usability interest and a public health, safety and welfare concern for members. GMD3 will work to efficiently advise and assist other local, state and federal partners to meet the policy, data, water usability protection and remediation needs of southwest Kansas. Surface land interests and the activities of the management program seek to protect district water quality while minimizing interference in the infrastructure construction and land use involving water resources, drainage, mining, river system and flood plain management.

Water Quality Goal Summary

1. Evaluate Permian saltwater movement data and update enforceable rule policy as needed in the GMD3 chloride management area.
2. Assist and advise KDHE bureau of water partners for proper governance of injection & water wells, public water supplies, permitting & compliance input, and watershed management benefits consistent with the management program.
3. Evaluate water treatment technologies of low-quality and reuse water sources for potential agriculture supply and other value benefits, working with Reclamation and other partners.
4. Evaluate the extent of old well drainage from upper fresh aquifers into deep brackish formations, working with KCC, KGS and other partners.
5. Support efforts of county sanitarians to protect drinking water supply sources.
6. Identify appropriate sanctions for unlicensed and unlawful well construction and use.
7. Evaluate the needs of district members to access a water quality sampling network or drinking water wells and evaluation service.
8. Work to see the district aquifer contamination from tons of uranium delivered by Ark River flows from Colorado lowered significantly.

The end of the GMD3 Management Program Executive Summary.
Access the full document at http://www.gmd3.org/what-we-do/management-program/
or contact the GMD3 office.

SOUTHWEST KANSAS MANAGEMENT PROGRAM

I. PURPOSE FOR LOCAL GROUNDWATER MANAGEMENT

Southwest Kansas runs on water. Water is a great connector in that everyone uses it and relies on its availability. It has always been the key resource for the prosperity of all. There are other resources which may mean the difference between wealth and poverty, such as oil and gas or fertile soil, but none is like water as a fundamental necessity for our existence and nearly all other economic development. Groundwater is the states principal reserve of fresh water and represents much of its potential future water supply. Abundant groundwater, technology advancements and energy supply in southwest Kansas historically provided opportunity for extensive development through private investment in infrastructure. Business demand for water flourished. When groundwater levels responded in decline, local wisdom for use and management of groundwater soon became state policy to allow the will of local servant leadership to consider and adopt an orderliness of thought and behavior to address water supply concerns with cooperation and assistance from many partners. Ultimately, all water supply depends on precipitation, storage and transport to valued beneficial uses. Heavy drafts on the underground reservoirs without recharging or parking sufficient replacement supply has sustained a depleting supply condition and a threatened economy. The challenges associated with water risk has pushed stakeholders and policymakers to further integrate groundwater and surface water strategies in supply projects across Kansas. Examples include Kansas River Aquifer modeling, Wichita Aquifer Storage & Recovery activities, Rattlesnake Creek augmentation for Quivira National Wildlife Refuge, the Cities of Hays and Russell groundwater transfer project, and the upper Arkansas River basin *water usability depletion* problem. There is hope in significant remaining storage and the existence of importable additional supply using new technology with digital approaches to water management and marketing strategies. The future economy of Kansas depends on the planning and brave actions from servant leadership at all levels, including the Board of GMD3 to update and implement the district management program.

Formal local advice and assistance. Kansas water planning recognized in 1958 (Cimarron basin study) a need for organized local groundwater management activity to work with the centralized administration of state water resources. A lead from local need approach appeared necessary and advisable in dealing with the differing social, economic, climate and hydrological communities of interest for groundwater across Kansas. Formal local groundwater policy development and review today occurs through the GMD3 to provide the essential advice and assistance in coordinated water related decision-making that fully considers the local methods for addressing water problems. State administration of water in Kansas is mainly divided among four state agencies: Division of Water Resources of the Kansas Department of Agriculture (DWR) with responsibilities for water appropriation, water rights and structures; Bureau of Water of the Kansas Department of Health and Environment (KDHE) with responsibilities for protecting Kansas's land, water, and air from pollution; the Kansas Corporation Commission with responsibilities for oil and gas activity and Wholesale water supply; and the Kansas Water Office and Water Authority (KWO/KWA) with duties of water planning, State Water Plan Storage and Water Assurance from federal reservoirs. Regional Advisory Committees (RAC's) have been formed by practice of the KWO/KWA for their purposes. Other state agencies have a lesser but important role in state water administration that include: the Kansas Biological Survey (KBS); the Kansas Department of Wildlife, Parks and Tourism; the Kansas Geological Survey; Kansas State University Research and Extension; the KDA

Division of Conservation; the Secretary of State, the Attorney General's Office and the Kansas Department of Commerce.

Necessity of local groundwater government. Rapid private development and extensive state granting of groundwater use rights without local advice and requested rules during the 1950s and 60s demonstrated a public interest need for organized local assistance to state water officials to provide a management program orderliness of thought and behavior adopted and funded locally. The state legislature identified several purposes for groundwater management districts that include advisable public decisions affecting economy and managed water use that consider the conservation of groundwater resources, the prevention of economic deterioration, associated endeavors within the state of Kansas through the stabilization of agriculture and to secure for Kansas the benefit of its fertile soils and favorable location with respect to national and world markets. To get this going, the legislature provided authority to GMD's to adopt and enforce local groundwater policy. However, this local control right was modified by the legislature in 1999 to favor coordinated and transparent rulemaking by the chief engineer and GMD's using the duties and powers granted to state officials.

Groundwater governance can be difficult for many reasons that include:

1. groundwater is a shared resource.
2. groundwater inflows and outflows are difficult to observe and cannot be measured directly.
3. surface water and groundwater are interconnected.
4. groundwater reservoir boundaries and characteristics may be locally unknown or poorly defined.
5. groundwater management requires specialized model tools.
6. groundwater conditions can vary on multiple time scales.
7. groundwater use can pit present needs against future needs; especially in declining groundwater reservoir supply.
8. diverse local, state and federal interests, institutions and authorities require significant coordination activity for productive partnerships.

II. GMD3 MISSION, OBJECTIVES & PRINCIPLES

MISSION: Act on a shared commitment to conserve and develop water supply to grow the social, economic and natural resources well-being of current members and future generations in the public interest.

Water

GMD3 Water Vision. Good water management involves organizing water so that each present and future member has enough and coordinating water sources, supplies and water treatment centers (and other equipment and logistics infrastructure relating to water) so that they work in the best possible way. As a general principle, equity abhors waste, and delights to restrain it. This demand to discourage unwise water use increases as supplies dwindle and management information becomes more readily available. Innovation and digital technologies are delivering help in meaningful ways. In the western states that include Kansas, water is so scarce and the possible beneficial uses thereof so great, that allegations of waste will, as time goes on, be more and more strictly construed against those who may be guilty. But historically, losses from less efficient use that returned to a hydrological system may be part of another person's supply. Under the doctrine of beneficial use, all water use must be for a beneficial purpose and tied to a reasonable need without waste. Wasteful or inflated use reported as part of annual water use reporting is not to function as a water reservation right. The dedication of

waters of the state for beneficial use by the people of Kansas so that the highest public benefit and maximum economical development is a goal of the management program.

Groundwater depletion. By the late 1960's, the legislature had become concerned with the groundwater "mining" (depletion) conditions of Kansas groundwater reservoirs and passed legislation in 1968 to enable the creation of groundwater management districts. When this legislation produced no GMD's, the legislature enacted the GMD Act of 1972. This Act deemed that in addition to water appropriation for beneficial use as a public good, it is also a public good "…to preserve basic water use doctrine and to establish the right of local water users to determine their destiny with respect to the use of the groundwater…" (K.S.A.82a-1020) The GMD Act declares a public interest to allow the formation of local government groundwater management districts and stipulates the process required to form, fund and operate a GMD and adopt the management program with direction for government activities either required or eligible to be undertaken.

The GMD Act and "the right" to manage groundwater use. In that statute, the legislature set two elements of policy in law for groundwater management: *"…to preserve basic water use doctrine and <u>to establish the right of local water users to determine their destiny with respect to the use of the groundwater</u> insofar as it does not conflict with the basic laws and policies of the state of Kansas."* The GMD Act establishes "the right" as a noun. According to Black's Law Dictionary, 6th addition, pg. 1324, "*Right … As a noun, and taken in a concrete sense, a power, privilege, faculty, or demand, inherent in one person and incident upon another."* In practice since 1999 when the legislature removed local authority to adopt and enforce policy independent of state officials, the right has only had legal effect confined to what unelected state agency officials may allow under discretionary powers.

Members. A GMD3 member is an eligible voter described in K.S.A. 82a-1021(a)(5). most domestic well users in the district annually use at least one acre-foot (325,851 gallons) of groundwater and therefore considered eligible voters of the district. A person must be a member of the District to be eligible to serve on the governing body of the District.

Local Groundwater Government. GMD3 and the management program is intended to express the local public interest and goals addressing water risk and public policy with a consistency of thought and behavior that results in achieving the purposes for the local government unit. For example, this document is not intended to interfere with the lawful exercise of water rights by limiting any right to change the characteristics of water rights or by limiting any right to enroll in statutorily authorized management tools such as multi-year flex accounts (MYFA) and water conservation areas (WCA) as explicitly provisioned in Kansas law. Instead, this document provides a local hydrological community orientation and orderliness of thought and behavior adopted to advise and assist members and the duties of state water officials in the fulfillment of water laws and policies for local groundwater management purposes. The governing body (Board) of GMD3 continues the work of the local hydrologic community to adapt the district orderliness of thought and behavior in building from more than 45 years of formal local action and practices to secure the blessings of water supply. Accordingly, this document serves as a written report of the characteristics of the district and the nature and orderliness of thought and behavior (methods) for dealing with groundwater supply problems in southwest Kansas. The contents of this document have no direct regulatory effect, but rather it describes the district area, goals, current practices and strategies to manage groundwater use

in the district. Moreover, this guidance document is not intended and should not be interpreted to limit any actions undertaken by GMD3 or options that may be considered or adopted by the governing body in future proceedings. This document can and will be modified over time as warranted. Additional documentation of program tools, planning coordination, program guidelines, strategic agreements and partner grant assistance will also be publicly considered. The GMD3 right to recommend district rule reform to the Chief Engineer under the Kansas Water Appropriation (KWA) Act, or to other state officials as needed will be further considered by the governing body of GMD3 upon completion of the public hearing to adopt the management program revision. (K.S.A. 82a-1029) The orderliness of the GMD Act is for management program revision prior to the adoption of any needed rule changes to implement it.

Intrinsic Values that guide the management program. People are inspired by a mission/vision worthy of their contributions. Members of GMD3 find ways to tie their work and life to that worthy mission and vision in alignment with community core values. GMD3 core values are exhibited in the members approach to wise water use and incentives for groundwater conservation by balancing between five competing water values (adapted from S Lauer, Social Aspects of Groundwater Conservation):

- Individual Responsibility - members desire the ability to make their own water project decisions based on what they believe is best for their operations and families
- Fairness - members desire that the benefits and sacrifices involved in water management are equitably distributed.
- Stewardship - members desire to preserve the benefits of groundwater for future generations.
- Community - members desire to have good relationships with their neighbors and to have functioning towns with schools, hospitals, churches, and businesses.
- Water risk – members recognize water risk is a basic part of their property, their estates, their homes, family farms, and water dependent projects.

Different members emphasize some values more heavily than others. The public interest in the management program recognizes that incentives for conservation may also become cultural barriers to conservation if they are not shared or sufficiently addressed in the implementation of the management program. The Fear factor of *water risk* is addressed further in the Economic Preservation and Development Activities section of this document.

Expressed Powers. To conduct the affairs of groundwater management as a public agency, GMD3 must have a management program, source of funding, regular meetings of the elected Board and members, respond to proposed management program change from state officials, and exercise a list of powers (K.S.A. 82a-1028) that include:

1. provide advice and assistance in the management of drainage problems, storage, groundwater recharge, surface water management, <u>and all other appropriate matters of concern to the district.</u>
2. construct and operate works for drainage, recharge, storage, distribution or importation of water <u>and all other appropriate facilities of concern to the district.</u>
3. contract with persons, firms, or agencies of state or federal governments or private entities.
4. conduct or participate in research and demonstration projects.
5. sue and be sued.
6. maintain equip, staff and an office.

7. extend or reduce district boundaries.
8. hold and sell certain property and water rights.
9. require installation and reading of meters or gauges.
10. levy groundwater user charges and land assessments, issue bonds and incur indebtedness.
11. recommend to state officials' rules and regulations necessary to implement and enforce Board policies that are not inconsistent with law, which relate to the conservation and management of groundwater within the district.
12. enforce by suitable action, administrative or otherwise, rules and regulations adopted.
13. enter upon private property for inspection purposes to determine conformance with policies.
14. seek and accept grants or other financial assistance from federal, public or private sources.
15. recommend to the Chief Engineer the initiation of proceedings to establish special groundwater management areas, including by rule, IGUCA, LEMA and WCA (other laws also apply).

Objectives of the legislature for GMDs (GMD Act):

1. Proper management of the groundwater resources of the state.
2. Conservation of groundwater resources.
3. Prevention of economic deterioration.
4. Associated endeavors within the state of Kansas through the stabilization of agriculture.
5. To secure for Kansas the benefit of its fertile soils and favorable location with respect to national and world markets.

Purposes for which GMD3 was organized in 1976:

1. To organize and develop the efforts of the entire Groundwater Management District for the proper management and conservation of its groundwater resources.
2. Provide local input into the use and management of groundwater.
3. Provide for the greatest total social and economic benefits from the development, use and management of groundwater.
4. Support research and education concerning proper water management.
5. Work cooperatively with all federal, state, and local units of government to accomplish the objectives of the district and the GMD Act and amendments thereto.

GMD3 Management Program Work Guiding Principles:

1. **Represent member interests** (eligible voters) for water management purposes.
2. **Use best data and information to manage water risk.**
3. **Protect member's** ability to make independent decisions about managing their project water supply.
4. **Protect neighbors** from infringement of their water rights.
5. **Manage conflict** to avoid litigation where possible.
6. **Encourage higher value** water uses (Type 1 conservation).
7. **Slowing and replacing groundwater depletion** (Type 2 conservation).
8. **Prefer voluntary conservation** actions over local regulations and for local regulations over state or federal regulations, except where agreed to as part of adding district imported supply.
9. **Advocate for free market mechanisms** when addressing water supply needs.
10. **Intervene as needed** to steer the course for implementing the management program.

III. ORGANIZATIONAL HISTORY OF THE DISTRICT

Lead from local need. In the 1960's, good, creative, local problem-solving folks saw that unregulated groundwater use was hastening the decline of local water supplies. As stated earlier, mandatory permitting for all non-domestic uses was not yet provisioned in Kansas law until 1978. These local leaders insisted on the adoption of mandatory standards, registration of groundwater water rights, available supply and use limits, minimum well spacing and special management area authority in their interest for protecting the health and welfare of Kansans. Good state and local action followed.

Steering committee. After local advocacy and the passage of the GMD Act occurred, a series of informational meetings were sponsored by the Southwest Kansas Irrigation Association in the fall of 1973 to determine the will of the people relative to the formation of a local groundwater management district, also commonly referred to as a GMD. As a result of these meetings a steering committee was formed to carry out the organization of the GMD according to procedures provided in the GMD Act. On December 4, 1974, the steering committee filed a declaration of intent, along with a map of the proposed district to the secretary of state, who accepted it and passed it to the Chief Engineer for certain technical determinations. On August 25, 1975, the Chief Engineer issued a report that certified the description of the lands proposed to be included in the third such special district of the State with the official name *Southwest Kansas Groundwater Management District Number three* and found that the public interest would be served by the creation of the proposed district.

Petition. The steering committee circulated a petition which was submitted to the Secretary of State for approval. The petition was approved on October 13, 1975 and was followed by an election that was held on February 24, 1976. The election resulted in 1,155 voters in favor and 230 opposed. The Secretary of State was compelled by the election results to issue a Certificate of Incorporation on March 23, 1976. The Certificate of Incorporation has been filed at each county's Register of Deeds Office that is located within the district. An organizational meeting to elect the initial Board of Directors was held in Garden City, Kansas on April 6, 1976. The second Annual Meeting was held March 23, 1977 and now all annual meetings are held on the second Wednesday of March unless appropriately changed with notice.

Governing body. GMD3 is governed by a 15-member volunteer Board of Directors that is elected by a general constituency of the qualified voters present at an annual meeting. Each county is represented on the Board by one director who must reside in that county. Accordingly, any type of "water user", as defined in K.S.A. 82a-1021(k), may be elected to serve as one of the 12 county positions. In addition, there are also 3 "at-large" Board positions that are designated to represent that single type of water usage. These "at-large" water use types include Municipal, Surface water, and Industrial use. All qualified voters of the GMD present at an annual meeting may vote on each position up for election.

District financing. GMD3 activity is financed by an annual land assessment and groundwater user fee that is levied against the landowners and water users in the district. This is accomplished through an annual budgeting process that includes a review of the GMD3 financial status, management program and draft budget for the ensuing year at the annual meeting. A public

hearing of the proposed budget and level of assessments to finance the budget is also conducted annually with notice (usually in July). For 2017 through 2020, the land assessment has been $0.05 per acre and the water withdrawal or "user" fee has been $0.14 per acre-foot. In comparison in 2020, the governing body of several other GMD's in Kansas set withdrawal fees to the maximum allowed by law of $2.00 per acre-foot to meet their program funding needs. Assessments are subject to change without updates to this management program document. For current perspective, a withdrawal fee of $0.02 per acre-foot generates about $70,000 to your local GMD3 general fund. If needed, debt funding through use of bonds is also authorized for infrastructure improvements. Groundwater User fees are generally certified to the tract of land containing the well. A verified claim of less water use may be filed annually by April 1st to alter the quantity used to calculate a parcel water user fee later that year. (K.S.A. 82a-1030) Contact the GMD3 office for any questions on district exemptions and assessments.

Eligible land for GMD3 land assessment and water appropriations for the water user fee

County	Total Assessable Acres	Assessed Acres	Excluded Acres	Wells	Authorized Acre Feet
Finney	625,637.27	624,438.81	1,198.46	1,085	581,233.00
Ford	662,719.10	662,006.70	712.40	660	200,531.00
Grant	357,715.95	357,570.35	145.60	642	328,266.00
Gray	536,554.15	536,063.78	490.37	1,303	420,880.00
Hamilton	71,209.95	71,209.95	0.00	73	40,871.00
Haskell	359,790.37	359,696.36	94.01	907	461,581.00
Kearny	449,230.77	448,767.60	463.17	494	233,298.00
Meade	399,646.59	399,449.21	197.38	553	278,636.00
Morton	481,659.65	481,414.11	245.54	307	129,058.00
Seward	381,891.63	381,566.10	325.53	501	281,904.00
Stanton	439,975.96	439,848.76	127.20	625	333,354.00
Stevens	467,219.07	467,018.89	200.18	705	383,949.00
GMD3 totals	**5,233,250.46**	**5,229,050.62**	**4,199.84**	**7,855**	**3,673,561.00**

All information from GMD3 2018 Assessment Information. Wells are those with permanent non-domestic water rights. Other uses of water may be assessed subject to board resolution. Numbers are subject to change. Completed 9-4-2018.

Gifting to the southwest Kansas community. Charitable contributions supporting the public water conservation work of GMD3 are tax-deductible under section 170(c)(1) of the federal Internal Revenue Code if made for a public purpose. This includes uncompensated private expenses incurred by elected board members in the conduct of their official duties. Partnerships with persons, foundations and other non-government organizations are welcomed and considered by the Board of GMD3.

Home office. The GMD3 office is in Garden City, Kansas. The Board conducts regular monthly business meetings on the second Wednesday of each month unless changed for cause and posted. An annual meeting of the membership and partners is held for the election of Board members on the same day as the regular March Board meeting. Public hearings are regularly conducted by the Board or conducted by others on district matters where GMD3 is a participant, to allow input on the budget, management program activities, and other pertinent public interest activities for the district. A set of bylaws has been adopted that are revised at annual meetings as necessary. All

Board of Directors meetings and any portion thereof are open to the public, except for executive session meetings, as prescribed by K.S.A. 75-4319. Committee meetings are generally of four or fewer board members and are also public meetings. Please complete a meeting notice form if you wish to be notified of Board of Directors meetings, hearings, work sessions or other open board business meetings. Notice forms may be obtained by contacting GMD3.

GMD3 working committees and advisory groups. Each year GMD3 Board members are appointed by the Board president to serve on at least one sub-committee of the governing body. Each Board committee addresses issues on an as-needed basis. The Board committees include:

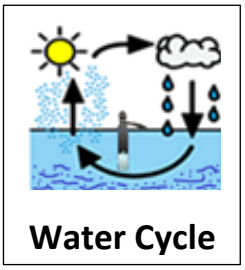
Executive
Policy and Legal
Finance
Research and Development
Renewable Supplies; and
Annual Meeting/Nominations.

In addition to formal Board committees, there are special project committees appointed or required by partner contract or other management activity. For example, the Western Water Conservation Projects Fund Advisory Committee. See: http://www.gmd3.org/about/special-meetings-and-committees/

GMD3 also works with numerous public and private member advisory groups on water management concerns. Such advisory groups contribute to and affect the implementation of the GMD3 management program and the governing body of GMD3. Example groups include:

- The Associated Ditches of Kansas
- 12 County Commissions and staff for county areas in the district
- 12 County Conservation District (CCD) Boards for county areas within GMD3 (See Conservation Districts Directory at: http://agriculture.ks.gov/docs/default-source/doc---directories/cd-directory-for-web-2013FB46A7A690AA.pdf?sfvrsn=46);
- Drainage, Watershed and Water Supply District Boards having areas within GMD3
- All classes of cities, towns and communities in the district as eligible voting members
- Upper Arkansas and Cimarron Regional Advisory Committees (RAC) in advising the Kansas Water Office and Water Authority (KWO-KWA) (see: https://kwo.ks.gov/about-the-kwo/regional-advisory-committees/upper-arkansas-regional-advisory-committee; and https://kwo.ks.gov/about-the-kwo/regional-advisory-committees/cimarron-regional-advisory-committee)
- Southwest Kansas Irrigation Association
- Kearny-Finney LEMA steering committee and other similar group initiatives
- Kansas Groundwater Management Districts Association
- Kansas Water Congress
- Kansas Aqueduct Coalition
- National Groundwater Management Districts Association
- National Water Resources Association
- State and Federal agencies with land or water rights in the district; and
- Numerous other non-government organization.

IV. CHARACTERISTICS OF THE DISTRICT



General Area Characteristics. The district area is approximately 5,338,334 acres, or approximately 8,341 square miles of land. This includes all of Morton, Stevens, Seward, Stanton, Grant, Haskell, Gray, and Ford Counties as well as parts of Meade, Finney, Kearny, and Hamilton Counties in the southwest part of Kansas and the west central part of the Great Plains region of the United State. Land surface elevations range from approximately 3500 feet above sea level (ASL) in the west to less than 2300 feet ASL in the eastern side of the district. The land surface slopes in an east-southeast direction at a gradient ranging from 5 to 20 feet per mile. The district is closed to most new appropriations from the Ogallala/High Plains (OHP) Aquifer. Projects must change existing rights to meet new use needs.

Number of counties served by GMD3	12
Number of non-domestic water rights	12,500
Authorized annual use	3.6 million acre-feet
Average annual use	1.8 million acre-feet
Average annual reduction in storage	776,000 acre-feet
Average annual recharge from precipitation	210,000 acre-feet
Estimated annual Domestic use	125,115 acre-feet (15 AF/section)
Estimated max. allowed annual use to avoid 40% depletion in 25 Years (40/25 rule)	1,732,832 acre-feet
Average net annual lateral groundwater reservoir inflow/outflow balance	+6,000 acre-feet gain
Average annual return flow recharge (13%)	234,000 acre-feet returned
Irrigation-enhanced precipitation recharge, dewatered unit drainage, inflows from Dakota system, streamflow capture.	621,625 acre-feet gained or returned to the High Plains Groundwater reservoir

See *KGS Water Level Change image* and *Isolating High Plains Aquifer Change* in Appendix. Values are GMD3 gross estimates from KGS models. Model updates will improve estimates and will be referenced as they become available. Local data will vary significantly from averages.

Physiographic Region. The district portion of the US Southern High Plains is flat to rolling cropland with only a few streams; it is the driest region of Kansas. The natural vegetation includes shortgrass prairie: blue grama, buffalograss, and scattered, isolated sites with alkali sacaton, western wheatgrass, and inland saltgrass. Wildlife includes: Pronghorn antelope, Mule and White Tail Deer, Lesser prairie chicken, Prairie rattlesnakes, Plains leopard frogs, Ornate box turtle, Spadefoot toads, and Woodhouse's toads, with significant populations of Coyote, Fox, Cotton tail rabbit, Black-tailed jackrabbit hair, Pheasant, Blue quail and Bobwhite quail. Forbs also occur such as: Three-foot-tall Sand sagebrush, Scarlet gaura, Field goosefeet, Scarlet globemallow, & Wild begonia. Forbs such as asterand and field crops are the main food source for deer and pronghorn antelope. Sandsage prairie is a smaller area of rolling sand plains laying mainly south along the Arkansas River. It is predominantly developed pivot irrigation fields and rangeland, but the historic vegetation is sand sagebrush, sand bluestem, prairie sandreed, and little bluestem.

Source Water. Precipitation is generally the lowest in the state with average annual measurements of 15 to 18 inches and as little as 4 inches (2011 Morton County). There is only one surface water reservoir in the district not sustained from groundwater pumping, which is the privately owned Lake McKinney on the Great Eastern Ditch Irrigation System. Groundwater is the primary source of water supply. The most common local source of fresh water for thousands of district wells is the Ogallala/ High Plains (OHP) Aquifer, or groundwater reservoir. The water comes from drainage of pores in the rock and sediments at or below the water table. The OHP Aquifer sedimentary rocks include saturated stream deposited alluvial sands and gravel sitting atop the unconsolidated, unconfined Ogallala Formation, older less permeable finer grained Oligocene deposits and an unconfined hydraulically connected sub-cropping Dakota Aquifer System of Dakota sandstone, Kiowa shale and Cheyanne sandstone formations, which is commonly referred together as the Dakota Aquifer System or "Dakota Aquifer." A key marker bed adopted for the GMD3 management program is the Cretaceous age black marine shale bed known as the Graneros shale. It is about 20 feet thick or less and readily identifiable in drillers logs where it exists stratigraphically atop the Dakota Aquifer system except where it sub-crops along a meandering line roughly east-west across the district and generally below the Arkansas River where the Dakota Aquifer system sub-crops directly into, and is considered part of, the OHP Aquifer locally. North of the sub-crop line, the Dakota Aquifer is considered under confined aquifer conditions and therefore a separate groundwater reservoir source from the OHP aquifer system. In comparison to the thousands of wells completed in the OHP Aquifer system, less than 100 non-domestic wells are authorized to tap into the confined Dakota Aquifer groundwater reservoir capped by the black Graneros shall formation. The characteristics of these groundwater reservoirs can vary dramatically at points throughout the district and recharge areas that extend west of the district at higher elevations in southeast Colorado. Additional development in these areas of Colorado are likely reducing Dakota Groundwater reservoir supply to GMD3 over time. New source water will be explored for use in GMD3 to aid in closing the demand-supply gap.

Water quality. The quality (or usability) of the groundwater in the OHP and Dakota Aquifer groundwater reservoirs is generally fresh. Some areas are experiencing deteriorated water quality such as high concentrations of chloride and sulfate salts that could result in lowered crop productivity, lowered crop yield, and degraded topsoil. Electrical conductivity (EC) is used as a general measure of the chemical quality of irrigation water (see below for brief definition). Low EC measurement is generally desirable for agricultural irrigation use because it indicates a low salt content of the water. In some locations, mineralization, including radio-nuclei levels, exceed recommended limits or maximum contaminant levels (MCLs) for drinking water established by the US Environmental Protection Agency (EPA). Poor quality sources can contaminate and deplete usability of existing stored fresh water supplies. River flows are declining in both quality and quantity, and poor-quality water moving into declining fresh groundwater reservoirs further decline water usability as a supply depletion factor.

Groundwater reservoir thickness. The remaining saturated thickness of the principle OHP groundwater reservoir system ranges from 20 feet to 600 feet within the district, with significant variability in the productive portions. Thus, well capacities range from a few gallons per minute (gpm) to 3,000 gpm. Historic depletion of saturated thickness locally also varies spatially across the district as documented in the Kansas Geological Survey (KGS) High Plains Aquifer Atlas. A 2010 computer model of the GMD3 area indicates that groundwater pumping caused a nearly 30% decrease in groundwater reservoir storage from pre-development to 2007, for an average

water level decline of roughly 70 feet, which equates to roughly 10 feet of actual water removed from the poor spaces of the productive portions of the area groundwater reservoir. The resulting groundwater level declines have ended the groundwater storage discharging to most streams, resulting in low to no stream flows (2014 draft Kansas Water Plan) and conservation of remaining groundwater reservoir storage and streamflow sources of supply. The dewatered groundwater reservoir space provides available storage capacity for about 63 million acre-feet (KGS model for GMD3). Due to large portions of an aquifer formation saturated thickness having low to no practical yield to a constructed well, saturated thickness data may not provide a good indication of practical water supply. Examples exist in the district where a well located within a half mile from a productive irrigation well may struggle to provide sufficient water for domestic use. This may be analogous to a silted in surface reservoir capacity being less than originally estimated. The present GMD3 groundwater model has been found to overestimate practical supply in storage for the district. An update project is planned for 2021.

River and stream groundwater resources. The Arkansas (Ark) River flows from Colorado, into Kansas and the district. It is the only water course with constant inflow into southwest Kansas. The Ark River is highly regulated upstream of the district and all of the flows are consumed either as deliveries to fields under surface water irrigation water rights or as inflows to declining underground reservoirs in the district. Flow across the lower portion of the Ark river basin in GMD3 (also known as the GMD3 lower Ark GMA) has become a rare event as development of basin water resources in both states occurred over time. For the intermittent river and stream segments in the district, flows occur as **pulse flow** from precipitation runoff events that service alluvial aquifers and the Ogallala/High Plains groundwater reservoir as conservation storage. Pulse flows are an important and declining historical source of water supply to member water rights in the district. Managing, protecting, and enhancing river and stream pulse flows destined to become inflow to the groundwater reservoirs across the district is a vital activity of the management program for southwest Kansas.

The Ark River Basin. Headwaters of the Ark River are located in the Rocky Mountains above Leadville, Colorado. Fed by mountain tributaries on both the east and west slopes, the River supports reservoir storage, front range municipal demands and agriculture in Eastern Colorado before flowing into Kansas and the GMD3 area. Significant changes in the basin water resource system upstream have created mounting management and supply concerns all along the basin that include very low-quality river water deep percolating into the subsurface, replenishing and contaminating the groundwater. The increasing contaminated nature of the water delivered to Kansas has reduced its usability over time, reducing crop yields and creating a drinking water crisis of public health and safety.

Ark River interstate litigation history. Kansas has contended that agricultural development demands for irrigation and other use development upstream in Eastern Colorado have depleted water coming into Kansas to the extent that irreparable injury has been done, particularly to the agricultural interests in the western part of the state. The State of Kansas and Kansas ditch companies (holders of senior surface water rights) above Garden City brought suit against the State of Colorado that ended up before the United States Supreme Court several times. In the first half of the last century, two actions brought before the United States Supreme Court were resolved in Colorado's favor. The two states formed the Arkansas River Compact in 1948 in an effort to resolve ongoing disputes over water, particularly after the federal construction of the John Martin Reservoir in Colorado in 1946. A key purpose of the Arkansas River Compact was to resolve water disputes between Kansas and Colorado and divide the waters of the Arkansas River

basin. The minimum standard concept of agreement is to preserve status quo delivery to Kansas in "usable Stateline flows" as of 1948. Pueblo and Trinidad Reservoirs were built after the compact agreement. As a result of a 1985 Kansas complaint accepted by the Supreme Court and two decades later, Colorado was found to have violated the compact by unlawfully withholding over 400,000 acre-feet (325,851 gal. per acre-foot) of water due to well development and unreplaced pumping in the basin after 1948. Settlement and damage awards of over $34 million occurred in 2006. Nothing concerning the administration of the compact or settlement agreements have addressed water quality to date. Colorado contends the compact is a water quantity agreement only. Local Kansans disagree.

GMD3 Ark River. There are six surface water irrigation ditch systems today that have historically diverted water from the Arkansas River between the Colorado-Kansas Stateline and Garden City. Collectively, these irrigation ditch companies owned by farmer-shareholders control approximately 140,000 acre-feet of senior surface water rights from available Arkansas River flows governed by a federal court decree, vested rights, and an interstate river basin compact. Surface water rights historically developed below Garden City have lost historical supply flows and now rarely receive any river flow for use. Lands below Garden City historically irrigated from surface water years ago now rely on groundwater sources or may not receive any water except for the rare large river pulse event. The GMD3 management program has adopted historical practices for management of flows at the Garden City river gage and management program activities for both above and below the gage as the GMD3 Upper and Lower Ark GMA's respectively. Additional geohydrology information can be found at: http://www.kgs.ku.edu/Hydro/UARC/index.html

Interstate compacts. Both the Arkansas River and the Cimarron River sub-basin water systems (including Crooked Creek) are associated with interstate compact agreements that are both state and federal law. Each establishes an interstate administrative body with water management purposes consistent with the authorities established by each compact agreement. See compacts map in Appendix.

Colorado and Kansas Arkansas River Compact. The 1948 Colorado and Kansas Arkansas River Compact relates to the waters of the Arkansas River drainage basin primarily above Dodge City to apportion the benefits of John Martin Reservoir and to protect the usability of the basin Stateline flows available at the time of the compact. The compact is administered by an interstate administrative agency called the Colorado-Kansas Arkansas River Compact Administration (ARCA). More information is available at: https://www.co-ks-arkansasrivercompactadmin.org/

Kansas and Oklahoma Arkansas River Compact. The 1966 Kansas and Oklahoma Arkansas River Compact limits new conservation storage capacity or water transfer amounts for each state in six major topographic sub-basins tributary to the Arkansas River basin from Wichita, Kansas to the confluence with the Arkansas River Mainstem in Oklahoma that together span the entire southern border of Kansas. The Cimarron River sub-basin, that includes Crooked Creek drainage, directly relates to the district as an upstream area. The compact also pledges cooperation between the states in man-made pollution abatements. The Kansas – Oklahoma Arkansas River Commission is the interstate administrative agency that operates this compact, and more information can be found online at: https://agriculture.ks.gov/divisions-programs/dwr/interstate-rivers-and-compacts/kansas-oklahoma-arkansas-river-compact.

Cimarron River Basin. Natural pulse flows from precipitation runoff events are identified historically in in the hydrologic record and literature. These pulse flows should be protected and

managed under the management program to assure continued groundwater recharge as an important renewable supply to GMD3 member water rights. The exception is about a 20-mile reach of the Cimarron River below Highway 54 east of Liberal, Kansas, where the river normally has base flow primarily from upper Permian natural salt springs as flow leaves the district and the state after crossing southeast Seward and Meade counties. Cimarron River flows entering Kansas in Morton County and exiting Kansas from Meade County have decreased in quantity and quality over time. Cimarron River water entering Kansas has high sulfate concentration, whereas Cimarron River flow in southern Meade County has high chloride concentration. River salinity in Morton County has increased and in Meade County has increased substantially over time. Decreased flow of the river entering Morton County is likely mainly due to irrigation use in Colorado, Oklahoma, and New Mexico, although phreatophyte water consumption could contribute. Decreased flow and increased salinity of the river in Meade County is mainly from declining discharge of fresh ground water from the High Plains groundwater reservoir that dilutes discharge of natural saline water from Permian bedrock, with some impact from phreatophyte water consumption. More geohydrology information on the Cimarron basin can be found at: http://www.kgs.ku.edu/Hydro/Publications/2005/OFR05_26/OFR2005_26.pdf
And http://www.kgs.ku.edu/Hydro/Publications/2005/OFR05_27/index.html

Pawnee River Basin. Portions of the headwaters of tributaries to the Pawnee River system are in eastern Finney, northeastern Gray, and northern Ford Counties of GMD3. Some spring discharge from the base of thin Ogallala deposits and precipitation runoff events provide public recreation and other services at Horse Thief Reservoir on Buckner Creek in Hodgeman County and other surface structures in the basin. A portion of Hodgeman County was originally included in the district. Controversy over water flowmeters mandated by the governing body of GMD3 drove an organized objection and request in that area to leave the district. The GMD3 Board agreed to an exclusion petition that resulted in the loss of district services in Hodgeman County. The alluvial groundwater reservoirs of these headwaters contain some water supply locally. However, projected yields are too small to be a significant water source to meet district demands for water.

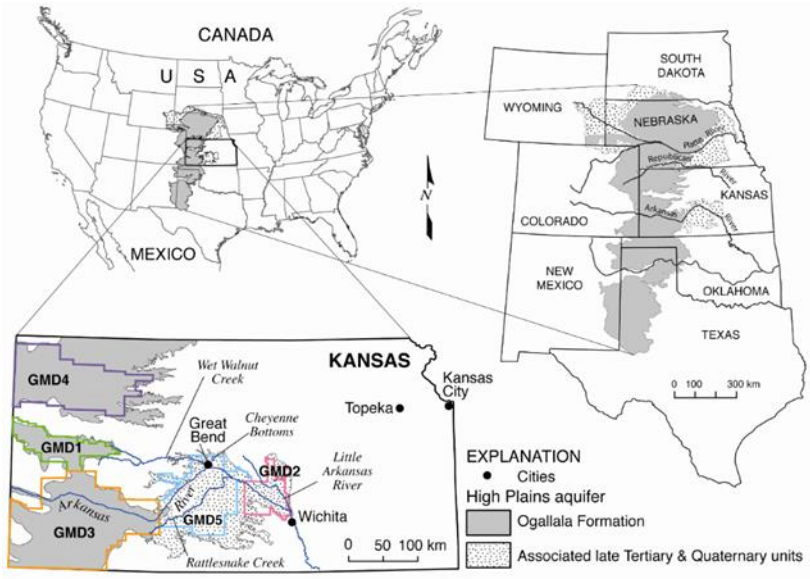
Water supply decline. The OHP falls in wet years, and it falls in drought years. For the district OHP groundwater reservoir, the maximum allowable rate of depletion adopted for the district has been a maximum allowable 40% in 25 years if all authorized use occurs. Recent figures from the GMD3 groundwater model indicate an overall decline in supply in excess of 30% since pre-development (50 years) conditions. However, that estimate is considered short of actual depletion based on observed well yield declines and discrepancies in the estimate to be improved under the area groundwater model update scheduled for 2021. The district area is generally blessed with available good quality groundwater and has some of the highest-intensity groundwater use areas in the country. Total annual use in GMD3 nears half of all groundwater use in Kansas. When combined with low groundwater recharge from rainfall and inflow from outside the district, The gap between consumption demand and replenishment supply has created a deficit of about 776,000 acre feet and large declines in water storage that will not recover nor sustain present use levels without new sources of water. Though declining, the OHP groundwater reservoir remains the most productive agriculture region for Kansas. Technology improvements adopted for use efficiency add value to the supply and maintain the economy as the inevitable lessening of water use from supply decline occurs.

Domestic water supply. Domestic water supply is a management concern in GMD3 as most domestic uses are not quantified or reported in the district and care is needed in review of other

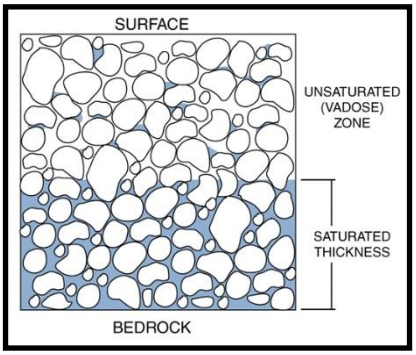
use proposals to consider domestic appropriation rights. Domestic use amounts are factored into models is estimated as an averaged 15 acre-feet annually per square mile but can vary locally.

Public water supply. In Kansas, a public water supply system is defined in law by K.S.A. 65-162a and by regulation in K.A.R. 28-15a-2 as a "*system for delivery to the public of piped water for human consumption that has at least 10 service connections or regularly serves at least 25 individuals daily at least 60 days out of the year*." These systems are regulated by the state to assure the citizenry safe and pathogen-free drinking water and are comprised of water intakes, wells, and water treatment facilities. Groundwater sources supply all drinking water in southwest Kansas. The Kansas Department of Health and Environment (KDHE) oversees 68 public water supply systems in GMD3 that include municipalities, rural water districts, and privately-owned public water supply systems. If drinking water is supplied by a private water company, the Kansas Corporation Commission supervises the rates charged. There are 242 active and emergency public supply wells within the boundaries of GMD3. These wells serve anywhere from a small community of 10 or more homes to the largest cities of Garden City, Dodge City and Liberal.

Ogallala/High Plains Aquifer Characteristics.



Some hydrological question persists as to where the bottom of the Ogallala/High Plains (OHP) Aquifer exists under the adopted administrative definition that includes all formations in hydrological contact with the Ogallala Aquifer. Generally, the OHP Aquifer is a series of groundwater reservoirs consisting mainly of a widely varying assortment of sand, gravel, silt, and clay of Tertiary and Quaternary age eroded off the Rocky Mountains that were deposited by sluggish streams that flowed eastward across what became the High Plains region of the central US. Unlike the illustration of the unsaturated and saturated zones below, the groundwater reservoir sediments can differ in particle size and hydrological qualities vertically and laterally over very short distances. These rock units overlie an eroded bedrock surface of Permian and Cretaceous age. The Tertiary Ogallala Formation makes up the main part of the OHP groundwater reservoir. The Ogallala Formation is a coarse-grained unit that is highly productive from certain water-saturated intervals. The oldest part of the Miocene Ogallala Formation in Kansas is ~ 12 million years old. The older Oligocene deposits (a.k.a. White River Group/High Plains Aquifer, 26 million years or older) are finer grained than the Ogallala, not nearly as productive for water and roughly coincide with the area of the thickest Tertiary deposits in SW Kansas. They also coincide with the area of the greatest water-



level declines (from KGS). Because of the similarity in composition, the older Tertiary sediments are difficult to distinguish from the younger Quaternary sediments. Many recent maps can be found in the Kansas Geological Survey High Plains Aquifer Atlas, at: http://www.kgs.ku.edu/HighPlains/HPA_Atlas/

Groundwater reservoir variability. The OHP groundwater reservoir in the district varies widely in type of material, thickness, and layer continuity. Even beneath a single section of land, well yields can range from tens of gallons per minute to thousands of gallons per minute. Individual rock beds generally are not continuous and within short distances may grade laterally or vertically into material of different composition and yield to a well. Hydraulic conductivity and specific yield depend on sediment types and therefore also vary widely both vertically and laterally that create hydrologic boundary effects when wells are pumped. Some layers are cemented and are referred to as mortar beds (looks like cement) and caliche (white chalky rock). Although the groundwater reservoir is generally unconfined, confined and semi-confined conditions may occur locally. Thick shale layers are present in areas of the OHP groundwater reservoir where significant saturated formation thickness may only provide small amounts of water to wells and the density of established wells is very low.

Groundwater reservoir thickness. The thickness of the unconsolidated sediments of the OHP groundwater reservoir system varies greatly due mostly to the uneven bottom of the set of formations considered hydrologically connected. An estimated 63 million acre-feet of groundwater reservoir poor space has been mined or drained of water since pre-development. Remaining saturated thickness ranges from zero to more than 500 feet as illustrated in the Kansas High Plains Aquifer Atlas (Kansas Geological Survey 2016). The areas of greatest thickness are found in the southern portions of Stevens, Seward, and Meade Counties. From the adopted definition of the OHP Aquifer, any hydrologically connected bedrock formations are considered part of the OHP reservoir, so more index well study can help answer where the bottom of the OHP Aquifer system is and how deep members should be allowed to go in relocating wells.

Groundwater rate-of-travel. Regional lateral flow of groundwater is generally from west to east-southeast across the district at an average rate of about 1 foot per day or less under the normal regional tilt in the static water table. Early recharge rate studies found a similar vertical rate of descent to the water table. Locally, a higher rate of groundwater flow can be estimated where there is a greater slope in the water table, especially during local well pumping drawdown effects. Groundwater travel rates can be significantly affected where water level gradient is increased near a pumping well and flow can exceed 300 feet per day (KGS) where sufficient conditions allow. Reduction of aquifer saturated thickness over time indiscriminately deprives wells of pumping capacity as needed saturated thickness is reduced by groundwater reservoir depletion. Depth to static water elevation from the land surface is highly variable and may now exceed 400 feet.

Rivers flow to groundwater storage. All surface water flowing into or across the district is targeted and destined to become one of three uses: direct beneficial use; evaporative loss; or groundwater reservoir storage in the pore spaces of the soils and geological formations of the GMD3 area. In some parts of the district, such as the Arkansas and Cimarron River corridors, the OHP Aquifer is hydraulically connected to overlying river alluvium (river sands and sediment) and the water table is below the surface or bed of the river, causing a downward gravity flow from surface water to groundwater. For water quality purposes, Kansas Administrative Regulations

(K.A.R.) broadly define groundwater as "water located under the surface of the land that is or can be the source of supply for wells, springs, or seeps, or that is held in groundwater reservoirs or the soil profile" (K.A.R. 28-16-28b(dd)). For water quantity purposes, Kansas regulations simply say "groundwater" means "water below the surface of the earth" (K.A.R. 5-1-1(ii)). Given that no water is truly static and can move both directions above and below the surface of the earth, it is useful in water rights administration to consider residency time as a measure of what may be considered a groundwater vs. surface water source of supply and whether that residency is managed or induced by mechanical means and other management activities to augment groundwater depletion. Surface water may be groundwater on its way to storage below the surface of the earth as a management program expectation and modeled water systems function.

Bedrock Aquifer Characteristics

Dakota. The Dakota Aquifer system is comprised of sandstones and shale that typically yield much smaller amounts than the yield of wells in the Ogallala groundwater reservoir. The Dakota groundwater reservoir underlies and is in hydraulic connection with the OHP groundwater reservoir in much of the southern part of GMD3. In western Stanton, western Morton, and southern Hamilton counties, the OHP groundwater reservoir is absent or is very thinly saturated and the Dakota groundwater reservoir (with some Morrison-Dockum strata contributing in Stanton and Morton counties) is the primary shallow groundwater reservoir. Additional Dakota groundwater reservoir information can be found at: http://www.kgs.ku.edu/Dakota/vol3/ofr961a/man02.htm.

In the northern part of the district, low permeability shale and chalk overlie and hydraulically isolate the Dakota groundwater reservoir from the overlying OHP groundwater reservoir. Some wells in northern Finney County may be completed in geologic voids in the Niobrara Chalk formation and are referred to as crack wells that typically produce a good amount of water until the crack or void is dewatered. For additional geologic information on groundwater formations above the Dakota, see: http://www.kgs.ku.edu/Dakota/vol3/ofr961a/man03.htm In the southernmost part of the district, Cretaceous age formations may be absent where Permian bedrock formations directly underlie the Ogallala and associated formations. For groundwater management purposes, OHP Aquifer formations include all hydrologically connected formations where hydrostatic pressures are similar and demonstrate connectivity. For more information and additional study needs, see: http://www.kgs.ku.edu/Publications/Bulletins/IRR8/05_deve.html

Morrison-Dockum. The Morrison-Dockum Formations are a distinctive sequence of Upper Jurassic Morrison and Late Triassic Dockum sedimentary formations that provide some water supply in the district that may be included as part of the OHP groundwater reservoir system where hydrostatically connected in the subsurface. They are generally composed of mudstone, sandstone, siltstone and limestone and is light gray, greenish gray, or red. The lower sandstones of the Morrison are relics of the rivers and floodplains of the Jurassic period.

Permian. The Upper Permian age red beds may contain sandstones with some usable groundwater locally and may also have water quality concerns that require careful water sample evaluation, monitoring and supervision to prevent water usability depletion of fresher groundwater supplies. Further investigation of potential uses of Permian age groundwater reservoir water for irrigation can be expensive, and some geological testing and completion of deep wells for irrigation have occurred as shallower sources become depleted and oil and gas

production tests indicate some limited deeper water sources are available. Efforts to evaluate the usability, reliability, and feasibility of these potential sources together with newer technologies to treat poor quality water from marginal sources to usable standards are necessary as part of the district development and management of additional supply.

Deep brackish bedrock groundwater reservoirs. KWA Act requires poor quality appropriation first, where feasible. Kansas regulations require the petroleum industry to protect fresh and usable groundwater reservoirs from contamination by confirming minimum depths for surface casing in a petroleum exploration borehole. Concern exists for old wells established early when surface casing depths were short or not fully cemented from top to bottom and may allow usable fresh water from an upper formation to flow uncontrolled to a deeper formation or vice versa. Partnerships with Kansas Corporation Commission and the petroleum industry may help protect groundwater reservoirs that become usable groundwater sources through advancements in technology for water treatment. Kansas law requires the state to put a priority on use of poor quality where feasible ahead of authorizing fresh water sources. The successful implementation of this policy may require adoption of criteria under the management program.

Precipitation recharge. The climate of southwestern Kansas is semiarid, characterized by moderate precipitation, low humidity, and high evaporation. Annual precipitation increases to the east across the district and typically ranges from 16 to 24 inches annual average. Most of the precipitation falls generally during the growing season, April through September annual pan evaporation rates are about 68 inches. Drought conditions can yield as little as 4 inches of annual rainfall in the southwest corner (2012). Potential sources of natural groundwater reservoir recharge include precipitation during wet years, inflows of surface water deep percolating into storage, return flow from irrigation use, lateral groundwater flow, and flow from adjacent groundwater reservoirs of varying quality. The most effective recharge from rain occurs on clean residue covered soils where ET, runoff and direct evaporation are minimized.

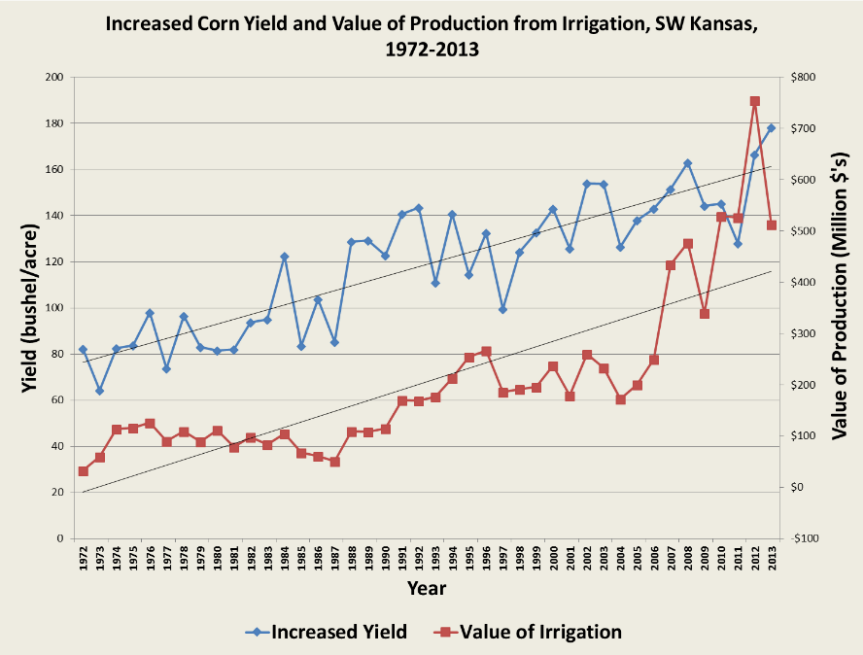
Managed recharge. Early experiments near Lakin, Kansas and elsewhere in the decade of the 70's in response to interest at the time to develop feasible methods of artificially recharging area groundwater reservoirs (Bulletin 20, Ks. Water Resources Board, 1977). Those studies concluded that utilization of surface runoff or imported water to recharge by water-spreading techniques would be feasible if water was made available. Managed natural and engineered techniques to enhance the recharge process hold promise for improving water supply for the district. Local natural recharge rates are affected by evaporation, soil properties, land cover, land use and proximity to sources of recharge water. Natural replenishment estimates are low, typically less than one inch of water annually. Generally, one inch of water fills about 6 to 8 inches or more of groundwater reservoir formation to saturation, depending on the size and connectivity of sediment pore spaces. Recharge rates may be higher locally, such as beneath river and ditch flows, fully irrigated land and through sandy soils. The overall imbalance between water use and recharge rates absent alternate imported supply is projected to cause billions of dollars in future lost economy. Recent estimates from the Kansas Geological Survey indicate about 776,000 acre-feet net groundwater storage loss occurs annually on average. Managed groundwater reservoir recharge can occur through protecting and enhancing natural surface water infiltration processes that refill pore spaces. Existing historical sources that recharge groundwater reservoir supply must be protected and managed collaboratively as critical infrastructure of the management program. Managed recharge can be enhanced with artificial constructed infrastructure projects that may

include infiltration basins, infiltration galleries, vadose zone infiltration wells or groundwater reservoir injection wells. Decline in surface water inflows to the district and a lack of additional sources of surface water deliverable to storage greatly limits this activity in solving the 776k district water supply gap. GMD3 will target key recharge water sources and inflow areas for protecting and enhancing groundwater reservoir inflows.

Weather modification. The GMD3 management program has historically provided support for a Western Kansas Weather Modification Program (originally "**Muddy Roads**" project) to increase precipitation and reduce damaging hail loss of crops and other property that reduces value from irrigation water use. Though discontinued in Kansas and GMD3, several other regions around the country operate weather modification programs that add new studies indicating program benefits. GMD3 will monitor global activity for consideration in possible future management program activities.

Economy

Water fuels the engine of economy. In an area of the country where there is little surface water and high evaporation rate, groundwater management is an activity of water supply and economy. From the Kansas Department of Agriculture (KDA) 2016 annual report, agriculture is the largest industry, employer and economic driver in Kansas, accounting for nearly 43 percent of the state's economy and valued at more than $64 billion annually. In 2018, over $3.8 billion dollars of Kansas' agricultural goods were shipped around the globe to 74 different countries. More than 229,000 Kansans, or 12 percent of the state's workforce, are employed in agriculture. At 28.2 million acres, Kansas has the second-most cropland of any state. GMD3 member farmers and ranchers not only manage the soils for sustainable production systems but they also work to economically improve management and conservation of district water resources.



The corn standard. Corn is the most popular irrigated crop in the district according to annual water use reports collected by the Kansas Department of Agriculture. The value of irrigated corn produced in southwest Kansas was $582.77 million in 2013 and the total economic income generated by that corn was $842 million. The Net Irrigation Requirement (NIR) for corn ranges from 13.7" in Ford County to 15.4" in Morton County; this is in addition to the average precipitation of 19 inches (K.A.R. 5-5-12, NIR at 50% chance of rainfall; K.A.R. 5-6-12, Average annual precipitation). USDA irrigated corn yield average in Kansas 1972-2016 was 165 bushels per acre (average 32 million acres harvested) and non-irrigated average 1972-2016 was 46 bushels per acre (average 557 million acres harvested). If corn acres were all dryland the

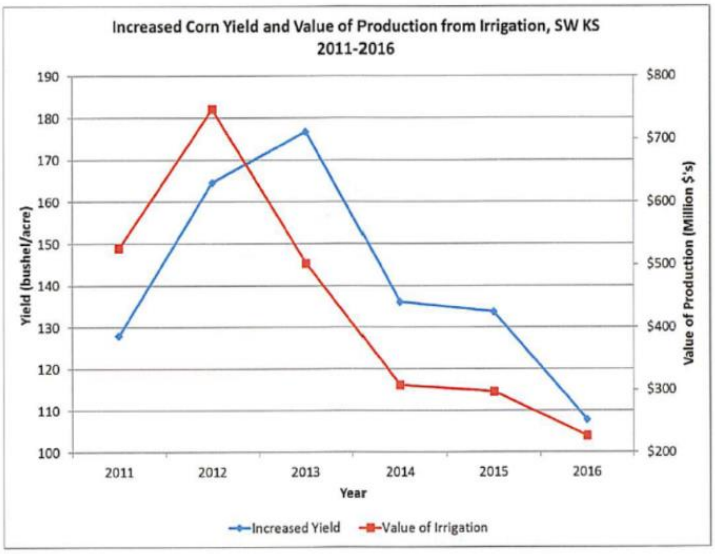
economic impact from reduced value and surety would be significant. Some years, dryland crops are lost by drought without the safety-net of irrigation.

County	No. of Farms	Farm Acres	Crop Acres	Irrigated Acres	Crop Mkt Value ($1000)	LVSTK Value ($1000)
Finney	450	790,500	679,472	186,357	181,137	641,954
Ford	505	669,832	529,171	67,068	108,771	406,481
Grant	315	358,649	304,628	82,239	80,280	733,861
Gray	422	556,070	439,359	116,874	119,343	871,310
Hamilton	353	544,086	435,412	20,481	41,273	294,387
Haskell	207	363,751	320,883	116,962	106,168	1,052,929
Kearny	299	516,230	415,995	53,209	76,465	204,513
Meade	407	587,924	331,600	93,775	90,381	143,004
Morton	323	401,305	330,988	31,969	40,054	94,760
Seward	282	360,711	263,690	95,497	80,237	344,461
Stanton	220	435,254	396,108	54,305	72,702	60,791
Stevens	377	455,494	369,963	138,437	109,942	230,624
Total	4,160	6,039,806	4,817,269	1,057,173	1,106,753	5,079,075

From USDA 2017 Farm Facts at:
https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Kansas/st20_2_0001_0001.pdf

Economy decline from irrigation decline. When commodity prices are strong, one less irrigated acre in Southwest Kansas can lead to an estimated loss to Kansas of $2,200 land resale value and 122.5 bu of corn at $6.78 = $831 and 2 cattle on feed, approximately equal to 1,060 usable pounds of meat or a 2012 wholesale value of $3,080 (assumes an average price of $2.90/lb. of beef). (KDA presentation to the Governors economic advisory council, 2013) This is an annual loss of $3,911 per irrigated acre transitioned completely to dryland. There are about 1,500,000 acres authorized for irrigation in GMD3. In the district, value added from irrigated corn and wheat production was $556,532,840 in 2013. Additional production generates income from agricultural producers and input suppliers, and this income circulates through local and state economies as a multiplier of monetized water use.

Market adjustments. In 2016 the return associated with irrigation (value of production) for corn in southwest Kansas was $226,638,720, while the return to irrigation for wheat was $17,227,200. (KDA) Combined, the increased return to irrigation from corn and wheat in southwest Kansas in 2016 was nearly $243.9 million. Considering generally accepted economic multipliers, the economic impact of this increased production was valued at almost $582.2 million. It is important to note that the value of irrigation is directly impacted by commodity crop prices and dryland yields. From 2014 onward, we have seen the combination of both declining prices and increasing dryland yields, which caused a market adjustment and reduced the return



Data from K. Liebsch, Economist, KDA, February 2018.

associated with irrigation. However, a change in either the dryland and irrigated yield spread, or the relative price would create a notable increase for the value of irrigation. This is evident in more recent year corn market driving uptake of irrigation water conservation technology and management to improve water value to irrigators.

Beef, Dairy and Animal Agriculture. Kansas ranked third nationally in numbers of cattle and calves on ranches and in feed yards in 2015 with 6 million head and second in the fed cattle market in 2014 (USDA, 2016). Revenue from cattle production grew more than 36% from 2010 to 2014, with cattle providing $7.75 billion in cash receipts in 2013 (KLA, 2016) and these number are growing. Nearly half of the state's agricultural cash receipts in 2013 came from the sale of cattle and calves. Kansas ranked 16th nationally in milk production in 2015 when milk production was valued at $746 million (USDA, 2016). Animal agriculture in the district provides a significant portion of these state numbers, due to reliability of irrigated grains and forage. The district is one of the fastest growing regions for dairy production in the United States with the advantages of open spaces, favorable climate, irrigation for consistent high-quality forage, and abundant groundwater at a safe depth that separates nutrient management activity from water stocks. GMD3 is now home to the largest milk drying plant in North America, located in Garden City. Other significant animal production sectors in the district include pigs, sheep, and goats. Value increases of water use moving from irrigation to livestock is significant for the economy.

Economic analysis. Economics drives water use, water reclamation and water conservation development projects. It is a critical element of water resources planning and management activity because cost/benefit not only evaluates the economic justification of plans, but it can assist in plan formulation and choice of alternatives. Although economic analysis is traditionally performed by economists, the implications of the economic analysis (which often can dictate whether a project is implemented) make it imperative that the concepts, methods, and tools used in the economic analysis be understandable to others, including: (a) the other specialists involved in the feasibility studies, (b) management personnel in sponsoring organizations who must make a decision concerning the proposed project, and (c) the various stakeholders who are involved in the planning process and who will ultimately be affected by the project or be asked to fund it in whole or in part. For example, in Kansas water policy, a cost to benefit analysis is required in law authorizing water conservation plan guidelines developed by the Kansas Water Office.

Opportunity cost of water. Opportunity cost is a key concept in economics expressing "the basic relationship between scarcity and choice". The notion of opportunity cost plays a crucial part in attempts to ensure that scarce water resources of Kansas are used and conserved efficiently. Opportunity costs are not restricted to monetary or financial costs, and the real cost of output forgone, lost time, pleasure, water quality or any other benefit that provides water utility should also be considered an opportunity cost. The opportunity cost of water dependent products or services includes the revenue or economy that could be earned by its alternative use. In other words, opportunity cost is the cost of the next best alternative use of water.

Value of water in GMD3. Water is widely considered to be undervalued. Because there are values and costs in every water transaction seeking to use or not use water, all values and costs should be considered when valuing water. There are several factors that influence the value of GMD3 groundwater. From a 1999 Senate Bill 287 that proposed a large set of water measures came, among other things, a requirement for Kansas Water Office recommendations to address competition for water in the Ogallala Aquifer region, including GMD3, for the next 20 years. See http://www.kgs.ku.edu/General/Personnel/tw/abs/HB287_executive_summary.pdf . GMD3 acted

to advise SB 287 work and commissioned an economic study by the Docking Institute of Public Affair's in 2000 to examine through 2020 "*The economic impact of an acre-foot of water on the economy of Southwest Kansas* (2001)." See http://www.gmd3.org/pdf/ogal1.pdf This information will likely be included in an update of the 2000 value of water study planned for 2021. Third parties may suffer indirect but significant economic impacts as water supplies decline. As the farming economy declines, so will the businesses that depend on the forage and commodity production, selling tractors, seeds, and fertilizer and the banks that lend money. All the businesses that depend on these businesses are, in turn, affected. With less business activity, local governments will collect less tax revenue, causing a decline in the ability of local governments and school districts to provide services to citizens. As community life declines the area will becomes less attractive to new businesses resulting in a downward spiral of economic effects.

Damage claim example of deficient groundwater valuation. Of the many studies of the economic value of district groundwater supply, the most comparable to the Docking study example is the "Kansas' Expert Reports in Support of its Claim for Money Damages for Colorado's Violations of the Arkansas River Compact 1950-94" (1998). Using only classic cost-benefit analysis, the experts found that the value of Arkansas River water in 1998 dollars was an average $514 per acre foot for all uses (irrigation agriculture, industrial, and municipal). However, a notable deficiency of the cost-benefit analysis for groundwater occurred when experts were unable to identify present value lost for the over 400,000 acre-feet of stored groundwater found absent permanently from district groundwater storage: used to replace supply shortages of Arkansas River basin water from the Colorado portion of the basin. The missing groundwater itself was considered to have no present value as a lost future supply when projected market use values (in 50 years) were discounted back to present value. The resulting present value estimate of the sizeable missing storage was determined near zero.

The "no present value" error. An extreme supply shortage in the future should find the instrumental value of preserved water storage significantly elevated and at a premium. A "no present value" view of water in the groundwater reservoir as a stored future supply is highly counter intuitive and inconsistent with the management program at every level of government. Such an economic theory strikes at the very heart of present conservation expenditures and efforts to leave water in storage to meet higher future value demand. It implies significant waste of public investments for conservation. The recognition of this error also suggests vigilance is needed to protect against value judgements that may prejudicially and unreasonably affect the public interest. Groundwater valuation should adequately consider that storage and use have elements of both market and non-market services and product over time. Monetizing and quantifying services of groundwater and the future surface water that recharges groundwater should consider the broader natural and intrinsic values and not erroneously consider water a free good under all scenarios. If groundwater value is only measured by its production cost to meet near-term needs, the value will always appear cheap until we look at cost to replace it or we get close to depletion, for which we did not protect or replenish supply and the loss of both market and non-market values (Instrumental and intrinsic values) become evident.

Conservation cost in instrumental water value. Both private and public water conservation activities have a cost that is in addition to what can be monetized in future use value. There is opportunity cost in lost benefits when choosing a less water profit activity over another more profitable alternative. There is public cost in lower land valuation from lower profit opportunity. Cost can occur directly as public financial support and as incentives paid for water conservation

practices. Dividing the amount of water actually conserved in program participation into actual costs can provide a value of an acre foot of water left in storage for valued future use.

Usability factor in valuing water. The quality of water has a water usability factor that must be considered when assessing the value of water supply. Models used for estimating water supply and economic value rarely apply adequate assumptions to address water quality decline over time; what is referred to here as "**water usability depletion**." Water usability depletion is when value of use for historical supply is lessened or impaired by a decline in the water quality, causing a material depletion in the utility of the water. This depletion makes it necessary to increase the amount of water and incur higher costs to achieve similar value services. For example, membrane filtration water treatment necessary to remove radio-nuclei contaminants requires additional energy expense and eliminates about 15% of the water as waste permeate disposed of through injection into deep geological formations. **A water usability factor should be employed in each water project or compact risk evaluation where water quality may affect district supply.**

Energy costs in valuing water. One cost of water includes the cost of energy to divert and transport water from storage to beneficial use. Groundwater pumping in the district uses a great deal of energy just in lifting costs in order to use the groundwater. Well depths average about 300 feet of lift. Of the 12,826 authorized non-domestic wells in the district, about 8,480 are pumped annually for irrigation. If the estimated energy used by those wells is expressed in terms of electric power, the total energy required annually in the district for irrigation would be approximately 1679.04 gigawatt hours to move 2,000,000 acre-feet (Pioneer Electric Coop and state well data). Actual energy sources used include Electricity, Natural Gas, Propane, and Diesel.

Water infrastructure as an economic force multiplier. Valuing water infrastructure properly is a critical activity in water planning over multiple timeframes and with multiple partners. All water supply and use depend on both natural and constructed infrastructure. Natural water infrastructure includes precipitation, natural rivers and streams, lakes, wetlands, soils and aquifers. Constructed water infrastructure includes dams, control structures, constructed infiltration areas, wells, pumps, pipelines systems and the energy systems to move and manage water. US Reclamation estimates that for every $1 spent in Reclamation infrastructure programs, $20 of direct economic benefit and about $40 of secondary benefits occur. When a project's benefits are estimated in terms of the growth of the national economy, rather than "cost benefit" fiscal return, the true value of a project can be measured (EIR report, Pick-Sloan: The Missouri River Development Project, 2011).

Federal cost depletion allowance. Taxpayers who extract groundwater for irrigation purposes from the Ogallala Formation are allowed a federal tax deduction for depletion. This is allowed under Revised Rulings 82-214 and 65-296 under Section 611 of the Internal Revenue Code. Section 611 grants depletion allowances for natural deposits and timber which are nonreplaceable. Revised Ruling 65-296 allows a groundwater cost depletion to taxpayers who extract groundwater from the Ogallala Formation in the Southern High Plains, whereas, Revised Ruling 82-214 amplifies the previous ruling to include taxpayers who extract groundwater from areas of the Ogallala Formation other than the Southern High Plains. In computing a cost depletion, the taxpayer must be able to show the following: 1). An economic interest in certain lands overlying the Ogallala Formation from which groundwater is being extracted for irrigation of crops. 2). An appropriation permit has been issued by the State of Kansas, which grants exclusive rights to the use of the groundwater for irrigation. 3). The amount of water under said lands was established at the time of acquisition, the cost basis of water, the amount of exhaustion (water-level decline) for each of the taxable years involved, and the amount of cost depletion deduction.

V. GMD3 PROGRAM ACTIVITIES - NATURE AND METHODS

GMD3 conducts groundwater supply evaluation, local water planning, policy development, advises and assists state water administration, data collection, economic development and represents district water users and landowners in matters concerning groundwater management in the district. The Board of Directors prepares and adopts the Management Program that contains the orderliness of thought, behavior and policy locally adopted to address the groundwater related resource and economic concerns to advise and assistance members, state and federal officials, the Governor, the Legislature and Congress.

Kansas water law. It is important to know a little about Kansas water law that set the framework for enforceable policy that affects your decisions in managing water risk. The core of Kansas water law for groundwater is comprised of several Acts or bodies of law that include the Kansas Water Appropriation (KWA) Act body of water use law, the GMD Act body of groundwater management law, and the Water Exploration and Protection (WEP) Act body of well construction and groundwater protection law. These Acts and amendments, and implementing rules, are intertwined in the history of the development of the state and the western US. To gain perspective of how to proceed with managing water use going forward, it is a good idea to learn some history and basics of Kansas water law.

See: Water Primer, Part 5: Water Law, KSU, January 2013.
https://www.bookstore.ksre.ksu.edu/pubs/mf3024.pdf ; and Water Law Basics.
https://agriculture.ks.gov/divisions-programs/dwr/water-appropriation/water-law-basics

Groundwater Policy. Kansas groundwater policy provides for a locally prudent form of practices, procedures and orderliness of thought and behavior adopted in a management program and implemented collaboratively through a formal elected governing body that serves an ancillary role in Kansas water administration. In more than 500 monthly meetings, the 15-member elected volunteer Board of Directors of GMD3 has identified district water use and supply problems and considered the nature and orderliness of thought and behavior needed to address them, assisted by professional staff, consultants, state officials and other important partners in water use and management concerns. Even with the significant progress achieved, individual well yields and the number of irrigated fields have declined dramatically in many areas. Reduced pumping rates and unproductive wells are real and current events in an ever increasing area that indiscriminately and adversely impact drinking water wells, livestock feeding operations, dairies, ethanol plants, irrigation, municipal and industrial users, making it ever more difficult for them to meet demands for water. There are areas that offer hope for stable water supply and economic growth through a balanced approach to conserve native supply and develop additional sources of Kansas water.

GMD3 policy. The governing body of GMD3 adopts administrative standards and policies relating to the management of the district. (K.S.A. 82a-1029(n)) GMD3 Policy in this management program document and in Board resolutions are posted on the GMD3 website. For enforceable policies, GMD3 seeks rules and regulations or regulation reform adopted by the appropriate state official or agency as necessary to further implement the management program. (K.S.A. 82a-1029(o) & (p)) Proposed rules and regulations recommended to the official, department, commission or other agency shall be of no force and effect unless and until adopted by the state official, department, commission or other such agency.

GMD3 Economic Preservation and Development Activities

Southwest Kansas runs on water. It is said that the business of water is not one of physical shortage but, rather, one of governance. Governance is matching market demand with supply, of ensuring that there is water at the right location, and the right time of year, and at a cost that people will be able to afford and will be willing to pay for. The future of economic preservation and growth in southwest Kansas is expected to be driven by agricultural markets and the interaction between rapid technology adoption, informed water use and wise infrastructure investments that sustain member productivity. Public policy in the KWA Act has guided state water allocation for 75 years *"…to conform to the public interest to the end that the highest public benefit and maximum economical development may result from the use of such water."* (K.S.A. 82a-711) The GMD3 area is the most developed region of Kansas for water secured agribusiness. http://www.kgs.ku.edu/HighPlains/HPA_Atlas/Land%20Cover%20and%20Irrigation/index.html#Water_Rights-Percent_of_Irrigated_Acres.jpg . In response to state over-appropriation and groundwater depletion, the policy of the GMD Act for local management was added to allow local say in what rights, duties and local public interest should look like and to lead from local need for improving on the public interest.

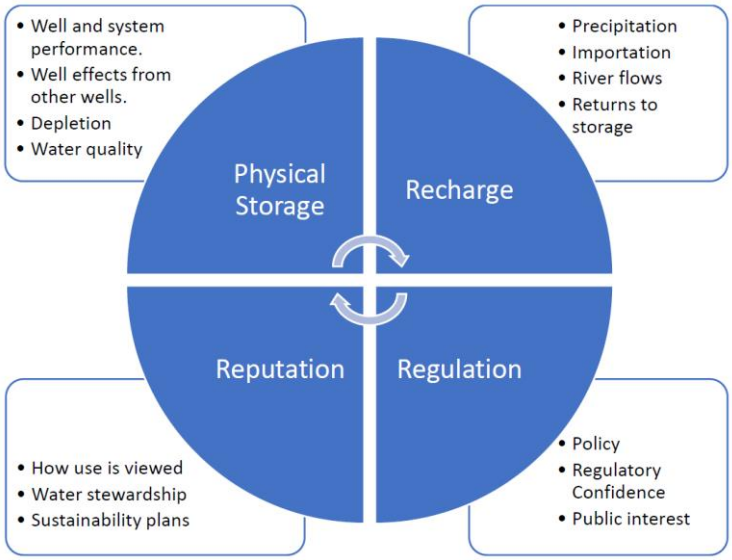
Authority. GMD3 authority for Economic Preservation & Development Activities include without limit:

- K.S.A. 82a-1020 declaring the economic preservation purposes of the GMD Act and the right of water users to determine their destiny regarding water use;
- K.S.A. 82a-1028 a local body politic and corporate with certain powers;
- K.S.A. 82a-1029 to adopt the groundwater management program for the area;
- K.S.A. 82a-1041 to recommend Local Enhanced Management Areas;
- K.S.A.82a-733(g) to approve certain state required water conservation plans;
- K.S.A.82a-745 to advise on acceptable management plans for Water Conservation Areas;

Local action. Organized local action and funding in 1976 turned the tide of unregulated development and prevented boom and bust economic conditions to secure for Kansas the benefit of its natural resources and favorable location with respect to national and world markets. These and other purposes of the GMD Act guide the economic preservation and development activities of GMD3. Assisting and advising government, members, partners and private industry in developing future business and economy by lowering water risk improves water reliability, regulatory confidence and builds a positive reputation in wise water use. The GMD3 area has demonstrated significant value in decoupling economy from local rainfall and climate variability through the development and use of vast water storage in underground reservoirs for irrigation, thereby providing significant gains in personal, community and national gross product. Stabilizing these benefits requires prudent investments advised by the management program.

Business water risk. Private and public institutions in GMD3 face four different types of water-related risk. **First**, there are the physical risk factors of available usable water; the risk that a region may lack sufficient supply from storage or that the local water supply might be of poor or unstable quality. **Second**, is there sufficient replenishment or recharge to replace what is consumed, degraded or exported. **Third,** local water regulations; regulatory change or lack of regulatory surety might challenge members' ability to do business. **Finally**, members face risks to

their reputation - they need to consider how their use of water will be viewed by others and the broader market communities. One can attempt to quantify the instrumental and intrinsic values at risk from those four dimensions, and that drives member companies to develop water stewardship strategies and make investments to manage that risk. GMD3 will work to assist district families, farms, businesses and communities in managing and mitigating their water risk to enhance confidence in their groundwater supply under the management program.



District Business Groundwater Risk

Supply & Demand management. For the GMD3 declining water inventory, supply and demand are generally considered two sides of the same water "coin." For planning purposes, demand should be viewed as actual use absent the unmet demand variable. Unmet demand is evident in the district members perfected annual use authority totaling 3.6 million acre-feet, but with recent average annual reported use of 1.8 million acre-feet. Investments in less water intensive production methods and optimized water management can lead to a more sustainable water-based economy. "Sustainable" can be defined as what is good for the economy, the environment, and people.

Economic growth. Both types of water conservation that (1) add use value to the water and (2) improve future supply of groundwater reservoir storage are important activities for growth in an economy that requires low water risk. Use plans and enforceable policy that does not accomplish this may conflict with the GMD3 management program. A shift to profitable less water intense crop acres and sustainable value-added agriculture hold significant promise absent any new water imports. The management program activities are intended to meet the agricultural water demand gap long term and also identify and incorporate strategies to address environmental and recreational needs for water places.

Water Infrastructure Investment. An investment in constructed water infrastructure, like a well or water delivery system, is a decision that provides private and public benefits that may otherwise become lost opportunity cost and regional loss of people, property valuation and capacity to respond to water risk. In a similar way, public resources supporting major water infrastructure can build a powerful economic driver with significant return on investment long term for both public and private interests. Economic studies indicate water infrastructure projects are a force multiplier. An investment in sustainable water and wastewater infrastructure has a six-fold return (5 U.S. Chamber of Commerce, Why Water Infrastructure Investment Would Make A Big Splash) – proving that investing in water infrastructure is sound fiscal policy. US Reclamation estimates that for every dollar spent in a reclamation program, $20 of direct benefit is realized. Secondary benefits may be as high as $40. Investing in water is not just about economic return. It is also about the health and wellbeing of communities.

Project stakeholders. Water projects require preliminary steps, planning, management and control to deliver the desired outcome; from the building of the first ditch irrigation systems of the

1800's in SW Kansas to the implementation of new communication and sustainable energy systems today, the necessity of satisfying key stakeholder requirements has been central to achieving a successful project outcome to deliver beneficial change. For example, large-scale agribusiness interests in western Kansas, most prominently Southwest Kansas Groundwater Management District No. 3 ("GMD3") revived the idea of a large-scale transfer of Missouri River waters to west-central Kansas in 2013 through several presentations to legislative committees. During the 2015-16 legislative session, GMD3 championed S. Sub. for H.B. 2059, which, among other things, would have made it easier for an applicant for water rights related to such a transfer to obtain approval. A study team for the Water Office recommended developing the bill concepts to include a detailed analysis of the bill in its final 2016 form and a summary and analysis of the larger legal, administrative, and regulatory issues raised by the bill, at both the state and federal law levels. The management program seeks partners in support of further work of the Kansas legislature on this and other key water policy development. A key to forming successful water project relationships is understanding that different stakeholders may have different expectations of a project and different definitions of project success. Thus, a project's success or failure, like the S. Sub. for H.B. 2059 act to support water transportation development, is strongly influenced by how well the project meets its stakeholder's expectations and their perceptions of its value. Stakeholder expectations and perceptions can be influenced by the capability and willingness of the project manager to engage effectively with the project's stakeholders and manage politics.

Water west. The future of our district investment-based economy is directly tied to the extent that we can improve the linkage and efficient management of natural and engineered water infrastructure. A gathering of Kansas stakeholder project partners with knowledge and interests in sustainable water and power values will occur for the purposes of adapting Kansas policy, planning and infrastructure development to phase in major water transportation system development. For the district, consideration of linking in Missouri river excess flows was assisted in the High Plains Study (1982) Kansas water transfer element updated in a 2015 report with funding from the US Army Corps, Kansas Water Office and GMD3 to help move planning development forward. The next steps for this activity include a development phase with further exploration, proof-of-concept (POC), demonstration project studies and a gathering of in-state partners and interstate supporters to advise and assist the Secretary of Interior in completing a phased plan authorized in PL90-537 with a supply route favorable to adding district supply. Prior work of GMD3 has found interest is shared with sister western regions and communities, including the upper Arkansas River basin of southwest Kansas and southeastern Colorado. Nobody wants to build a house and see it flooded. Nobody wants to plant a field and watch it wither. The management program commits the district to forward looking evaluations of natural and public water infrastructure and water marketing options that inform and build understanding of future water risk, feasible improvements and energy cost opportunity to move excess high flow water supply west with evaluations of who may pay under the management choices that include doing nothing. Without these Vision strategies and local, state, interstate and federal partner investments, GMD3 consultants estimate annual future economic loss could see reductions in gross state product of approximately $18 million annually, with a $10 million portion of that annual amount lost in GMD3 if current trends continue.

Public water places in a semi-arid climate. Water as a key resource for community wellbeing creates a desired service of well-managed public drinking water systems, enjoyable public water features and places that educate and inform on the importance of water. Wise water use includes encouraging a respect and understanding of the emotional and aesthetic power of water that

comes from places of water enjoyment and education. Water places are needed in conjunction with direct uses, green fields and local products for healthy communities and water services. Water places such as water bodies, water displays, playa lake education sites, water walks, and multi-purpose sites along natural or constructed water features enhance water value awareness and encourage responsible personal and community water stewardship.

The High Plains Study example. Eight years after the Colorado River Basin Project Act that directed the Secretary of the Interior to conduct ongoing water augmentation study for the western U.S. (Public Law 90-537, 1968) and in the year GMD3 formed (1976), the problem of depleting Ogallala Aquifer water supplies to support 15 million acres of irrigation crop farming in the High Plains region of the United States was addressed by Congress in the very first WRDA bill (Water Resources Development Act) Section 193, Public Law 94-587. The Intent was clear and concise in directing the Secretary of Commerce ". . . to examine the feasibility of various alternatives to provide adequate water supplies" for the High Plains Region, and ". . . to assure the continued economic growth and vitality of the region." To carry out the Congressional directives concerning the Ogallala/High Plains region and to fulfill a High Plains Study Council objective, two incremental management strategies to reduce water demands in the Region and three strategies to increase regional or sub-regional water supplies were formulated. The Framework for High Plains Study Management Policy Impact Assessment were to establish a **"Baseline"** trend projection of currently available water conservation and use technology and practices already in use to some extent at the time, with no new purposeful public policy to intervene with action programs for altering the course of irrigation water consumption (the Baseline). Then use the baseline condition to evaluate five strategies as follows:

1) A strategy which would **stimulate voluntary action** to reduce water demands through research, education, demonstration programs and incentives, using technology and practices either not considered Baseline practices or rates of implementation purposefully accelerated. (Management Strategy One)
2) A strategy which assumes Strategy One policies and programs and adds further water demand reduction by **mandatory programs** of a regulatory nature to control water use. (Management Strategy Two)
3) A strategy to add **local water supply augmentation** to demand reduction efforts. These actions included local practices such as cloud-seeding, local storage, ground water recharge, desalination, and snowpack and vegetation management. (Management Strategy Three)
4) A strategy of **intra-state surface water interbasin transfers**, importing water into the High Plains Region in accordance with State Water Plans. (Management Strategy Four)
5) A strategy of **interstate surface water transfers,** importing water from sources in areas adjacent to the Ogallala/High Plains Region by means of large-scale federal-state or federal projects to restore and maintain irrigation of the acreage that would have reverted to dryland farming by 2020 under Strategy One or Two. (Management Strategy Five)

Results of the Department of Commerce High Plains Study released in 1982 with a 40 page Executive Summary provides several analyses synthesized and available at: https://scholar.law.colorado.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1007&context=new-sources-of-water-for-energy-development-and-growth-interbasin-transfers Many western states have recognized that major water transfers are considerations for their states future. New prospective High Plains study and planning will provide new cost and benefit projections that will further aid in making project, policy and program choices. GMD3 participated in a 2015 update of the 1982 High Plains Study Route B Water Transfer Element not to promote the old project, but to move stakeholders and partners in the direction of future transfer projects to meet future water needs. See: http://www.gmd3.org/2019/09/27/updated-1982-high-plains-study-on-water-transfer-element/

GMD3 Water Rights Administration Assistance

Regulation Cost and Risk. There are costs in every water transaction to gain water value. Privately owned water rights were perfected that way based on investment and actual development of water value. The costs of a project and permitting is a question of state review for decision that must address identified matters of public interest in law, rules and the management program. Management policy tools have been adopted locally and implemented collaboratively by the state and district since the beginning of GMD3 in 1976. The first district method for evaluating groundwater depletion was adopted by GMD3 on July 12, 1978 immediately after the Kansas legislature made applications to appropriate water mandatory. This regulation tool involved calculating the potential depletion rate due to the addition of a single new well or added appropriation stacked on an existing well and added to prior appropriation amounts of all existing groundwater rights in the section of the proposed well and the eight adjacent sections commonly described as within a 9-square-mile area. Later changed to a two-mile radius circle around the well of new use, the method was relied on in conducting state duties to move resource development from unmanaged to managed development. Now that the district OHP aquifer is considered closed to most new appropriation, the desired culture of conservation requires a more balanced and informative application review of proposals under the KWA Act and GMD Act. Improved management tools, data and information are available to identify critical well conditions that advise members and state duties of any potential impairment concerns for water risk management. The most urgent policy needs to implement the management program is for consensus on government duties for which rights and powers have been granted by the legislature that serve to aid in managing water value and water risk. GMD3 necessarily advises a more transparent and informative application review process that includes the best evidence available so that members have the information they need to manage their water risk and make the best decisions they can for their business and livelihoods according to basic water use doctrines.

GMD3 authority. Authority for Water Rights Administration Assistance include without limit:

- K.S.A. 82a-1020 declaring the purposes of the GMD Act and establishing the right of water users to determine their destiny regarding water use as a public interest.
- K.S.A. 82a-1028(g) & (i) to construct, operate and maintain works & to contract with persons…, and enter into cooperative agreements.
- K.S.A. 82a-1028 (m) “provide advice and assistance in the management…" [of groundwater in] "storage… and all other appropriate matters of concern to the district.”
- K.S.A. 82a-1028 (n) adopt administrative standards and policies relating to the management of the district which are not inconsistent with the provisions of the GMD or the KWA Acts.
- K.S.A. 82a-1028(o), (p) & (q) to recommend rules & enforce them by suitable action.
- K.S.A. 82a-1028(r) to enter upon private property within the district for inspection purposes.
- K.S.A. 82a-1028(u) to recommend … an intensive groundwater use control area.
- K.S.A. 82a-1029 adopt the official management program for the district.
- K.S.A. 82a-1041 to recommend adopted Local Enhanced Management Areas for implementation.
- K.S.A.82a-1042 provide formal response to any rules or GMD management program changes proposed from the Sec. of Agriculture or Chief Engineer that may alter an adopted local groundwater management program or impact water use in the district.
- K.S.A.82a-733(g) approve state required conservation plans.
- K.S.A.82a-745(d),(h) & (m) to advise and assist acceptable management plans for WCA’s; and
- K.S.A.82a-1906(b) notification to water users of certain applications under review by DWR.

Kansas water rights. A *water right* under Kansas water law refers to the right of a person to take water under control from a water source in Kansas for beneficial use, such as from a groundwater source of supply, and to have that right continue unimpaired into the future subject to senior or prior water right demands. The western US water law doctrine of "prior appropriation" (or "first in time is first in right") has been a part of basic water policy in Kansas since the mid 1800's (See Appendix for *Kansas Water Law and History Notes*). Uniform prior appropriation policy was not fully adopted for all usable water sources until the KWA Act of 1945, whereby ownership of the water is dedicated to the use of the people of Kansas as a public good, but the right to use the public water is a private right created through an application and subsequent state grant under its police powers as a US water resources trustee. The KWA Act is administered by the Kansas Department of Agriculture's Division of Water Resources (DWR), which issues state permits to appropriate water, decisions on changing water use terms, regulate usage by responding to complaints, and keep records of all water rights. Short term and temporary permits are also issued by DWR. The grant for lawful water sue includes water user action and investment to apply the water to authorized beneficial uses and supply records that lead to receiving a vested determination (pre-1945 use) or a certified real property right. Water rights are documented as part of a traditional "bundle of legal rights" transferred with land from seller to buyer as an appurtenance to the land. Or, a water right can be separated from the land and conveyed by evidence of a separate deed or lease document. Domestic rights are not required to be recorded with the state but have a water appropriation right by law for domestic use to the extent of actual use, and with all the protections of right under the KWA Act and management participation under the GMD Act. The maintenance of records by DWR allows Kansas water to be apportioned legally and managed fairly. Except for domestic use, water cannot be appropriated, or even threatened to be appropriated, without first making application, participating in a process of project review and receiving approval from DWR. Declining water levels have created a *functional equivalent* deepening drought condition locally. Those who have earlier more senior water rights may be entitled to meet their needs before those who have junior rights. One element of the management program is to address member information needs to advise and assist in a balance of rights, help members make requests with other water members and to help with the management of actual water supply conditions.

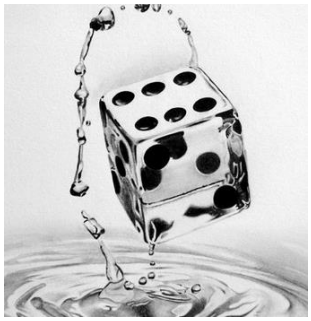
Waste of water. A goal of the management program is to help people recognize and avoid low or negative floodwater value, negative water evaporation value, water use conditions that are wasteful and that prejudicially and unreasonably affecting the management program public interest. Activity that may unreasonably diminish usable water value through contamination and waste may receive due consideration for impairing the GMD3 management program. However, surface water flows and ditch delivery losses that have historically delivered inflows to underground reservoir storage are an important source for groundwater recharge locally and are not considered a waste of water, unless water quality or other concerns dictate otherwise.

Impaired water right. One water user can affect supply available to another who is exercising a prior right to enjoy water resource benefits in a limited supply setting. This affect is assured in a declining groundwater reservoir where a well can become critically unable to meet authorized and investment backed demand. Evaluating conditions for this effect prospectively will have a unique set of considerations in a declining groundwater reservoir setting. Well pumping effects can incrementally vary over multiply dimensions of time and space. So, a system of concepts and customary practice has evolved adopted by GMD3 to assist and advise members and partners

implementing the KWA Act and GMD Act in southwest Kansas. This includes adoption and use of maximum allowable depletion rate and other science-based locally occuring well drawdown factors on other wells with prior use rights and to assist in resolving complaints regarding supply. Appropriate steps of discovery and evaluation provide vital information that informs market participants, clarifies impacts and injury, quantify mitigation, and reduce transaction costs associated with the exercise of water rights. The duties of the state to supervise water use is guided by ascertaining whether a proposed use (or change in use) may prejudicially and unreasonably affect the management program public interest for district aquifer areas.

Water scarcity and regulation. No one wants regulations but most want protections from water scarcity. No one wants to see anybody lose any groundwater, but people are. Members of GMD3 don't want to see that hardship come to anybody, but in a declining supply there is going to be hardship (well yield decline and increased water costs). How we deal with it starts with a fair and transparent orderliness of thought and behavior based on the best evidence available at the time to allow capital markets, farm managers, other members and partners to learn conditions and accept responsibility for their part in managing water value, water cost and water risk under Kansas law.

State and local government judgement. Because water rights are real property rights in Kansas, the importance of transparent policy practice with fair and even-handed expert judgement on questions of water risk and water right impairment cannot be over emphasized. Accordingly, state officials like the Chief Engineer and agency staff of the Kansas Department of Agriculture are key partners in the implementation of the GMD3 management program for southwest Kansas. The Chief Engineer cannot grant an application to appropriate groundwater if the resulting activity will impair existing water rights. (K.S.A.82a-711 & 82a-711a) Likewise, for:



- **changing location** of well pumping (K.S.A.82a-708b, 82a-711 and 82a-711a).
- **injunctions** - potential or existing impairment of prior rights (K.S.A.82a-717a).
- **limited transfer permits** (K.S.A. 82a-743).
- **WCA** (water conservation area) adding pumping location flexibility (K.S.A.82a-745).
- **rule waivers** (K.S.A. 82a-1904); and
- **management program** preservation of basic water use doctrine (K.S.A.82a-1020).

All the above require the Chief Engineer to decide whether the proposed action may impair other water rights in the district before approving each request. The basis for each decision should consider both the rights involved and the public interest of the GMD3 management program.

Members use waters of the state of Kansas according to their water rights. A water right is not a guarantee of a water supply in turn as it is subject to the availability of water not needed to satisfy demands by owners of prior water rights. For groundwater, the green light to pump water is a somewhat predictable condition with predictable effects on the supply source that may include some assumed data where better data from measurements is not available. The success of water conservation activities of the management program will depend on a consistency of thought with the management program and orderliness in the state review process for a decision that avoids extending or increasing local depletion rates or exploiting benefits of prior conservation. The questions of whether a hardship or injury to the water supply of others may result from present or

proposed use change has always been a GMD3 concern of the management program to guide KWA Act decisions since 1976.

Kansas law provides *"It shall be unlawful for any person to prevent, by diversion or otherwise, any waters of this state from moving to a person having a prior right to use the same."* (K.S.A.82a-706b(a)) This raises a question under theGMD3 area policy of aquifer depletion whether this unlawful condition occurs prior to when a local well with a prior right goes dry. Impairment may occur on the way to a condition of complete loss of supply and the management program advises using well drawdown constraints to identify where pumping effects may be unreasonable or even unlawful. Kansas law also provides "*with regard to whether a proposed use will impair a use under an existing water right, impairment shall include the unreasonable raising or lowering of the static water level or the unreasonable increase or decrease of the streamflow or the unreasonable deterioration of the water quality at the water user's point of diversion beyond a reasonable economic limit."* (K.S.A. 82a-711) This statute is interpreted to involve a prospective "will impair" question to be evaluated with some physical constraint over some reasonable future period and applying some reasonable economic constraints that consider water cost and water value effects.

The courts. The courts in the district have acted to define when impairment occurs from a standard law definition of "impair" to mean when that diversion 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)). The Garetson Bros. case definition of impairment was used by the chief engineer on other wells not enjoyed in the case even though the adopted well spacing rules was met. The general GMD3 spacing rule is uninformative to questions of water risk and the court definition is considered too harsh for regular application in the economic interests of members and the GMD3 management program.

A more practical and transparent method of screening and estimating well drawdown conditions likely to result in impairment is appropriate and advisable to help members in managing their water risk. Members need tools to help evaluate whether their concerns are "out of line." Given that "impair" is not defined in statute or rule, and strictly defined in area caselaw and actively referenced in state letters advising members how to act should it occur, a reasonable even-handed method of evaluating critical well conditions is provided in this management program applicable by all for whatever local aquifer numbers are chosen using objective hydrologic principles. When followed, these guidelines provide the basis to establish best evidence for evaluating impairment.

1. **GMD3 Water Rights Administration Assistance Guiding Principles:**
   A. **Preserve basic water use doctrine.** A public interest of the GMD Act and this management program.
   B. **Good public record for good decisions.** Complete and transparent public record of facts, science and policy provides for good public decisions.
   C. **Conserve to preserve supply** – Engage members to grow present and future benefits from preserved or replenished supply. In the depleting groundwater reservoir, limiting "paper water" on poor wells (incapable of providing the water) from moving to good wells (a concept termed "chasing water") will protect conservation benefits and avoid imposing new hardship on member wells.
   D. **A closed groundwater reservoir dedicates native supply to existing usufruct rights** – Groundwater reservoir natural inventory and recharge system closed to most new

appropriation becomes supply dedicated to users having existing real property rights owned by district eligible voters. New appropriations should be offset by non-use of prior rights or replaced from other sources to assure a net zero or better change in supply.

E. **Drinking water necessity**- Safe drinking water is a fundamental necessity of every person which must be considered in member management activity for future supply. It is a waste of water and improper if one person, for individual profit, may destroy a community and render a neighborhood uninhabitable.

F. **Contributions to future supply** - An unexercised right to enjoy beneficial use has a present groundwater conservation value as a voluntary conservation contribution that shall not carry any penalty to the contributor.

G. **Communicate and exchange information** - Effective communications between GMD3, its members and state and federal regulators are necessary for productive partnerships and wise decisions implementing the management program. Conclusions that differ from those of GMD3 and the management program can prejudicially and unreasonably affect the public interest when the basis for them are not disclosed or allowed to be discovered.

H. **Seek mutual benefits and good will** - All water users and landowners can make water right decisions, agreements or stipulations between property right interests to promote mutual benefits and goodwill. users of a common resource can arrange for their own private enforcement mechanisms through private agreements.

I. **Encourage careful risk evaluation for investment stability -** Spur wise water-resource development and intervene to protect the interests of all members.

J. **Promote free enterprise –** Enable a market-based system of water rights administration of available supply.

K. **The public interest of the management program –** Have it used to advise and assist the chief engineer in conducting water rights administration duties.

2. GMD3 will aid in proper consideration of public interest of the management program. K.S.A.82a-711(b) states as follows: *"(b) In ascertaining whether a proposed use will prejudicially and unreasonably affect the public interest, the chief engineer* <u>*shall*</u> *take into consideration:*

> *(1) Established minimum desirable streamflow requirements.*
> *(2) the area, safe yield and recharge rate of the appropriate water supply.*
> *(3) the priority of existing claims of all persons to use the water of the water supply.*
> *(4) the amount of each claim to use water from the appropriate water supply; and*
> *(5)* <u>*all other matters pertaining to such question*</u>." (Emphasis added)

For "*a proposed use"* or proposed change in use in the GMD3 area, consideration (5) above necessarily includes the public interest declared in K.S.A. 82a-1020 et. seq. and of GMD3 declared by the Chief Engineer per K.S.A. 82a-1024. Legislative provision for changing water rights continue the required public interest considerations in requiring that the chief engineer shall approve or reject the application for change in accordance with the provisions and procedures prescribed for processing original applications for permission to appropriate water. (K.S.A. 82a-708b)

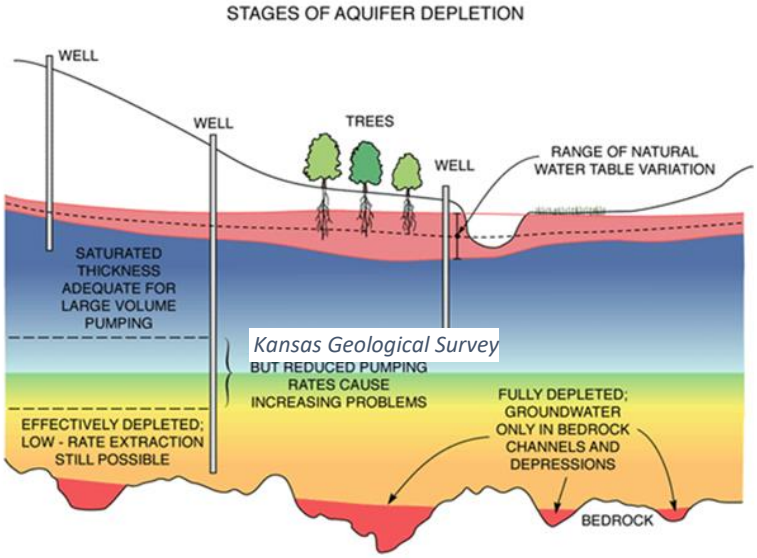
Additional policy in law regarding GMD's include that the KWA Act duties and responsibilities of the chief engineer are preserved by the GMD Act where nothing therein shall be construed as limiting or affecting any duty (emphasis added) or power of the chief engineer (K.S.A.82a-1039). Notwithstanding K.S.A. 82a-1039, any participating water right in a WCA established according to the KWA Act remains subject to all rules and

regulations and management program of the GMD in which the water right is situated (K.S.A. 82a-745). Conservation plans and practices that are required by the chief engineer as a condition of a groundwater right in a GMD shall be subject to approval by both the chief engineer and the board of directors of the GMD (emphasis added) unless such plans and practices are incorporated in the GMD's management program (K.S.A. 82a-733). Notification to member water users of certain applications under review by DWR is a requirement of DWR in consultation with the GMD (K.S.A.82a-1906(b)). With the exception of WCA policy referenced above, these and other provision of law lend credence to the necessary and advisable inclusion of GMD3 and the management program in the conduct and agency practices implementing the duties of the Chief Engineer.

3. **GMD3 will advise and assist water rights administration.** Adoption and enforcement of groundwater use policy appropriate for the unique practices and aquifer conditions of southwest Kansas has been a key goal in the formation and funding of GMD3 by the water users and landowners from the beginning. Challenges remain in a depleting aquifer area when the state process is unable to identify evidence water right impairment would ever occur and case law suggests otherwise. The GMD3 management program advises a more analytical, transparent and site-specific method of applying basic water use doctrine in southwest Kansas to meet member needs for managing water risk to their water rights and capital investments.

   No free lunch. Water use benefits have associated costs paid by members. New proposals to change prior use conditions present new cost effects to all involved in each local source of supply, especially others with prior rights to a declining supply. There is no free lunch. Someone's well(s) will pay the price of changing an appropriation location. Without proper evaluation of the best evidence available, administrative decision can add risk, inflict injustice to prior rights, eliminate conserved water benefits, and prejudicially and unreasonably affect the management program public interest.

4. **GMD3 will participate in water right application review to advise and assist evaluation and provided board recommendations of the management program.** As local groundwater reservoirs decline, the value of usable water goes up. The Stages Of Aquifer Depletion concepts at left are further complicated by physical realities locally in vertical and lateral formation variability in capacity to provide water to a well. Many district wells are already in the yellow stage of aquifer depletion. In well fields that span areas of green to red stage conditions, a zero-sum net effect standard for multi-well use flexibility can actually accelerate depletion rates as demands and "paper water' move to remaining preferred pumping wells. K.S.A. 82a-1028(m) authorizes GMD3 to "provide



advice and assistance in the management of drainage problems, storage, groundwater recharge, surface water management, and all other appropriate matters of concern to the district." The question of whether a proposed use or water right change will impair existing water rights is "advice and assistance in the management" of groundwater in "storage" and "all other appropriate matters of concern to the district." The GMD3 Board seeks clear accountability to align incentives, manage risk, and communicate standards in their advice implementing the public interest of the management program that include the following:

A. **Public and domestic drinking water supplies.** Steps to ensure quality drinking water is available locally for people and animals is recognized as a necessary element of the groundwater management program. No modification to historic terms of groundwater use should contribute to unreasonable or unsafe drinking water supply conditions, including deteriorating drinking water quality (Water Usability Depletion).

B. **Water usability depletion.** Water usability depletion is when the value of use of water supply is lessened or impaired by a decline in water quality, causing a material depletion in the utility of the water. The degradation of quality can either restrict or eliminate the beneficial use or reuse of water or require additional “fresh” water use to dilute or replace the degraded water.

C. **Maximum allowable rate of groundwater reservoir depletion.** The OHP groundwater reservoir is subject to a maximum allowable rate of depletion not to exceed 40% in 25 years; a limit adopted by GMD3 on July 12, 1978 and enforceable by state rule. This cap set the potential maximum allowable local consumption rate of the OHP Aquifer. The depletion rate cap is used as an economic constraint, given that the entire groundwater reservoir is now considered closed to most new appropriations unless offset by unused prior use rights not constrained by conservation lack of supply (paper water).

D. **Well drawdown estimates.** Conducting well evaluations in declining groundwater reservoirs to identify critical wells (supply hardship wells) will be applied in a proposal review process with a framework where analytical tools such as a Theis Calculation and numerical tools such as the GMD3 Groundwater Model can be applied and considered to inform water decisions where critical well conditions may suggest a strong candidate for impairment of water rights.

E. **Local source of supply.** Administrative practice and hydrological constraints such as rate of lateral movement suggest a local source of supply for a K.S.A.82a-708b(a)(3) demonstration should not allow a move beyond a 2-mile radius circle. Management program policy and guidelines may further constrain changes or change-like evaluations.

F. **Water right priority contribution.** GMD3 member-owners of senior water right interests who stipulate to forbearance agreements or otherwise withhold priority call provide mutual benefits and good will are recognized.

G. **Use of lesser quality water.** Under state law (K.S.A.82a-711), Water with a lower usability factor must be considered where technology and economics will allow it.

H. **Member agreements that implement the Management Program.** GMD3 members may seeking rule waivers or negotiated water management plans and inter into agreements that

support needs of nearby well owners when developing a water conservation plan and who meet the requirements of K.S.A. with no critical well concerns

I. **Economic use value.** Plans or proposals that increase water use value while decreasing supply decline contribute to the GMD3 management program public interest.

J. **Alternate supply development.** Proposals to conserve OHP aquifer water by seeking an economically and technologically feasible lesser quality alternative source should be recognized as contributing to the success of the GMD3 management program.

K. **New flexible use among wells and their prior allocations.** New use flexibility between wells presents a new benefit and a significant risk of adding new pumping effect on remaining wells with prior rights in a declining local source. Also, with improvements to type (1) water conservation (efficiencies), there is risk that no real type (2) water conservation (groundwater reservoir maintenance) is achieved to mitigate new use effects on the neighbor. Local hydrological community evaluation for critical well conditions is needed to avoid impairment of nearby wells, especially where "paper water" may be re-allotted to remaining productive wells.

5. **GMD3 will assist in the preparation of applications.** Assistance provided by GMD3 staff may be for completing an application for a state permit or for other such water-rights related member project planning and paperwork, but it shall be the responsibility of the proposer to review all such information and to submit it to the Chief Engineer as required by law and as advised by their own independent legal counsel and/or technical expert.

6. **GMD3 will review water right proposals.** Analytical and numerical tools and results will be provided when considering effects of use proposals or plans that affect supply to member prior rights for consistency with water use doctrine and the management program.

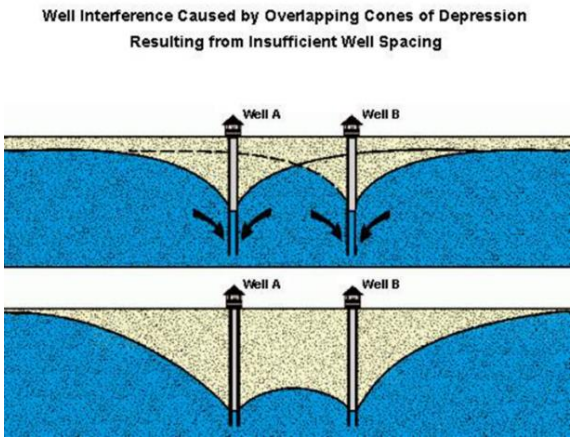
7. **GMD3 will provide MOU conditional change application services.** Compliance monitoring assistance will be provided to implement a Memorandum Of Understanding (MOU) with the Chief Engineer for change applications under member contract agreements with GMD3 implementing the provisions of K.A.R. 5-5-9(a)(2), K.A.R. 5-5-11(b)(2) or K.A.R. 5-5-11(b)(3) and the management program and policies of the district.

8. **GMD3 will address additional wells vs. supplemental wells and "chasing water."** Additional wells may be necessary to allow a partial sale and change of water right use from irrigation to a higher value beneficial use. This additional well activity is distinguishable in the management program from efforts to add one or more wells in order to supplement or restore aquifer extraction rate capacity to replace lost capacity due to general water level decline. This raises concerns for changing purpose and conservation strategy of the management program, causing a disproportionate local rate of aquifer depletion and a "chasing water" concern that shortens the time to eventual complete depletion of supply to all. **A goal** of the management program is to provide careful evaluation procedures necessary to identify critical wells under such proposals. A **Standby well** is different yet as a source security condition documented on the water right of a primary well, should catastrophic failure occur. A standby well meets standard spacing from the primary well of other water rights. A primary well is not required to meet well spacing from its standby well and emergency operation is for 60 days.

GMD3 will advise and assist multi-well use flexibility (MUF) activity. Someone's well always pays a price when pumping allotments are moved in a shared declining supply. So, care to evaluate critical well concerns and any voluntary corrective controls is needed to assure they are consistent with provisions of law and the management program. For example, the WCA law in K.S.A.82a-745(e)(2) may allow aggregate use flexibility between participating wells as long as impairment of non-participating rights does not occur. This optional provision can threaten wells with prior rights in GMD3 if the result adds critical well conditions on other members in a declining local source of supply already overcommitted to next generation water rights. **A goal** of the management program is to provide proposal review and well drawdown estimate services to applicants and the application review process so that members have the information they need to make the best decision they can for their business and livelihoods looking ahead for at least one generation. Legislative tools for water management that may cause impairment locally are not allowed. An example of this in the upper part of the Arkansas River IGUCA is where MYFA's are not allowed by the Chief Engineer because of drying seasonal surface water delivery concerns. Drying aquifer conditions present similar concerns. The WCA tool is good for implementing new corrective controls while avoiding adding critical well problems to unwilling members with prior water rights.

9. GMD3 will provide application review and well drawdown estimate service. Groundwater pumping imposes stresses on natural groundwater systems and lowers the natural groundwater pressure at the location of the pump. This pulls groundwater out of storage in the pore spaces of the earth, and toward the pumping well, changing the natural groundwater pressures in an area resembling an inverted cone called a "cone of depression." Multiple wells can have additive effects. If physical conditions are allowed to be considered, guidelines will be employed to provide information that may include the following:

- drawdown and/or stream depletion due to a proposed well pumping.
- drawdown from use under existing water rights.
- impact of drawdown on existing well completions.
- potential to obtain the rate and/or quantity of water sought.
- water availability.
- water quality.
- other information needed to support decision making.



New effects. Proposals for new or added pumping in a local source of supply simply propose new well effects that may or may not be adequately addressed by general well spacing rules. GMD3 area rules provide minimum well spacing and move limits to implement statutory policy absent better demonstration or investigation results. As the aquifer depletes, a better evaluation process to consider well effects is needed. Significant additional data and information are now available to provide better information to today's water use proposals that should not be ignored or prohibited from the record. GMD3 guidelines for well drawdown estimates provide a consistent member neutral format and methodology to evaluate project proposals on a case-by-case local condition basis to

include the unique characteristics of each application and groundwater setting. Disputed conclusions for the aquifer numbers used should be reviewed on the record of a hearing.

Well drawdown evaluation guidelines. Well drawdown evaluation guideline will be used to inform questions of water risk and water right impairment. They may be updated and posted on the GMD3 website as needed. Guidelines address the following:

- Member water rights are real property right that can be impaired.
- Groundwater depletion is provisioned in law and practice for the district.
- Hydrogeology is sufficiently understood.
- Mutual well interference is prevalent.
- A regional groundwater flow model (and any revisions) has been employed.
- Application and proposal reviews occur regularly.
- Minimum well spacing rules are not adequate to protect rights in many cases.
- Property right holders are entitled to seek injunctive relief/protection from harm to their property.

Guidelines provide an orderliness of thought and behavior that will have a settling effect on the general controversies of impairment of prior groundwater rights and serve as a framework for judgments on whether to investigate or to require more demonstration of local hydrology and well effects. Under a physical solution to well hardship or injury in a declining supply, the objective often is to enable an existing junior use proposal, but in using less water from the well and conserving supply. Members can know the gravity concerns for maintaining vital well operations in the face of a proposed new normal water level decline rate. A test period for the guidelines since 2017 when training was provided to the Chief Engineer and staff found a majority of the applications have met the GMD3 guidelines and were recommended for approval.

A. **Drawdown Allowance.** Preventing any level of new impact on a well is impractical, as this would result in the denial of all applications including those causing small or de minimis impacts. A drawdown allowance will be used as **a maximum reasonable lowering of a critical wells water table** and to define a relatively small impact due to a proposed diversion that may be allowed to occur on wells in which economical and/or physical constraints are exceeded. A drawdown allowance can also be used as an application screening tool to determine if additional evaluation is warranted.

RECOMMENDED ADDED DRAWDOWN ALLOWANCE
FOR AREA WITH NO IMPAIRMENT CLAIM

AVERAGE AQUIFER THICKNESS IN THE VICINITY OF A PROPOSED WELL (ft)	TOTAL DRAWDOWN ALLOWANCE OVER 50 YRS (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

For up-to-date allowances, see GMD3 posted guidelines at GMD3.org, now at: http://www.gmd3.org/wp-content/uploads/2019/04/DRAWDOWN-ASSESSMENT-GUIDELINES-for-GMD3-2019.docx

B. **Critical wells.** Critical wells have high risk of suffering excessive supply decline and water right impairment. Wells in which economic and/or physical or other constraints are exceeded due to adopted criteria are referred to as "critical wells." Adopted criteria are used unless better site-specific information is available. Wells may become critical due to the use of existing water rights in a declining supply alone or the combined effects of dynamic drawdown, existing uses, and proposed uses if one or more of the drawdown constraints are exceeded.

C. **Economical Drawdown Constraint.** The economical drawdown constraint is calculated in two ways, with the more conservative result used. Constraint (1) is based on the percent of initial useable water column that can be lost before the well falls below economical viability. In the absence of more reliable data, a value of 70 percent of the initial water column may be assumed as the economical drawdown constraint where from a theoretical (hydraulic) standpoint, it is impractical to pump a well in an unconfined groundwater reservoir at a drawdown that exceeds two-thirds of the thickness of the water-bearing formation (Groundwater and Wells, Third Addition, Johnson Screens, 2007, page 429). Constraint (2) for the OHP Aquifer uses a maximum allowable rate of depletion calculation as a standard under the management program for over 40 years. The GMD3 40/25 calculation will be used to ensure proposals will not result in exceeding nor increase and exceeding the maximum rate of groundwater reservoir depletion.

D. **Physical Drawdown Constraint.** Physical hardship is the loss of the required well yield due to excessive usable water level decline. The physical drawdown constraint is the difference between the depth to the current static water level (or depth to the potentiometric surface) and depth to the **Lowest Practical Pumping Level** (LPPL). The LPPL depends on the availability of well completion information such as the depth and thickness of the water bearing zone or confining unit, pump setting, and screen setting. For non-domestic wells in an unconfined groundwater reservoir, the LPPL may be assumed to be 60 feet above the base of the water column. If the screen interval and/or pump setting is unknown, a different LPPL may be determined to address reasonable concerns such as cascading water or other physical well concerns. The LPPL for non-domestic wells in a confined bedrock groundwater reservoir may be assumed at the base of the upper confining unit unless this assumption is unreasonable (Sterrett, 2007). If the total drawdown extends below the LPPL that well becomes a critical well.

E. **Domestic wells.** Due to the relatively low volume of water produced by domestic wells, and other construction factors, some wells may be close to the bottom of the well. The LPPL is typically assumed to be 20 feet above the base of the water column for domestic wells unless a different value is supported. At least 20 feet may be necessary to maintain submerged conditions, avoid sediment problems, and allow for dynamic drawdown, etc.(length of pump and net positive suction head).

F. **Water usability constraint.** Usable water column for well evaluations can be significantly reduced by unusable water quality, or water usability depletion of supply. Usability constraints will be addressed as available information dictates. Water rights that authorize use in depleting areas may be held to existing use terms in response to

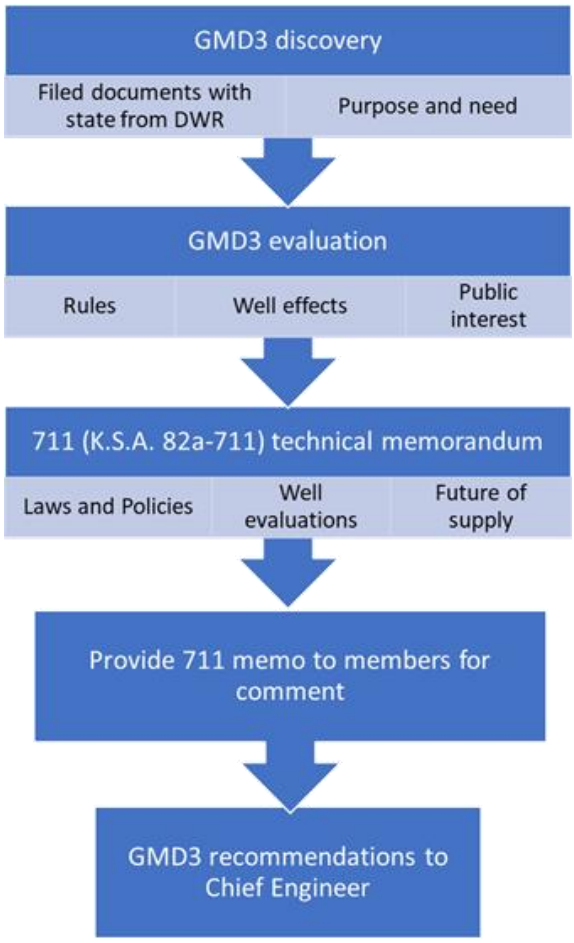
critical well or drought-like warning conditions. **A goal** of the management program is to include water quality constrains of law and well drawdown evaluation guidelines to advise and assist decisions under the KWA Act in GMD3 and water management need for corrective control or drought-like response under the GMD Act.

10. **GMD3 will monitor annual water use.** GMD3 will work with partners to improve the water use and reporting process as needed to advise member interests and the public interest of the management program.

11. **GMD3 will provide on-site diversion and flowmeter inspection services.** Installed water flowmeters and other devices have been required by the governing body of GMD3 on all non-domestic wells for 30 years. On-site services assure good water measurement assistance and ensures groundwater programs are based on good use data.

12. **GMD3 will work with members and officials.** GMD3 will provide program compliance assistance and options to address wise water use that may include seeking facilitated consent agreements to be recognized by water officials. Activity may include review of use proposals or supply complaints using a 25-year prospective supply evaluation period.

13. **Time for GMD3 review process.** A GMD3 application review process will be conducted with efficient use of time to respect the needs of all members and to add value and confidence in groundwater project investments by applying rigor and relevance in the evaluations of local groundwater supply conditions, well operating needs and private property rights to use the available water supply for a reasonable period of time. Accordingly, some review time to a recommendation may range from **less than 15 days to significantly more time** depending on a number of factors that may include: legal setting; physical setting; insufficient information provided; request for rule waiver; extent of available data; number of calculations to complete; communication time; concerns from other members; proposal revisions; GMD3 committee and board review; mitigation of impairment concerns; and any hearing requested and allowed by DWR.



The complete GMD3 Guidelines For The Assessment of Well Drawdown Estimates can be found at: http://www.gmd3.org/wp-content/uploads/2019/04/DRAWDOWN-ASSESSMENT-GUIDELINES-for-GMD3-2019.docx

Contact GMD3 or your private consulting specialists for assistance in calculating well effects.

GMD3 Water Conservation Activities

Wise use. Under considerations to address depleting groundwater resources, water has generally become a commodity to be weighed, measured, allotted and metered out by the gallon or acre-foot. These are important management program activities. But a better leading public policy strategy might be devised than one that only conveys the message that water use is something to be minimized or even defeated by water conservation. Instead it should be stressed that conservation is not so much about prohibiting water use as using water wisely, even during extreme flood and drought conditions. Such uses are many and include an understanding of the four elements of water risk (storage, replenishment, regulation and reputation), and the emotional and aesthetic power of water. The GMD3 water conservation activities will encourage members to be wise in use and to conserve and extend supply sources while also developing alternative supply sources to replace or replenish district groundwater reservoir inventory. Both forms of conservation are equally key and necessary elements of the management program to move the wellbeing of Kansas communities and economy forward. Strengthening links between natural infrastructure (Rivers, streams, playa lakes and groundwater reservoirs) with private, community and public constructed infrastructure (Wells, tanks, pipelines, canals, pits, lakes, and surface reservoirs) will help build plans for climate and drought resiliency all across the district.

- **Water Conservation -** has two types of activity under the GMD3 management program:

  (1.) **Use efficiency**
  - the amount of valued output per unit of water consumed.

  (2.) **Maintaining aquifer storage**
  - preserves and/or replenishes future useable storage.

Type (1) Water Conservation = Use Efficiency. Use efficiency is the amount of valued output per unit of consumed water. This type of activity improves wise use by adding present economic value and benefits to each unit of water diverted from storage. But it also adds risk in greater capacity to consume every drop available from declining groundwater reservoir supply. Efficient water use technologies, products and services are an effective means of increasing or sustaining GMD3 economy and member water project bottom line. Use efficiency is the first activity generally attributed to water conservation for wise use without waste. As the cost of water increases, the business incentives and benefits associated with efficient use increase. However, as efficiencies increase, historical return flow back to the groundwater reservoir decrease. So, in a declining groundwater reservoir, type (1) conservation activity adds present supply value and opportunity for both groundwater reservoir maintenance and groundwater reservoir consumption. So improved use efficiency by itself does not assure aquifer storage maintenance for the future.

Type (2) Water Conservation = Maintaining Aquifer Storage. Maintaining aquifer or groundwater reservoir storage requires conserve-to-preserve activities for future water supply value. Supply maintenance activity includes protecting renewable recharge sources, adopting lower project demands, adjusting local use corrective controls and administering the exercise of water rights based on the long view while also seeking replacement sources. All are effective means of Type (2) water conservation. Groundwater reservoir maintenance activity may be coupled with type (1) use efficiency activity. **A goal** of the management program is to develop a conserve-to-preserve factor evaluation tool to determine useable preserved or replaced storage amounts vs. unusable or unavailable paper water for proper water conservation accounting.

Meet needs and preserve storage. GMD3 members know the gravity of maintaining their vital well operations in the face of new normal water level decline rates. Type (2) water conservation can have positive effects to reduce local decline rates. The water conservation activities of GMD3 seek to have members use what they need under modern efficiencies and leave or replace in storage what they can in order to improve future valued water supply. A proper water valuing tool can inform decisions and markets about allocating water across multiple uses and services to maximize future district well-being. Properly valuing water under the management program can make the cost of usability depletion and waste apparent and can promote conserve-to-preserve practices.

Conserve-to-preserve factor. Conserving to preserve or replenish "wet water" supply may be considered the water conservation (conserve-to-preserve) factor of a plan or program, expressed in acre-feet. A water conserve-to-preserve factor is a calculation that requires a separation of the inevitable non-use of a water right (inaccessible or depleted supply) from groundwater reservoir maintenance actions (demand reduction choice or groundwater recharge actions that preserve physically and legally available storage) that most agree adds future water supply. **A goal** of the management program is to account for every acre foot of water stored or available for management. Of the 3.6 million acre-feet of perfected annual authorized groundwater use from the declining district inventories, generally about 44% is not used for various reasons, including voluntary groundwater conservation activity or diminished well yields from depleted groundwater reservoir conditions. Wells generally perform under several factors affecting well yield. Well yield is rate in GPM that a well can reliably produce water under normal operating conditions. The water that the well provides may differ from the authorized maximum allowable conditions of a water right. For diminished well yields, there is a significant amount of **"paper water"** (water rights on paper only, due to diminished well yield). So, it will be necessary to determine through a practice suitability audit and appropriate data review to determine the actual water conservation factor or conserve-to-preserve factor for any accounting of credit or due consideration provided in the GMD3 area.

Conserve-to-preserve water accounting. A goal of the management program is to account for voluntary conserve-to-preserve factor amounts in member water management activities. Development of conserve-to-preserve water conservation factor calculations have numerous considerations that may be best developed and implemented through separate GMD3 program guidance documentation further implementing the management program. Such an accounting activity may enable the tracking of groundwater reservoir storage maintenance on a project or on a regional scale to determine the extent of groundwater reservoir maintenance ongoing.

Reporting conserve-to-preserve amounts. Water management based on use requires water use reporting. Water management based on conservation requires water conservation reporting. Water management actions that conserve-to-preserve supply should be routinely documented for member benefits; benefits realized either in extended supply, monetary incentives or in matters of water right administration. No-call or non-exercising of a senior right to use available supply generally goes undocumented or is not fully considered in state water planning, administration or legislative policy development.

No conserve-to-preserve penalty. Any policy that non-use demonstrates lack of need or results in loss of water right benefits or lack of resource concern is not a proper basis for water management accounting or management program support of decisions that conserve-to-preserve groundwater supply. A declining groundwater supply is a resource concern that requires sustained conservation incentive and reword commensurate with the value of the resource described earlier. Water planning documents tend to describe water demand in terms of water use and fail to account for voluntary decisions for non-use of groundwater storage nor adequately describe the unmet demand and lost opportunity costs for lack of available supply. There is little standardized data available to quantify the extent of water conservation occurring now in the district. **A goal** of the management program is to help members with water conservation activities and voluntarily submit annual water conservation reports for their water right record and implementing a no-penalty for conservation and contributing to the management program.

Every manager a water conserver (EMAWC) initiative. As family and corporate water managers juggle many related business concerns, each must act in their own way to manage climate variability and their own project water risk with wise use that improves their bottom line. So, members are encouraged to adopt their personal leadership in groundwater conservation to determine the destiny of their water use value and the future of their water dependent enterprise. GMD3 will provide support consistent with the management program to facilitate knowledge uptake in business sustainability communities. The actions of every manager a water conserver (EMAWC) activity may ultimately determine the fate of all reliance on available groundwater supply for the farms and industry of the GMD3 area. Regular water system evaluation and conversion investments to gain maximum efficiency is highly encouraged Type (1) water conservation for the district and a core activity in developing home-grown water management.

Home-grown management plans. Being climate resilient involves incorporating water risk into plans that anticipate, prepare for, and respond to hazardous water related events, breakdowns, regulations, or other costs. With local groundwater storage generally slow in lateral flow, each member can expect benefits of their managed conserve-to-preserve activities to generally remain home. It is fundamental groundwater management that each project manager conserve-to-preserve supply where possible and to develop a water budget strategy that defines and adopts project benefits; incorporating minimum use need, water sources and identified conservation adoption opportunities with a long view of water supply and community. **A goal** of the management program is to implement an EMAWC activity to incorporate actual well conditions, supply management, recharge, and alternate sources into a bottom-line water strategy for each manager. Using measured farm data, water rights analysis and available expert assistance, an EMAWC project level activity can yield benefits and provide baseline awareness of changes in use by other water users in a local supply neighborhood. Managing rain benefits and evaporation loss is an excellent place to start, with use of irrigation scheduling and sensor technologies that places each

member on the front lines of water responsibility to protect the Ag industry and communities with wise water systems.

Master Water Manager. The Master Water Manager pilot project can promote the EMAWC activity and be an extension of ongoing demonstration programs. Master Water Manager can be designed to take the demonstration process to the next step by facilitating the adoption of proven best management practices by significantly reducing the learning curve for water managers and promote adoption of Type (1) use efficiency. Master Water Manager participants will learn how to manage water use using conservation practices with tools and strategies accessible immediately, making conservation solutions practical. Lectures, problem solving and in-field, hands-on applications will be used during teaching, and the length of the program will give participants time to reflect on what they learn and build a network amongst themselves to rely on when implementing best practices in their operations. This is to be patterned from the North Texas Master Irrigator program spoken about at the Ogallala Water Summit that took place April 2018 in Garden City.

Groundwater Exploration and Protection (GE&P) Act. The GE&P Act is a body of Kansas law to provide for the exploration and protection of groundwater through the licensing and regulation of water well contractors in Kansas to protect the health and general welfare of the citizens of the state; to protect groundwater resources from waste and contamination by requiring proper description of the location, drilling and well construction, and proper plugging of abandoned water wells and test holes; and to provide data on water supplies through well logs, well pumping tests and water quality tests which will permit the economic and efficient utilization and management of the water resources of this state. In order to achieve these objectives, the Kansas Department of Health and Environment (KDHE) Bureau of Water handles licensing of water well contractors; provides for enforceable standards for well construction, reconstruction, treatment and plugging; requires each licensed water well contractor to keep and transmit to the state, upon request, a copy of the log of the well, pump test data if available, and water quality samples, and maintains within the Kansas Geological Survey (KGS) a record system of well logs and water quality data available to the public. **A goal** of the management program is to utilize the information made available under the GE&P Act and work with KDHE Bureau of Water staff to accomplish its purposes in harmony with those of the management program. Enhancements may include test hole log reporting, field help in well plugging and enforcement of unlawful drilling.

GMD3 Drought Resiliency Program

Drought. Drought affects southwest Kansas frequently with a subtle onset that develops significant impacts over time. Long-term historical climate variability estimates over the last 1000 years produced by Layzell and others at the KGS indicating significant climate variability historically beyond modern experience and data. Vast development of local groundwater reservoir storage pumped to replace rain deficiencies has provided great drought resiliency and agribusiness advantage for the region. Significant value has been realized by decoupling economy from local rainfall and climate variability through the development and use of stored groundwater for irrigation. But groundwater reservoir depletion is also a reality that is causing a re-aridification of irrigated farms consistent with the subtle onset of drought as reserves are mined and projects are forced to adapt to a new water supply condition and outlook. Average annual water table drops in the district when it rains, and when in drought. In that sense, the GMD3 Management Program provides the ongoing

regional drought resiliency program. Reference: http://law.ku.edu/sites/law.drupal.ku.edu/files/docs/law_review/v62/KLR%20Website%20Griggs_Final%20Press.pdf . The response to severity of drought under the management program relates both directly to the three drought stages of Watch, Warning and Emergency described in Tables 2 and 3 of the Kansas Drought Operations Plan, and also to the extent local groundwater reservoir inventory and infrastructure has preserved the capacity to mitigate local water shortage conditions. The Kansas Drought Operations Plan can be accessed at: https://kwo.ks.gov/reports2/climate-and-drought-monitoring-response The Kansas 2007 Municipal Water Conservation Plan Guidelines reflect the drought response stages in the Kansas Drought Operation Plan. Programs will be implemented to inform members in their use and available supply conditions with interactive water management and technology tools. A **goal** of the management program is to encourage and support regular review and updating of water conservation plans.

U.S. Drought Monitor – The U.S. Drought Monitor is produced weekly through a joint effort of the U.S. Department of Agriculture, The U.S. Department of Commerce – National Oceanic and Atmospheric Administration and the National Drought Mitigation Center. Advice from local experts throughout the nation, including the Kansas State Climatologist, is used in producing the Monitor. This composite drought map incorporates information and products from hundreds of experts from many entities and levels of government in an effort to represent the extent, magnitude, impacts and probability of occurrence. Both short term management program drought response tools like Multi-Year Flex Accounts and long-term strategies for type 2 groundwater reservoir maintenance will be employed to help determine the destiny of water use in the district. **A goal** of the management program is to develop water use, climate and conservation feedback to members utilizing annual water use report, site visits and other data to inform and assist members in their decisions affecting their drought resiliency.

State mandated water conservation plans. There are mandated water conservation plans added by the Chief Engineer as a condition of water use tied to many water rights in the district. They are intended to provide information and encourage Type (1) water conservation originating from a joint state and district initiative beginning in year 1990, with legislation passed the following legislative session. Under that law (K.S.A. 82a-733), the Chief Engineer may require applicants for permits to appropriate water, water users with relatively high use, and water users applying for any state administered grant, loan or cost-share moneys for water-related projects to develop water conservation plans. GMD3 has historically advised and assisted the state and members with completion of conservation plan requirements and review with the help of State Water Plan funding from the Kansas Water Office.

One duty of the KWO is in developing and maintaining guidelines for water conservation plans (K.S.A.74-2608). Current state guidelines for irrigation conservation plans are available at:

https://kwo.ks.gov/docs/default-source/reports-page/water-conservation-reports/2006-kansas-irrigation-wcp-guidelines-jan2006.pdf?sfvrsn=6

And for municipal (public water supply) use available at:

https://kwo.ks.gov/docs/default-source/reports-page/water-conservation-reports/2007-municipal-wcp-guidelines-aug2007.pdf?sfvrsn=4

Water conservation under state guidelines. Under statewide Kansas Water Office guidelines, water conservation is defined as:

"*The utilization of cost-effective water use efficiency practices to curtail the waste of water and to ensure that water use does not exceed reasonable needs.*"

This general definition implementing K.S.A. 82a-733 of the KWA Act and other water use considerations focuses on use efficiency, which is Type (1) water conservation activity under the GMD3 management program. Type (2) water conservation that is emphasized in our management program needs other guidelines. GMD3 will seek to develop district guidance to assist members and others in an understanding of the terms and conditions of their water right, water use agreements and conservation activities consistent with the management program. Per Subsection (g) and (h) of K.S.A 82a-733, GMD3 will review and consider approval of conservation plans and practices and retain this authority for any proposal to set plans aside or to provide due consideration thereof in the conservation activities of IGUCA's, LEMAs and WCA's.

GMD3 water conservation plan guidelines. A goal of the management program is to investigate, develop and update GMD3 water conservation plan guidelines for Type (2) conservation under separate guidance documentation to achieve the following:

1. Provide a plan template that can be used to develop a water conservation plan to meet the requirements of GMD3 management program, the state, and/or other partners, federal interests, institutions and authorities.
2. Provide considerable flexibility to develop and monitor water conservation plans based on management program desires and initiatives.
3. Provide Internet access to the Guidelines and the Plan template, so that members, consultants and other management partners can easily download the template or develop a Plan.
4. Include a subsection on source conditions and management goals.
5. Plans more useful to member water managers, so that the majority of GMD3 water users can be directly involved in the management of their local water sources and use destiny.
6. Provide for a source benefiting and consistent water conservation plan format.
7. Curtail waste of water using readily available best practices that ensure water use does not exceed reasonable needs.

Benefit-to-cost ratio effect of conservation plans. K.S.A 82a-733 requires the Kansas Water Office to conduct benefit-to-cost review for conservation plan guidelines. The more documentation obtained on the actual benefits from water conservation, the more believable are the results from a cost-benefit analysis of potential programs or activities. Once benefits and costs over the projected life of the water conservation plan have been estimated and discounted to their present value equivalents, it is straightforward to determine whether a project's conservation plan benefits would be expected to exceed its costs under classic economic theory. A common way to compare the benefits and costs of a conservation plan is to divide total benefits by total costs. The result is called the benefit-to-cost ratio, or B/C ratio. A B/C ratio greater than one indicates that benefits are greater than costs while a B/C ratio less than one indicates that costs are greater than benefits. A B/C ratio exactly equal to one indicates that costs are expected to exactly balance benefits of the water conservation plan. Alternative conservation projects can be ranked by their net benefits or B/C ratios to identify which projects are expected to provide the greatest amount of benefit to members and the district. **A goal** of the management program is to develop more information on B/C ratio calculations for the district in a separate implementation document to advise and assist the Kansas Water Office in implementing this state law.

Water flowmeters. The GMD Act under K.S.A. 82a-1028(l) provides that GMD3 has the authority to "*install or require the installation of meters, gauges, or other measuring devices and*

read or require water users to read and report those readings as may be necessary to determine the quantity of water withdrawn." GMD3 works with members and partners to provide the expert judgement in flow measurement and practical program administration to accomplish this management activity. Water measurement in its various forms is much more than just a water right compliance activity. Recognizing the difficulties of managing what is not measured, the GMD3 board was an early leader in advocating for and requiring water flowmeters and measurement reporting on all non-domestic water uses in 1991. Thousands of flowmeter inspections are conducted by GMD3 each year and feedback are provided as member service. See inspection video at: https://www.youtube.com/watch?v=exmaiZAEMnE&t=1s Measurements identify opportunities for water project improvement, showcases examples of efficient use, ties use to water level response and other valued data uses for members and the management program. Use measurement at the project level empowers and demonstrates water stewardship. Hefty GMD3 seals are installed as a member service when light weight manufacture seals are in place in order to preserve the durability of rule presumptions of existing seals or verified flow measurements. **A goal** of the management program is to support flowmeter maintenance as an important management tool to evaluate the effectiveness of groundwater management at the project level and regionally as a district.

Capping new appropriations to conserve and extend groundwater supply. Once water rights were made mandatory in the state, GMD3 adopted administrative conservation measures and conducted maximum allowable depletion rate water availability calculations and made recommendations to the Chief Engineer for each new water appropriation application. The Chief Engineer relied upon GMD3 calculations to grant or deny new water rights in the district based on a maximum allowable rate of depletion not to exceed 40% in 25 years. This conservation partnership includes recent GMD3 action to adopt a closed groundwater reservoir policy and request that the Chief Engineer close the Ogallala/High Plains groundwater reservoir to new water rights with some small use exceptions. Those small use exceptions have subsequently been reviewed by GMD3 and Board resolution 2018-5 was passed to require a minimum of offsets for any new non-domestic water right to help avoid nullifying member local source conservation efforts and not inflate appropriation totals. **A goal** of the management program is to have existing area water use potential identified to implement Board Resolution 2018-5. In addition, GMD3 will be working with well owners in a review process to evaluate current well and groundwater reservoir conditions with each administrative request to the state. The fundamental conservation policy of GMD3 in such cases is that there is no additional water available from the source beyond what is needed to satisfy existing water rights under the management program.

GMD3 member water conservation stewardship. There are extensive undocumented groundwater conservation activities by individual members within the district that are implemented as a matter of good practice and personal resource stewardship. A full review of the many water conservation activities is too lengthy to list here and may be enumerated in separate GMD3 implementation documents. Voluntary water conservation efforts in the district include:

- Water use measurement, management, reporting and evaluation.
- No-till farming methods which improve soil moisture retention.
- Crop selection and field rotations that require less water than historically needed.
- Improved irrigation system efficiency technology.
- Enrollment in voluntary sponsored programs of GMD3, state and federal partners.
- Local conjunctive management practices of surface water and groundwater where possible.

- Voluntary member conservation, including non-use of viable wells.
- Reuse of wastewater and effluent left over from primary beneficial uses.
- Use of lesser quality water where economically and technologically feasible.

GMD3 water conservation leadership. Public policy accelerates the adoption of conservation products and services through incentives, including cost sharing, regulatory relief, tax credits, rebates and technical assistance. **A goal** of the GMD3 management program is to continue providing leadership and support activities for water conservation as defined in this management program in coordination with other local, state and federal partners to conserve, extend and replenish the groundwater inventory of the district. Recent examples include:

- **Flowmeter technical assistance (FTA)** in over 2500 project diversion site visits annually by GMD3, including flowmeter sight visits, management plan audits and flowmeter verifications.
- **Ark River Conservation study (ARC)** conducted in 2005 to investigate water management and conservation needs and alternatives in the upper Arkansas river basin of southwest Kansas.
- **Western Water Conservation Projects Fund (WWCP Fund)** working through a nearly $10 million grant (2008) from the Kansas legislature to relocate interstate water damage award funds from SGF through a legislative budget proviso and grant agreement with the Kansas Water Office.
- **Conservation Reserve Enhancement Program** (**CREP**) working with the state and federal Farm Service Agency and many partners to retire water rights and transition irrigated agriculture to native grassland in parts of the Ark River basin where GMD3 provides cash and in-kind services and conduct supply verification tests for member applicants and NRCS program partner needs.
- **Water Transition Assistance Program (WaterTAP)** was promoted by GMD3, Kansas Water Congress and partners authorized under K.S.A. 2-1930 for state conservation incentives to be administered by the State Conservation Commission. Limited state funding has been available.
- **Agricultural Water Enhancement Program** (**AWEP**) agreement with USDA/NRCS to transition irrigated acres to dryland agriculture (completed) with ongoing use of Environmental Quality Initiative Program (**EQIP**) conservation tools and opportunities.
- **Regional Conservation Partnership Program** (**RCPP**) agreement with USDA. In 2015, GMD3 was awarded a $2.4 million-dollar grant from the NRCS to help incentivize Advanced Irrigation Water Management across the region through telemetry technology, remote soil moisture and flowmeter monitoring as added conservation activities.
- **Conservation Innovation Grant** (**CIG**) agreement (2016 - 19) with NRCS that evaluated mobile drip irrigation and other application innovations with the goal of federal implemented assistance for uptake of mobile drip water conservation technology in a thousand fields**.**
- **System Optimization Review** (**SOR**) with the US Department of Interior, Bureau of Reclamation (Reclamation), which evaluated the irrigation ditch delivery systems along the Arkansas River corridor for targeted efficiency improvement projects.
- **Local Enhanced Management Area** (**LEMA**) discussion and facilitation concepts and surveys with members to consider local mandatory and voluntary groundwater conservation strategies with corrective controls in priority areas of the district.
- **Water Conservation Area** (**WCA**) review and policy development to assist members and the state in developing voluntary water conservation plans for meaningful corrective controls and appropriate project plans consistent with state law and the district management program.
- **Planning Assistance to States** (**PAS**) partnering with the Kansas Water Office and the US Army Corps of Engineers in 2015 to update a 1982 High Plains Study Water Transfer Element for conserving waters of the state normally lost annually from use in Kansas.

- **Public Water Supply (PWS)** 2014 GMD3 WaterSMART study grant working with Reclamation and Kansas Water Office to examine public water supply options for systems to maintain safe drinking water in the depleting usability of the GMD3 Upper Ark basin groundwater supply that includes the IGUCA above Garden City.
- **Basin Plan of Study (POS)** GMD3 effort in 2015 with Reclamation seeking Ark River basin planning partners in the Arkansas River basin spanning the Stateline with Colorado and includes the Hamilton County river corridor outside the district for collaborative efforts addressing contaminated water and other water concerns in the shared resource that set the stage for 2019 legislative resolutions requesting partnerships and other state and federal cooperative action.
- **Value of Water (VOW)** evaluations with the Docking Institute for Public Policy (2000) and the Kansas Aqueduct Coalition and Apparet Analytics, LLC (2015) on the value of water to Kansas and the GMD3 area.
- **Proof-of-Concept (POC)** project in 2020 demonstrating the transfer of high flow Missouri River water to GMD3 conservation storage with the aim of verifying that source import water can occur and have practical potential to manage Ogallala supply decline.

Rain capture, re-use and recycle water. One way of expanding the usable supply of water is using harvested, recycled and/or reclaimed water for irrigation and other purposes. In some cases, potable water has been the only water resource available for irrigation, either because of infrastructure, use right constraints or regulation. Under suitable conditions, irrigating crops, landscapes and recreational areas with harvested, recycled and/or reclaimed water will not only increase the water available for health and human safety, but will also support the environment through economic, social and environmental benefits. Limited water usability will necessitate treatment to gain appropriate purity levels for use and the effects on supply of other users should be adequately evaluated. Like potable water, non-potable water is a vital and limited resource that requires management to avoid waste of valuable water resources. **A goal** of the management program is to implement the Kansas Water Vision to EVALUATE THE SOURCES AND POTENTIAL USES OF LOWER QUALITY WATER as part of water resource management activity in the water short environments and economy of the GMD3 area.

MYFA conservation. The MYFA law provides for flexible groundwater use from the same well over five years (**K.S.A. 82a-736).** The updated law contains two provisions for considering past implemented water management and conservation. **A goal** of the management program is for a conserve-to-preserve calculation to be considered to implement the MYFA prior conservation calculation provision and a set of evaluation criteria adopted to evaluate the long-term effects on any source of supply.

Due consideration for past conservation measures. In 2015, the Kansas legislature added policy to the Water Appropriation Act requiring the chief engineer to give due consideration to water management or conservation measures previously implemented by a water right holder when implementing further limitations on a water right and take into account reductions in water use, changes in water management practices and other measures undertaken by such water right holder. Under the GMD3 management program and the unique considerations of the district, this means the Chief Engineer will sit down and think about how to implement the new program in the GMD3 area in a manner consistent with the management program or any proposed revision (K.S.A. 82a-1042).

Surface water storage in underground reservoirs. Today on average, more than eight times the annual amount of groundwater used in Kansas leaves the state annually as river flow. So, the

conservation and management of available surface water presents significant opportunity for leadership that will find the opportunities to divert, transport and store water in the groundwater reservoir poor space in the GMD3 area. Linking natural and constructed water infrastructure to conserve and manage water supply is a key activity to add water conservation, value and to manage sustainable water supply systems for Kansas. Operational integration of surface and groundwater storage will increase water supply for all users. The significant demand annually for water (3.6 million acre-feet developed in SW Kansas alone), and the more that 60 million acre-feet of available groundwater reservoir storage space in GMD3 compels action on the water extremes in Kansas flood and drought conditions to secure minimal value supplies to meet higher value needs. The untapped potential of a cooperative groundwater reservoir storage initiative across the state may hold significant promise for added supply when surface water reservoirs are unable to hold needed water for Kansas. Available surface water flow is a limited time supply opportunity that should be harvested and conserved accordingly.

Needed action. An act to facilitate and encourage use of high flows from the Missouri river and other basin flows is needed from the Legislature of the State of Kansas and other leadership to preserve the water interests of the people of Kansas and to support a statewide water conservation development initiative in recognition of the deficient local water supply in many areas of Kansas to meet present and future water needs. Either an annual reservation of some amount of water needed to replace present unmet water demands and reasonable future need of Missouri river high flow water and flows in excess of maximum desirable streamflow that may be available from other basins for direct appropriation under the water appropriation act. For the purpose of this section, "high flow water" means river flows in the Missouri river above historical navigation support targets. Any GMD3 management program activity looking to include future agreements or contracts to purchase and transfer excess water carries a requirement to locally adopt and implement water conservation plans and practices that are consistent with the state guidelines as per K.S.A. 82a-1311a. **A goal** of the management program is to exceed state guidelines for type (1) efficiency and waste elimination activity with type (2) water conservation storage activities.

Conservation storage pore space in GMD3. In recent years the issues surrounding geological formation pore space and rock structure ownership has been raised in discussions generally connected to oil and gas operations for carbon capture sequestration into subsurface geologic formations and for ownership and management rights in topics of water rights administration, federal reserved water rights, deep formation disposal projects and in artificial storage and recovery of water. With water being an exception in Kansas, generally ownership of the surface of the land includes ownership of all that lies beneath the surface boundaries, to include mineral, rock structures and voids (David Pierce, Washburn Law School, legislative briefing, 2011).

Estate ownership and water. Ownership of the surface estate of land can be separated from one or more mineral estates below the surface of the earth, which is where one finds groundwater. The owner of the surface estate generally retains ownership of minerals not expressly encompassed by the conveyed mineral estate. Owners of minerals (oil and gas) also have the right to access the rock structure where the oil and gas are found so they can be developed, even though the mineral owner may not “own” the minerals comprising the rock structure. Similarly, a water right to use groundwater may be a right to access the water in the poor space even though the user may not own either the surface or the mineral estate. Remember that a water right is a usufruct right to use public water where ownership is not conveyed in the corpus of the water or the channel of the stream or the rock formation. Regardless of who owns the pore space of the rock formation, it is going to be connected and one cannot completely control where it goes. Pore space structure, like oil and gas reservoirs or groundwater reservoirs, is not compartmentalized beneath a single tract

of land but is interconnected by body of rock. The naturally stored usable water within the rock formations is a part of the "waters of the state" governed under the provisions of the KWA Act and the GMD Act and the management program. The GMD Act in K.S.A.82a-1021(a)(7) defines a "land owner" and includes the following: *"Owners of oil leases, gas leases, mineral rights, easements, or mortgages shall not be considered landowners by reason of such ownership."*

A natural groundwater reservoir may contain a native body of public water subject to public appropriation and management, but artificial conservation storage in geological formation poor space owned by another may be something different. For example, ownership of a surface reservoir storage space comes from acquiring the use of the surface estate and construction of the storage space. Use of a natural water course is provided in Kansas policy for private conveyance of water (K.S.A. 42-303) but a constructed surface reservoir on a surface water course for possessed conservation storage requires easement or ownership of the surface estate. Groundwater reservoir pore space may be replenished or filled with non-native water under a managed program where there is reasonable consideration to satisfy prior groundwater rights to native supply. This is based on the theory that no owner of either the mineral estate or the surface estate or of a water right should be allowed to hold management improvements to natural water storage infrastructure for ransom. **A goal** of the management program is to recognize ownership and use potential of natural vs. artificially constructed water storage mechanisms and any retained ownership of artificially stored water in rock formation pore space owned by another as key factors in the question of whether any pore space use easement may be necessary.

Conservation in preparing for water importation. As society confronts the challenges of managing and delivering enough fresh water to meet the needs of agricultural, municipal, industrial, and environmental users, multiple sources must be managed with type (2) conservation from available sources. The Kansas Water Transfer Act state that no water transfer shall be approved unless a number of provisions for water conservation have occurred and have been previously implemented and that the benefits to the state outweigh the benefits for denying such transfer of water (K.S.A. 82a-1502(b) and (c)). Based on the above, **a goal** of the management program is to document the conserve-to-preserve activity in the district to fulfill the purposes of the Water Transfer Act requirements and exceed statewide conservation plan guidelines by emphasizing Type (2) water conservation. This will aid the efforts to deliver additional inflows into the more than 60 million acre-feet of available underground storage space in GMD3.

Culture of conservation. Growing the market for water conservation in a culture of market driven uses involves a strategy of reaching out to specific industry groups and areas which have comparatively low rates of participation and engagement around water conservation and efficiency. As more members participate, vendors can develop economies of scale and more cost-effectively run active and passive programs. "Growing the culture" naturally occurs as participation rates increase across the district. While programs might lose their potential for scale as more members participate, the proportion of the population engaged increases.

<u>Targeting designated Groundwater Management Areas (GMA).</u>

A GMA is any targeted area in the district designated for unique specified groundwater management program activity. GMD3 conservation and/or management activity may exist to accomplish special private, corporate or governance purposes and use one or more institutional tools uniquely applied through the district management program in each GMA.

Conservation barriers. GMD3 and other Kansas GMD's pursued forming special GMAs for corrective controls in 1977, but found a lack of local and state authority, which was considered barriers in attempting to manage groundwater supply and use. Local or state permitting of all non-domestic water use was not required in Kansas at the time and the extent of water use was not known. The GMD3 Board immediately requested an official moratorium on granting new water rights by the Chief Engineer for an area in the Arkansas River basin above Garden City to allow work for data and policy development on over-allocated water short areas. GMD3 learned that conservation barriers can be institutional as well as cultural, technological and legal in nature.

Mandated permitting and IGUCAs. Legislation was successful in 1978 to add state policy in the KWA Act requiring permitting of all water rights to define water use across the state and to add policy in the GMD Act providing authority for a GMD or a group of GMD members to initiate special GMA corrective control action in their GMD. That GMA tool was called an Intensive Groundwater Use Control Area, or "IGUCA." It was designed as a request made to the Chief Engineer, who then must conduct a process to consider the need and formation of the IGUCA. The IGUCA tool, once requested by a GMD, involves a prescribed review and fact-finding process where the Chief Engineer conducts one or more public hearings and can result in an order of the Chief Engineer imposing corrective controls on water use. For areas outside GMD's, the legislature extended the IGUCA tool for the Chief Engineer to initiate proceedings on his own initiative. A few IGUCA management orders have been developed and issued to implement mandatory corrective controls onto groundwater rights in GMA's across the state.

GMD3 Upper Arkansas River IGUCA. The Upper Arkansas River IGUCA was requested by GMD3 in 1984 as a GMA to replace the GMD3 requested 1977 moratorium on new appropriations in certain counties with high vested right (pre-1945) amounts. The request was to extend corrective controls from the Colorado and Kansas Stateline in a corridor along the river across GMD3. This IGUCA was ordered by the chief engineer after significant public process, testimony and recommendations of the Board and district members. See map of the IGUCA area in the Appendix. Any revision action should include GMD3 review and recommendations implementing the management program. Additional state information on the Upper Arkansas River IGUCA is available at: http://agriculture.ks.gov/divisions-programs/dwr/managing-kansas-water-resources/intensive-groundwater-use-control-areas/arkansas-iguca

Corrective controls. Water right administration under the prior appropriations doctrine is the most direct form of corrective control provided by the Kansas legislature for water short supply conditions. Protecting a prior right generally involves a complaint, opposition to an administrative action or a request to secure a water entitlement. Beyond water right administration, corrective controls are considered new program actions to secure corrections to water supply decline problems. Corrective controls are intended to benefit future supply in addition to present use constraints. It is well established that the supply problem conditions set forth in K.S.A.82a-1038 of the GMD Act exist across the entire GMD3 area for the OHP groundwater reservoir. These conditions have been perpetuated in the customary approval decision processes of the Chief Engineer. Corrective controls in the declining OHP aquifer must add new controls as Type (2) water conservation to maintain aquifer storage and improve future supply under the management program. **A goal** of the management program is to assure new corrective control benefits fall to all members, and that members may not benefit from higher groundwater use than their peers in obtaining additional use benefits or to impose new critical well risks from voluntary corrective

control plans. GMD3 feedback to members on their reported water use and aquifer condition may advise and assist in evaluating the merits of volunteer corrective controls.

Special rule conservation areas. Another GMA tool identified by the management program is a special rule conservation area with controls requested and established as enforceable policy or state rule corrective controls. These concerns may be quantity, usability or use practice related concerns that require administrative standards to manage or encourage efficient groundwater use while protecting useable supply. K.A.R. 5-23-4(c) is a special rule for a water quality control area in parts of Seward and Meade Counties. Naturally occurring saltwater upwelling from Upper Permian Age formations invade into the overlying connected Ogallala groundwater reservoir formation threatening water usability depletion in the Ogallala supply of the area.

Targeted water rights buy-back. State buy-back of water rights can occur, if funded, through the administrative activities of the KDA Division of Conservation (K.S.A. 2-1915). The Division of Conservation shall make water right transition grants available only in areas that have been designated as target or high priority areas by a GMD and the chief engineer or priority areas outside of any GMD as designated by the chief engineer.

LEMA. The Legislature added a new GMA tool in 2012 for GMD's after more than a decade of development work by Northwest Kansas GMD4 and partners. The Local Enhanced Management Area (LEMA) statute (K.S.A. 82a-1041) provides a procedural structure for the development of LEMA management plans to be adopted by a GMD and recommended to the chief engineer.

LEMA plans. A LEMA plan is a tool of local leaders and the GMD3 governing body to address local groundwater concerns. When members of GMD3 come together to seek ways to extend supply and reduce the rate of groundwater decline, the GMD3 Board has the authority to adopt a LEMA plan and seek acceptance by the Chief Engineer, who must consider only the requested plan for implementation. GMD3 has adopted LEMA plan policy that a proposal can be recommended to the GMD3 Board by members as a priority GMA to be further managed with infrastructure development and/or corrective controls in the public interest. Basic steps for establishing a GMD3 LEMA involve formulation of a plan generally accepted by area members, presentation of the plan to the Board, Board adoption of the proposed plan, Board request for a LEMA to the Chief Engineer based on the plan, two prescribed public hearings considering the proposed plan, and a decision order of the Chief Engineer approving, returning, or rejecting the LEMA. Any LEMA plan proposed to the Board for adoption shall include: 1) A clear groundwater management goal; 2) A basis for the proposed boundaries; 3) Evidence in the record of plan development that multiple alternatives were formulated for setting corrective controls on member water rights, including use of the principle of prior appropriation; 4) Reasoning for the use or rejection of each alternative; and, 5) The recommended strategy for determining the will of the eligible voters of the district having property rights within the proposed LEMA area. **A goal** of the management program is to support LEMA development with facilitation resources and evaluate goals for corrective controls, including impacts to property valuation and economy.

Voluntary consent agreements. A voluntary agreement can be a highly effective tool to obtain regulatory, conservation or other water management needed outcomes. This tool was used early in a federal court consent decree of 1910 to establish the Associated Ditches of Kansas along the Upper Arkansas River. Voluntary agreements for water management consistent with the management program are highly supported and encouraged by GMD3. Today, the voluntary

consent agreement tool includes various forms in conservation plans, water banking and other water management activities that benefit from voluntary consent agreements. **A goal** of the management program is to encourage use of consent agreements that are in harmony with the management program.

"Water Conservation Area (WCA)." In 2015, the Legislature provided an additional GMA tool referred to as a WCA. A WCA is a Water Appropriation tool where any water right owner, or group of owners can develop a water conservation plan for consideration and agreement of the Chief Engineer to commit water rights to conservation through voluntary corrective controls consistent with other laws and the public interest. Public interest includes the GMD Act and GMD3 management program and recommendations of the governing body. By order of the Chief Engineer, a WCA plan consent agreement can allow new reallocated use authority that temporarily moves base water right allotments under a very junior priority of right in relation to other prior rights. WCAs can encourage conservation that is properly quantified through volunteered corrective controls and may be used as an agreement tool to document voluntary water conservation. Any proposed additional pumping authority made available for a well should be carefully evaluated to avoid negating prior conserve-to-preserve local conservation efforts and adding risk of critical well conditions to near-by non-participating well owners.

Changing WCA plans and agreements. With the consent of all participating water right owners in a WCA, the Chief Engineer may amend the agreement and order to modify corrective controls or boundaries, add or remove water rights, terminate the WCA or make other changes requested by the water right owner(s). Under the management program, GMD3 will review each proposal, WCA change or extension and provide recommendations to the Chief Engineer that implement the management program. GMD3 supports and encourages the voluntary groundwater reservoir maintaining corrective controls in WCA consent agreements that are consistent with board policies and management program. **A goal** of the management program is to adopt and enforce policy needed to implement WCA's in harmony with other concerns of the management program. For more state information on the WCA tool, see: http://agriculture.ks.gov/divisions-programs/dwr/managing-kansas-water-resources/wca.

Paper water. Members depend on the normal protections of rules adopted for the district and the judgement of the local Board of directors concerning the public interest of the management program. Local management strategies cannot succeed as designed if rules are waived unless careful evaluation of the effects on the management program occurs and is made available to support wise decisions. **"Paper water"** is considered a legitimate water right on paper but lacking divertible supply from the source as authorized. "Paper water" on wells in a depleted local source of supply must be allowed to remain dry and the demand unsatisfied in the absence of adequate demonstration of no potential impairment under actual conditions present or any new water proposed to replenish the local supply. "Paper water" ownership may not carry a right to relocate pumping or chase remaining depleting groundwater supply at the cost to others relying on the local source of supply and a management program that encourages type (2) water conservation. Moving "paper water" to better yielding well locations may deny supply longevity to other member wells with prior rights to a depleting supply. It is important to review hydrological community conditions and evaluate them under the GMD3 well drawdown guidelines.

Water bank conservation review. Water banking policy has different application in declining vs. non-declining groundwater reservoir areas. The Central Kansas Water Bank is the only

chartered water bank in Kansas operated in close coordination with GMD5, officed in Stafford Kansas. Banked credits were set aside Water bank tools that include aquifer maintenance crediting, water savings accounting and safety deposit box accounting can have both good and bad implications on the GMD3 management program of a declining supply. Similarly, statewide statutory provision for bank-like tools under "Flex Accounts," LEMAs and WCA's with "carryover" use credit provisions can affect aquifer management. Banking "credits" beyond perfected annual use right constraints, if needed, from a groundwater reservoir may raise conservation use and possession questions in the predicable future times of shortage. Questions occur whether lawful possession of stored water may happen, and any pore space use easement needed for possession of water storage lawfully obtained. These banking tools and questions can have a profound impact on the management program for a declining supply and the preservation of basic water use doctrine purpose for state groundwater policy in the GMD Act. GMD3 will review each water bank or bank-like proposal to evaluate effects for consistency with the management program public interest.

Managing water by the drop. Member management of their water use by the drop helps maximize water value and is being achieved through the adoption of field scale drip irrigation technology for agriculture and municipal applications in southwest Kansas. This technology allows water users to avoid the big water thief of direct evaporation during field irrigation. Drip or other precision water application technology generally requires management investments that improves water value as a conservation practice. For example, one 15 gallon per minute (GPM) set of leeks or preventable evaporation loss during field irrigation sun and wind conditions can mean material water loss and expense over one irrigation season or 120 days. Under that loss scenario: 1 hour = 900 gallons, 1 day = 21,000 gallons, 1 month = 648,000 gallons and 4 months = 2,592,000 gallons. In perspective, that equates to 7.95 acre-foot or 95.5 acre-inches of water. Drip technology helps avoid the inconsistency and the evaporation thief.

Mobile Drip
A combination of price and non-price strategies are needed for supply security improvement. Planning, regulation, education and the uptake of water efficient technologies are important in the GMD3 management program where drops of water matter.

See video at: https://www.youtube.com/watch?v=3yT9yiyjB-4

GMD3 Ark River Management Activities

The management program for Southwest Kansas includes management considerations and activities associated with the Arkansas (Ark) River. Ark River flows from upstream snow melt, runoff events, groundwater reservoir discharge and surface reservoir flow regulation and storage release. The Ark River is a historically significant source of renewable water supply for southwest Kansas use and storage in a highly developed and regulated basin that necessitates management activity by GMD3 in the public interest. Since the decade of the 1970s, the mining of groundwater near the Ark River created groundwater storage space that has conserved available river flows into district storage with the river system effectively operating as a terminal reservoir at the end of the closed basin affected by the Kansas and Colorado interstate compact where use greatly exceeds inflows.

Authority. Authority for the GMD3 Ark River Management (ARM) program activities are in statutes that include without limit:

- K.S.A. 82a-1020 declaring the purposes of the GMD Act and establishing the right of water users to determine their destiny regarding water use;
- K.S.A. 82a-1028(g) to construct, operate and maintain such works as may be determined necessary for drainage, recharge, storage, distribution or importation of water, and all other appropriate facilities of concern to the district;
- K.S.A. 82a-1028(i) to contract with persons, firms, associations, partnerships, corporations or agencies of the federal government, and enter into cooperative agreements with any of them;
- K.S.A. 82a-1028 (m) provide advice and assistance in the management of drainage problems, storage, groundwater recharge, surface water management, and all other appropriate matters of concern to the district;
- K.S.A. 82a-1028 (n) adopt administrative standards and policies relating to the management of the district which are not inconsistent with the provisions of the GMD or the KWA Acts;
- K.S.A. 82a-1028(o) and (p) to recommend rules and regulations for the conservation and management of groundwater resources;
- K.S.A. 82a-1028(q) to enforce by suitable action, administrative or otherwise, rules and regulations adopted as provided by subsection (o) or (p);
- K.S.A. 82a-1028(r) to enter upon private property within the district for inspection purposes, to determine conformance of the use of water with established rules and regulations, including measurements of flow, depth of water, water wastage and for such other purposes as are necessary and not inconsistent with the purposes of the GMD Act;
- K.S.A. 82a-1028(u) to recommend to the chief engineer the initiation of proceedings for the designation of a certain area within the district as an intensive groundwater use control area.
- K.S.A. 82a-1029 adopt the official management program for the district area
- K.S.A. 82a-1041 to recommend Local Enhanced Management Areas;

Basin water resource change. Over time, hydrological change has occurred in the basin from a variety of activities, including development of surface water reservoir storage and transfers, re-regulation of river flows, direct diversion development, groundwater well pumping development, land use changes and water use efficiency improvements. These have caused fewer and less intense rain runoff flows, riverbed and banks to narrow, diminished beneficial system flushing, diminished recharge to adjacent groundwater reservoirs, cottonwoods and tamarisk salt cedar to proliferate, floodways to fill with sediment and water quality to decline. Changes in the resource

system have created mounting water management and supply concerns all along the basin. Opportunities exist to provide leadership and management assistance in the district to address natural resource concerns as part of a GMD3 ARM program.

An Ark River problem breach of the bank of the intermittent river reach between Garden City and Holcomb, Kansas. Pulse river flows must fill surface space and exceed underground reservoir inflow rates before continuing on downstream.

Water development. Water management concerns that influenced the two states of Colorado and Kansas to enter into an Arkansas River basin compact agreement also influenced the adoption of the GMD Act in Kansas in 1972 and the formation of GMD3 in 1976. Immediate action was taken by GMD3, working with local and state partners to address special GMA needs as discussed earlier in the GMD3 Water Conservation Program section. Significant additional need and opportunity exists for GMD3 to continue collaborative work with other local, state and federal interests, institutions and authorities to address the unique water resource needs of Arkansas River basin affecting water supply and water usability under the management program.

GMD3 Upper Ark GMA. The portion of the basin above Garden City to the Colorado and Kansas Stateline that include the IGUCA, ditch service areas and tributary underflow affecting supply within a 25-year prospective evaluation period is considered the GMD3 Upper Ark GMA for the purposes of the management program; an area to be further defined by mapping from the next update of the GMD3 groundwater model in 2020. For this area, native river flow, runoff events, reservoir deliveries, reservoir spill supply, groundwater reservoir water level management, irrigation return flow management and other activities upstream generally maintain river flow year-round to a point near the Kearny–Finney County line above Garden City. The problems of dwindling supply, river sediment accumulation and water usability depletion due to poor river water quality are significant growing concerns in the GMD3 Upper Ark river reach.

Upstream reservoir development. The loss of large spring freshet runoff flows out of Colorado that historically flushed the braided river system down basin to wetter climate has now left few options for affordable local solutions to river basin problems under a highly regulated and multi-state river flow regime. Sediment load transported to points of water delivery and diversion cause

accumulation of remaining sediment load that fills the floodway, increases flood risk and restrict surface water diversion and operating capacity of distribution systems. In addition, the river's poor and declining water quality also creates water usability depletion of the water resources of GMD3, affecting the fertility of soils receiving irrigation water within river water delivery areas and in adjacent groundwater use areas. Under such conditions, land valuation is diminished, and water quality threatens public health and the health of the local economy.

Lake McKinney. Lake McKinney is a private irrigation water storage lake owned by the Garden City Company. From study conducted by Lee Rolfs during the KS v. CO Original Action #105 case, Lake McKinney originally cost $350,000 in 1906 and was the largest manmade lake in Kansas at the time. It was called Reservoir No. 5 at first but was renamed after J.R. McKinney, the sugar beet pioneer. In 1909, capacity increased to 31,063 acre-feet at a gage height of 3,030 feet above mean sea level, a maximum depth of 30 feet and surface area of 3,200 acres. At the time of vested right determination for the associated Great Eastern ditch system, all water deliveries had to pass through the lake, and transit loss needs associated with Lake McKinney operations factored into the determination of the vested right. The capacity of Lake McKinney has since been significantly reduced due in large part to declining available river flows in the basin in the 1970s. Lake McKinney remains an important local groundwater management feature of a ditch system that provides deep percolation losses that replenish area groundwater supplies.

Water quality. Arkansas River basin lateral flow into the state and district as Ogallala/High Plains (OHP) groundwater reservoir underflow is generally of good quality. However, water entering the state as Arkansas River flow is has seen high levels of contamination from a number of elements that include sulfate salinity and uranium. In addition to concerns of other contaminants, high radio nuclei levels have a significant effect on water treatment costs to restore water usability for public water supply and other systems. Estimates from the Kansas Geological Survey of the weight of uranium coming into Kansas annually from Colorado via the Arkansas River are concerning, indicating 10 tons annually delivered to Kansas each of 2017 and 2018.

Colorado Uranium delivery estimate results for the Arkansas River near Coolidge. Data and estimates for approach A, based on average annual flow, average annual specific conductance, and estimated average annual uranium concentration for each year (from D. Whittemore, KGS Open-File Report 2017-2, updated January 2019 and February 2020). See: http://www.kgs.ku.edu/Hydro/Publications/2017/OFR17_2/index.html

Year	Average annual Sp.C., µS/cm	Average annual uranium concentration, µg/L	Average annual flow, ft^3/sec	Average daily uranium load, kg/day	Annual uranium load, metric ton/yr	Annual uranium load, ton/yr	Annual uranium load, lbs/yr
2012	4,271	73.0	28.7	5.13	1.88	2.07	4,140
2013	4,395	75.9	26.9	5.00	1.82	2.01	4,020
2014	3,813	62.7	92.1	14.1	5.14	5.68	11,400
2015	3,230	50.1	196.1	24.1	8.78	9.68	19,400
2016	3,285	51.3	201.5	25.3	9.25	10.20	20,400
2017	3,324	52.1	234.6	29.9	10.92	12.03	24,100
2018	3,409	53.9	206.6	27.2	9.95	10.96	21,900
2019	3,401	53.7	186.2	24.5	8.93	9.85	19,700

Water contamination reduces usability. The contamination of the Arkansas River basin water is diminishing the utility of the water and in some instances creates problems that must be addressed at significant cost to local water users. Local irrigators who rely on surface water from river flows must run water through plastic pipes beneath their pivot systems because the saline river water is highly corrosive and will collapse a galvanized steel pipe sometimes within a single growing season. Higher volumes of river water must be used for irrigation than would be the case if the water were less saline, and often producers must either blend or run groundwater onto their fields after applying the water from the river to mitigate the effect of the salinity of the river water.

Water usability depletion. As reviewed in the 2015 federal Reclamation Basin Plan of Study, the contaminated river water from Colorado deep percolates into the subsurface and replenishes and contaminates the groundwater under the riverbed and ditch service areas of the basin. The saline nature of the water reduces its safe use and reduces crop yields. Mitigation efforts are employed to dilute the river water with fresher local groundwater for irrigation in the ditch service areas where possible, with return flows back to the groundwater reservoir continuing the water usability depletion of the OHP groundwater reservoir. The declining surface water and groundwater quality also greatly increases the operation and maintenance cost of irrigation systems due to its corrosive effects on water diversion works.

Public drinking water supplies. Within GMD3, the cities of Lakin, Deerfield, Holcomb and Garden City have experienced a decline in water quality due to infiltration of river water near their city well fields. The City of Lakin is a district member that recently had to construct a nanofiltration water treatment facility at great local expense to get their drinking water within the Environmental Protection Agency's (EPA) maximum contaminant limit (MCL) for uranium. The community must now bear an ongoing water usability depletion cost of millions of dollars and 15% loss of supply permanently disposed. The water extracted from the Deerfield and Holcomb wellfields has been within safe drinking water standards. However, it has been deteriorating and water usability is depleting. Those cities must develop additional freshwater sources and treatment solution and explore additional sources of reuse supply. **A goal** of the management program is to support efforts to provide clean drinking water and mitigate water usability depletion. These efforts are not assessing involuntary compact curtailments or violations. Rather, they are seeking to avoid compact deficiencies and mitigate public health and welfare concerns of interstate river flow.

Federal partners. GMD3 works with federal partners and program opportunities for assistance in projects consistent with the management program and the needs of members and management partners. For example, GMD3 worked with the US Department of Interior, Bureau of Reclamation (Reclamation) and Kansas Water Office to evaluate public water source options in the river basin above Garden City. The purpose was to help identify options to preserve safe drinking water, considering the deteriorating water quality and declining groundwater reservoir levels. The 2014 study included the cities of Coolidge, Syracuse, Kendall, Lakin, Deerfield, and Holcomb to identify possible solutions, including construction of new facilities, infrastructure, and collaboration efforts. The 2014 study identified local potential options for future public drinking water supply and need for added study.

Federal boundaries. Federal agencies have regional administrative area boundaries that may unintentionally function as institutional barriers limiting communications and collaboration within the proposed study area by potential partners and stakeholders. Each area office has developed its

own set of stakeholder partners that are not normally involved in concerns or response projects outside of the agency office administrative area. Viable solutions to address the water quality problems across the proposed interstate study area may depend significantly on an added level of success in overcoming operational boundaries of federal agencies and other potential study partners in the study area. Federal agencies with operation office boundaries that end at the Colorado-Kansas Stateline in the proposed basin study area include: Reclamation, US Army Corps of Engineers, EPA, US Geological Survey, and the US Fish and Wildlife Service.

2019 Kansas Legislative Resolutions. SR1729 and HR6018 were identical in message as passed by the respective houses of the Kansas legislature in 2019 session. They requested the federal government aid in addressing water quality issues in the Arkansas River Basin in Southeast Colorado and Southwest Kansas and for state and local partners, including GMD3, to cooperate in addressing the prevalence of radionuclides in the waters of the Arkansas River Basin. See SR1729 in the appendix. In response, the Kansas Water Office, Kansas Department of Health and Environment and the Kansas Department of Agriculture worked with the Kansas Geological Survey and GMD3 in a two-year Mineralization Study, with free drinking water testing provided to participating well owners. **A goal** of the management program is to advocate and participate in interstate basin water usability improvement efforts with federal and interstate partners.

Compact. The Kansas-Colorado Arkansas River Compact (Compact) was negotiated in 1948 between the States of Kansas and Colorado. Article I of the Compact provides its purpose:

- Settle existing disputes and remove causes of future controversy between the states of Colorado and Kansas, and between citizens of one and citizens of the other state, concerning the waters of the Arkansas River and their control, conservation and utilization for irrigation and other beneficial purposes.

- Equitably divide and apportion between the states of Colorado and Kansas the waters of the Arkansas River and their utilization as well as the benefits arising from the construction, operation and maintenance by the United States of John Martin Reservoir Project for water conservation purposes.

The Compact does not allocate specific quantities of water to each state, but rather provides for maximum release rates for each State from the conservation pool. A provision of the Compact requires releases from John Martin Reservoir (JMR) storage be applied directly to beneficial use, without storage after release. The reservoir is located approximately 60 miles west of the Stateline and has an available capacity for irrigation water supply of approximately 338,000 ac-ft. The JMR has an effective priority date in Colorado of 1948, though the Compact operations are not subject of a Colorado Water Court Decree but is state law in each state and also federal law.

Additionally, the Arkansas River Compact Administration (ARCA) operates the Compact, investigates concerns and develops interstate agreements as resolutions. Resolutions include those concerning an operating plan for John Martin Reservoir (1980 Operating Plan) as amended which establishes separate accounts in the JMR for users in Colorado and for Kansas along with related operating provisions affecting basin water use. ARCA also adopted a resolution concerning an offset account in John Martin Reservoir for Colorado post compact groundwater pumping as Amended March 30, 1998 (Offset Account). The Offset Account is provided and regularly reviewed to allow Colorado replacements to stream flow depletions caused by post-compact well pumping. As such, the Offset Account is not an additional water supply, but water that Kansas

should have received if not for the junior Colorado groundwater pumping. Additional operating accounts are regularly requested by the state of Colorado for system efficiency improvements that require careful study to consider further development in Colorado and Kansas. **A goal** of the management program is to advocate for an interstate water management support account to support state staff efforts to inform interstate water management work.

Western Water Conservation Projects Fund. The KS v. CO original action no. 105 cash damage award to Kansas, after reimbursing the state for cost to litigate, was split 1/3 to the State Water Plan Fund (SWPF) and 2/3 to the Water Conservation Projects Fund (WCPF) for use in the area affected by the compact violations. The statewide Water Plan portion was used primarily as state cash cost share funding to create the Kansas Conservation Reserve Enhancement Program (CREP) under contract with USDA. However, several state legislative budget cycles resulted in removal of most of those damage funds from the Kansas CREP.

Local leadership. The 2008 Kansas Legislature provided for GMD3 to administer WCPF to assure those public funds would be preserved from legislative budget sweeps for the intended purposes and created an efficient way to accomplish the purposes of the WCPF. This also allowed the investment interest on the principle fund to also accrue to those purposes under the fiduciary care of GMD3 and to leverage the fund with other granting opportunities. Projects funded in whole or in part by the WWCPF must be in the area impacted by the Arkansas River Compact and meet eligibility requirements and goals in K.S.A. 821-1803 and Senate Bill 534. The WCPF became the Western Water Conservation Projects Fund (WWCPF) with project goals that are **adopted as goals of the management program** to do the following:

1. *Maximize general public good (public interest).*
2. *Maximize efficiency of call water for ditch irrigation (low transit losses).*
3. *Maximize benefits of high river flows to improve recharge.*
4. *Mitigate water quality problems in surface and groundwater.*
5. *Reduce consumptive use of water to help stabilize the system.*
6. *Improve the stability of the hydrologic system for irrigators.*
7. *Address compact compliance.*

Under a state legislative budget proviso in SB 534 and KWO Grant Agreement, the Arkansas River Litigation Fund Committee established in 2005 became the advisory committee to the GMD3 board, who in turn manages the funds, approves projects and expenditures, and makes requests to the KWO Director for approval as consistent with grant purposes, in consultation with the Chief Engineer, KDA/DWR. An annual audit and activities report to the legislature is provided by GMD3. The 2019 GMD3 Legislative Report may be found at: http://www.gmd3.org/about/special-meetings-and-committees/

Ark River Watershed Group. GMD3 will continue to provide leadership in considering development of an Ark River Watershed group. All stakeholders share concerns regarding declining surface and groundwater quality, insufficient water supply, occasional flood flows, state and private land management, natural resources management, and intermittent and interruptible streamflow. The water quality within the upper portion of the Arkansas River in Kansas is very poor due largely to diminished stream flows, underlying geology of irrigated fields upstream of the proposed area, and other uses. The Kansas Department of Health and Environment (KDHE) has identified this stretch of the river as impaired waters due to gross alpha (bundled with uranium), fluoride, total suspended solids, boron, selenium, and sulfate.

GMD3 Lower Ark GMA. The river reach below Garden City and adjacent areas of the IGUCA and tributary flows affecting the benefits arising from the existing natural and constructed water infrastructure and system operations under the GMD3 management program is considered the GMD3 lower Ark GMA. This area is to be further defined by mapping in the next update of the GMD3 groundwater model in 2020. River flow at the Garden City USGS river gage is now a rare occurrence beyond local public infrastructure discharge. The river reach below Garden City has essentially become a closed basin where all flows enter the area become conservation storage in the OHP groundwater reservoir. Little or no discharge occurs downstream out of the district below Dodge City. Groundwater development and loss of surface inflows to the GMD3 Lower Ark GMA that historically replenished adjacent groundwater reservoir supply prior to regional mining and formation of GMD3, made it necessary to apply groundwater management activities immediately upon the formation of GMD3 to mitigate supply problems, limit additional appropriations and address issues associated with the relocating of wells closer to the river channel. **A goal** of the management program is to have state water planning recognize the importance of recognizing rivers and aquifers as natural Kansas water infrastructure and using natural water infrastructure to manage transit loss river inflows into groundwater storage in the GMD3 Lower Ark GMA to improve storage and water management efficiency.

Declining interstate pulse flows. Pulse flows are flows from runoff events down normally dry streams. Over time, the GMD3 Lower Ark GMA river reach has lost the seasonal flushing flows from upstream spring snow melt and runoff events. Declining pulse flows diminish supply to area GMD3 member water rights. Groundwater mining has nearly eliminated groundwater reservoir discharge losses except for a reach of perched alluvial water table in the vicinity of the town of Cimarron following surface water diversions by ditch rights when pulse flow supply becomes available. The rare pulse flow that now occurs in the GMD3 Lower Ark GMA deep percolates into adjacent groundwater reservoirs as critical groundwater reservoir storage for the area. The lack of regular river flow also creates similar land management and flood control problems as occur in the GMD3 Upper Ark GMA. See graph of *Difference in Arkansas River Flow Between Syracuse and Dodge City Adjusted for Irrigation Diversions* (KGS 2018) in appendix. **A goal** of the management program is to protect and enhance management of flood and pulse flow events to replenish underground reservoir storage and examine other sources to add ecological benefits, flow water features and district storage inflows while limiting or reducing flood risks.

Pre-compact water rights. There are vested rights (pre-1945) and pre-compact (1949) water rights in the portion of the Arkansas River IGUCA between Garden City and Dodge City that have a right to a cumulative rate of diversion of more than 200 cubic feet per second (CFS). Since the time of district formation and upstream reservoir construction, large extended river flow events have been rare in the reach of the GMD3 Lower Ark River GMA. In actions that seek to meet pre-compact water supply needs during lower wet river conditions below the Garden City gage, state permits have authorized up to an additional acre foot per acre for existing surface water ditch company acreage in the GMD3 Upper Ark GMA without exceeding the total authorized amount of all vested water rights of said irrigation ditch companies**,** but only when 200 CFS average daily flow is measured at Garden City with continuous river flow measured to the Dodge City river gage. In the opinion of GMD3, this GMD3 Lower Ark GMA senior flow criteria has become a standard of practice and **a goal** of the management program adopted to

preserve river supply to pre-compact water rights during wet river conditions as a delivery of an entitled supply to senior water rights.

Ark River IGUCA review or revision. The Arkansas River IGUCA order within GMD3 currently applies little additional corrective control not already superseded by administrative rules or practices. Relocating groundwater wells closer to the river channel in excess of ten percent (10%) is a remaining administrative limitation in place under the IGUCA order that has recently been waived in WCA cases and may be best converted to administrative rule or re-evaluated. Several modifications to the first IGUCA order from the GMD3 request and hearing process have occurred without the benefit of public process or GMD3 management program recommendations. Under statewide rules adopted by the Chief Engineer, the Arkansas River IGUCA is required to have periodic formal review now more than three years past the 7-year state deadline. **A goal** of the management program is to advise and assist in any review or update of the Ark River IGUCA consistent with the management program. GMD3 will assist and advise the Chief Engineer in each proceeding or review to consider changes to the Upper Ark River IGUCA corrective controls established more than 32 years ago and provide recommendations of the governing body.

River navigability for title and management program activity. The Ark River in the GMD3 area should be fully utilized for groundwater reservoir recharge purposes and other natural and managed resources benefits. The obvious effect of water use development in the basin on what may be considered "normal high-water mark" raises a resource management reality that "one cannot manage what one cannot define." Management challenges today include the lack of delegation by the Kansas legislature to any person or agency to manage the state-owned land in title as a navigable stream defined and conveyed to the state by the federal government at the time of statehood; a federal doctrine called "navigability for title." For GMD3, this ownership and boundaries issue starts with the 1874 survey conducted shortly after the January 1861 time of statehood. The terminology on most land deeds include the phrase "plus or minus accretions" which is confusing in a diminished river flow regime. Boundaries raise a set of property and easement questions that are intertwined together with the history of river flow changes under the activities of man and navigable stream law for the basin across GMD3. The GMD3 Ark River riparian interests under the management program include the management of the river supply and natural infrastructure for water supply distribution and diversion, groundwater reservoir storage benefits and the associated supply concerns of water usability depletion. To manage this, practical state land boundary lines along the Arkansas River in GMD3 are needed. In western states and southwest Kansas, depleted groundwater reservoirs are used as parking lots to store water by substituting surface water use for groundwater pumpage (conjunctive use) or directly recharging groundwater with surface water (managed groundwater reservoir inflow). Investigations, proof-of-concept and demonstration projects will be conducted to further develop management strategies for the Ark River natural resources in southwest Kansas.

GMD3 Outreach, Advocacy and Public Education Activities

The high value of water in Kansas is widely recognized at all levels of government that includes your GMD3 as well as by a number of stakeholder groups and the general public. Additional action at the local, state, and federal level is necessary to ensure future generations of Kansans have a safe, reliable source of water to fuel our state's growth. Policies, programs, newsletters, presentations, websites, documentary specials, public meetings, school courses, testimony and other educational efforts are all part of the GMD3 outreach program. Purposes of GMD3 under K.S.A. 82a-1020 are to promote the management, conservation and use of the district groundwater resources for the stabilization and improvement of agribusiness benefits relative to national and world markets. GMD3 has a goal to assist and advise the soft infrastructure of information systems that represent and inform members and partners on local, state, and national issues affecting members and Kansas.

1. Through pro-active involvement and dedication of resources, GMD3 will seek to inform, shape and influence public policy and legislation affecting local groundwater management, district member interests, and the operations and funding of the district management program.

2. GMD3 will enhance and expand partnerships and working relationships with key elected and appointed officials to advance Southwest Kansas perspectives on proposed legislation and regulations at the state, interstate and federal levels that may affect water resource interests.

3. Member and public support will be required in order to achieve the various activities and methods of the management program. GMD3 will expand its efforts to actively engage members and the public through original initiatives and cooperative activities for:
   a. Promotions of program activities and access to program implementation documents, website postings and other social media, including a YouTube channel of informational videos, with a purpose of reaching and engaging all generations of water users, young professionals and potential partners.
   b. On-site project signage, resource education stations, community public water awareness features and water and agriculture benefit promotions.
   c. Conduct education activities to push water saving measures and practices, particularly those which maintain the economic benefits of water use, such as alternate crops, use of technology and irrigation scheduling to reduce waste.
   d. GMD3 support and the results of research on water conservation methods.
   e. Stories and strategies from those who are using less water than their peers.
   f. Use proof-of-concept and demonstration projects to help producers to economically reduce net water supply loss. (CIG project with USDA, Master Water Manager Certification, K-State Research and Extension farm projects and other water management projects to provide valuable examples to encourage uptake in water saving efforts.)
   g. SW Kansas Water Center collaboration with management program partners will consider development to meet needs for water places, uptake of water resource knowledge of water values and capacity for wise water management for healthy SW Kansas communities.

GMD3 State Water Planning Coordination Activities

As a special district that conducts local activities in water planning, policy development, water use and supply, GMD3 participates in state administration matters affecting groundwater supply and economy and represents members in matters concerning groundwater management. GMD3 relies on this collaborative assistance and prepares and adopts the management program for district and makes recommendations to members, state and federal officials, the Governor, Kansas Legislature and to Congress. This requires identifying the water planning needs to be communicated to the Kansas Water Office and Kansas Water Authority to be included in their comprehensive water planning, funding and policy recommendations needed in the implementation of the district management program.

GMD3 authority. Authority for GMD3 State Water planning coordination activities include without limit:

- K.S.A. 82a-1020 declaring the purposes of the GMD Act and the established right of water users to determine their destiny regarding water use;
- K.S.A. 82a-1029 adopt the official groundwater management program for the district area;
- K.S.A. 82a-1028(g) to construct, operate and maintain such works as may be determined necessary for drainage, recharge, storage, distribution or importation of water, and all other appropriate facilities of concern to the district;
- K.S.A. 82a-1028(i) to contract with persons, firms, associations, partnerships, corporations or agencies of the federal government, and enter into cooperative agreements with any of them;
- K.S.A. 82a-1028 (m) provide advice and assistance in the management of drainage problems, storage, groundwater recharge, surface water management, and all other appropriate matters of concern to the district.

Kansas Water Office, Water Authority and State Water Plan. Nine years after the passage of the GMD Act, two years after making state water permits mandatory and one year before the release of the US Commerce Departments' 6 states High Plains Study that contemplated major interstate water transfers, the 1981 Legislature created the Kansas Water Authority and Kansas Water office per the State Water Resources Planning Act (K.S.A. 82a-901 to 82a-945), declaring:

> *"the people of the state can best achieve the proper utilization and control of the water resources of the state through comprehensive planning which coordinates and provides guidance for the management, conservation and development of the state's water resources."*

The Kansas Water Office, working with the Kansas Water Authority, formulates project, programs, and policy recommendations for inclusion in a State Water Plan to accomplishing the coordinated management, conservation and development of the water resources of the state to benefit Kansas citizens. GMD3 members participate in Regional Advisory Committees (RAC's) formed by the Water Office and Water Authority for their planning input purposes. GMD3 works to add value to RAC meetings and providing advice and assistance directly to the Water Office, Water Authority, the governor and Kansas Legislature. GMD3 will participate in all venues to advise and assist in the development of an effective Kansas Water Plan and Funding process to advise and assist in the needed water policy for implementing the state water plan and management program for the district in concert with the long-range goals and objectives of the legislature (K.S.A. 82a-927).

KWO/KWA Mission: The primary statutory function of the agency is the development and coordinated implementation of the State Water Plan. It is the policy of the state to formulate on a continuing basis a State Water Plan for the management, conservation and development of the water resources of the State (K.S.A. 82a-903). In formulating the State Water Plan, KWO must consider a number of provisions in K.S.A. 82a-907 that directly relate to the plans, projects and recommendations of GMD3 to implement the management program.

Kansas Water Authority. The Kansas Water Authority was established in 1981 within and as part of the Kansas Water Office. The KWA provides the leadership to ensure that their advice to the Governor and Legislature for water policies and programs address the needs of all Kansans. The Water Authority is responsible for approving water storage sales, the State Water Plan, federal water related contracts, and regulations and legislation proposed by the Kansas Water Office. The Authority meets quarterly and consists of 13 private citizens and 11 ex officio state water agency advisors. See

State goal. It is a goal of the State to have sound management both public and private, of the atmospheric, surface and groundwater supplies for the State (K.S.A. 82a-927).

GMD3 initiatives encouraged. To achieve the state long-range goals, Kansas law provides for "*the encouragement of local initiative in the planning, implementation, funding and operation of local water programs to the extent that the same are supportive of state water programs"* K.S.A. 82a-928(p).

The state of Kansas is responsible to protect, conserve, and control all waters affecting the people of the state (K.S.A. 82a-929). GMD3 understands this includes interstate aquifer lateral flow and all interstate intermittent streamflow as part of historical supply into the district not covered by any compact or interstate agreement. State planning is to coordinate with local and national planning and undertake the resolution of any conflicts that may arise between the water policies, plans, and projects of the federal government and the water policies, plans, and projects of the state and its people (K.S.A. 82a-931). This is considered a vital activity for GMD3 to advise and assist in implementing the GMD3 management program.

Kansas Water Plan Fund. The State Water Plan Fund was created in 1989 (K.S.A. 82a-951). Funding includes revenues from statewide fees and SGF demand transfers.

FY19 Est. Water Plan Fund revenue from statewide water user fees			
Municipal Water Fees	3 cents/1,000 gallons	$3,200,000	25.6%
Clean Drinking Water Fees	3 cents/1,000 gallons	$2,800,000	22.4%
Industrial Water Fees	3 cents/1,000 gallons	$1,100,000	8.8%
Stockwater Use	3 cents/1,000 gallons	$450,000	3.6%
Pesticide Fees	$100/Registration	$1,300,000	10.4%
Fertilizer Fees	$1.40/ton	$3,500,000	28.0%
Pollution Fines/Penalties	Est. $150,000	$150,000	1.2%
Sand Royalties	$0.15/ton	$16,000	0.1%
Total		$12,516,000	

Kansas Water Plan Fund Budgeting Process. The budgeting process for use of Water Plan fee funds begins with Input in February and a proposed budget for the following state fiscal year is annually presented to the full Kansas Water Authority in August. The Authority-approved budget is then used by state agencies in their budget efforts with the legislature. The Governor's budget includes recommended expenditures for the State Water Plan Fund when it is presented to the

Legislature each January. Appropriations from the State Water Plan Fund are made by the Legislature. GMD3 provides advice and assistance to the Legislature as a proponent of the State Water Plan and Fund in support of the public interest of the district management program. GMD3 will encourage state comprehensive long view budget and planning ahead one generation of 25 years and encourage fair funding design to include the purposes, needs and activities of the GMD3 management program.

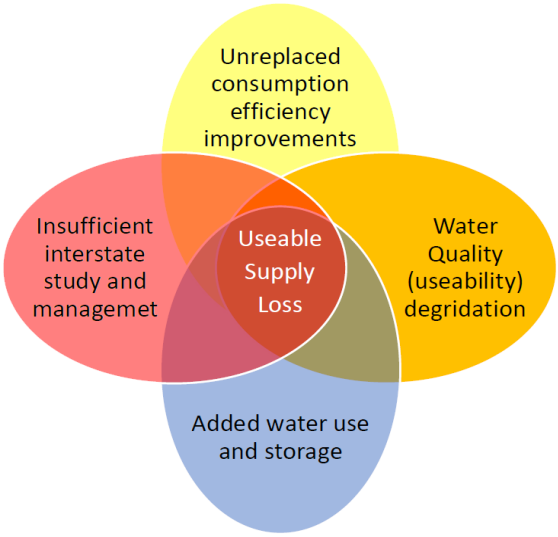
The District contains half of the historically perfected annual demand of 3.6 million acre-feet for water withdrawals from Kansas underground reservoir storage. Only half of that demonstrated demand is met annually. Demonstrated unmet demand in the district provides a basis and justification for attention to additional planning resources and state water planning. State Water Plan documents historically review demand from groundwater sources in terms of recent use and have not included consideration to supply unmet demands. Big capital improvement projects identified in the Kansas Water Vision and this management program document seek to improve water supply and management across the state to meet unmet present and future water demands.

G**oals** for water planning coordination activities include:

1. GMD3 will seek to coordinate with partners to further implement the long-term goals and objectives of the legislature consistent with the management program for southwest Kansas.
2. GMD3 will work to improve and sustain effective Water Plan budgeting process for budget recommendations to the Governor and Legislature that are coordinated with local agency planning in support of the management program covering 25 years projected costs and revenues.
3. Per K.S.A.82a-928(p), GMD3 will seek encouragement and support for local initiative and water programs and will work with the Kansas Water Authority and Regional Advisory Committees (RAC's) for understanding and support for the management program.
4. GMD3 will provide annual project and funding requests and recommendations to the Kansas Water Office and Kansas Water Authority.
5. GMD3 will work with RAC members and advisors across the state to enhance understanding of any differing perspectives of common long-term water supply interests and concerns.
6. GMD3 will work with legislative partners to achieve a consistent and informed perspective on GMD Act implementation, needed water planning, cost and risk evaluations and funding sources.
7. GMD3 will work to restore dedicated state funding for timely interstate water management support studies and evaluations needed to inform Kansas staff and interstate partners, assure compact administration and other interstate water management purposes.
8. GMD3 will support comprehensive future natural and constructed infrastructure planning for a minimum of 25 years to include groundwater transportation and storage. (e.g. January 22, 2018 letter from GMD3 Dr. Dan Devlin, Tracy Streeter, and Gary Harshberger, (Water Office and Water Authority) transmitting 23 requested Water Vision activities be initiated).
9. GMD3 will seek state water planning and funding support for proposals, programs, and state assistance each year to be included in the Kansas Water Plan and budget process at a level commensurate with what is paid into the Water Plan Fund from the GMD3 area in order to carry out the legislative purposes for the GMD Act and the management program. (e.g. July 22, 2019 letter and spreadsheet at: http://gmd3.org/pdf/State_Water_Plan_FY2021_Budget.pdf)

GMD3 Interstate Water Management Assistance

GMD3 supply problems includes hydrology that extends beyond district and state. replenishing surface flows GMD3 historically received from both the Arkansas River and Cimarron River basins and the lateral flow of interstate groundwater aquifers have declined significantly. All of these sources are generally closed to new appropriation in the district but not so in the sister states. The Kansas Water Vision goal to *IMPROVE INTERSTATE COOPERATION SO THAT KANSANS' WATER NEEDS ARE MET AND PROTECTED* is a focus of this activity area. The **sources of useable interstate supply loss** Venn Diagram at right illustrates activities that have a threshold of material supply harm to Kansas if not adequately managed. GMD3 will seek to advise and assist state and interstate collaborations and studies to improve the equitable sharing of interstate supply and reduce district water risk.



Source of Usable Interstate Supply Loss

Authority for GMD3 Interstate Water Management activities include without limit:

- K.S.A. 82a-1020 declaring the purposes of the GMD Act and the established right of water users to determine their destiny regarding water use;
- K.S.A. 82a-1029 adopt the official groundwater management program for the district area;
- K.S.A. 82a-1028(g), (i) and (m) [referenced in earlier sections of the management program].

Compacts. Two interstate compacts are in place with administrative bodies staffed by officials from Kansas and each respective sister state bordering the district. While each Compact and administrative body is a forum for the states to pursue "interstate comity," the purposes of these compacts must be read within the express terms of each compact. Each compact administrative body provides a portal and forum for GMD3 communications to express interests and concerns. **A Goal** of the management program is to provide advice and assistance in development of needed interstate agreements consistent with the management program. No compact yet exists to protect the Cimarron River basin historical water supply to the district. Nor is there a groundwater reservoir compact to govern lateral flows into Kansas and surface water runoff pulse flows and the associated groundwater reservoir recharge. Sustaining underflow and surface runoff supplies are modeled and important considerations for successful partnerships to secure and improve the future of area water supply.

Interstate aquifer management coordination. Interstate resource management coordination is appropriate activity under the management program where the OHP Aquifer, Arkansas River and Cimarron River basin management policy is closed to most new. Large additional new appropriations are allowed in the adjacent areas of sister states without regard to depletion rates. The governing body of GMD3 sought to provide information to official proceedings in Colorado and were not allowed.

1. GMD3 will encourage multi-state attention to shared water resources to exchange the best evidence of supply and use conditions that reduce water speculation where additional supplies may not exist under respective state law to reduced water risk for members and interstate partners.

2. GMD3 will encourage interstate partnerships and collaborative efforts to manage and restore the quantity and usability of existing water sources, including investment in participating in state

water administration in each state where permissible, work with landowners of properties both inside and outside the district and state.

Interstate Water Management Support Fund. From GMD experience on the Cimarron River with ongoing groundwater and surface water development in Colorado above the Stateline, Kansas requires study resources that are not always available for timely investigations (January 22, 2018 and October 11, 2018 letters from GMD3 board to KWO). There are recognized interstate water management questions all across Kansas that pop up with little prior notice to manage agency budgets and officials must scrounge to fund study needs or pass. The lack of sufficient state funding dedicated for interstate water management support unnecessarily places Kansas at significant disadvantage and in a subordinate role in addressing interstate questions of future water supply significance. The best evidence possible is needed to promote good working partnerships with sister states. A dedicated funding source outside regular agency budget process will improve supplies to Kansas for all time.

Federal Reclamation Assistance. A Basin Study grant with Reclamation and interstate partner participation can provide leadership in a multi-year and multi-state partner cooperative effort. This is a commitment of collaboration and does not involve exchange of cash. Contaminated water is exacerbating the scarcity of water clean enough for human and agricultural use from Colorado. Any changes in climate and use efficiencies will worsen the problem. Near 100% of the contaminated flows are applied on fields or percolate down into SW Kansas aquifers. The Basin Study requires Colorado participation, and will build on the prior GMD3 Basin Plan of Study in 2015 in keeping with 2019 session SR1729 and HR6018. Basin Studies are collaborative studies, cost-shared with non-Federal partners to evaluate the impacts of climate change and help ensure sustainable usable water supply by identifying strategies to address imbalances in water supply and demands. The Basin Study will be a technical assessment and will not make statements of policy or future commitments by Reclamation or partners.

Additional policy for state water development. KSU study proposed to evaluate future value to the Kansas economy in marketing excess surface water to meet future Kansas groundwater storage needs and for western US water marketing partners. Water leaves Kansas annually at an estimated amount of more than eight times the groundwater used annually in Kansas on average. A VISION - STATEWIDE PHASE III Study as referenced in January 2018 letter from GMD3 board to KWO. Identify suitable areas and ability to transfer water to areas of need and available Kansas aquifer storage space for water transfer replenishment opportunities. Develop interconnected water storage computer model for all eastern Kansas basins with federal water supply reservoirs. Update mid 1980s Kansas Water Office plan to interconnect reservoirs across multiple basins to move water to higher demand and increase overall yield, management, and marketing. The 2016 SSub for HB 2059 proposed additions to the Kansas Water appropriations processes to create a path not currently available for proposing development of waters otherwise lost to the state. The bill and the KDA compromise language is still needed. The Water Authority accepted a three-part proposal from a special study team and included $200,000 in its FY 2019 recommendations to the Governor and Legislature. No legislative action occurred, and the study team is no longer available. A task force review of current policy and needs is requested as presented at the April 2019 KWA meeting by the Upper Ark RAC. The search for an appropriate path for Kansas study continues as a Kansas Water Plan priority need.

Department of Interior federal study assistance. Evaluate and seek federal assistance through further implementation of the augmentation study authority of Public Law 90-537 of 1968. The text of the law reads “the Secretary of the Interior shall conduct full and complete reconnaissance investigations for the purpose of developing a general plan to meet the future water needs of the Western United States.” It also requires periodic progress reports to Congress. That has not been done. Augmentation from floodwater east of the High Plains should be considered with milt-state leadership for transportation of water west.

GMD3 Models, Research and Development Activities

The governing body of GMD3 maintains a working committee to assist them in this area of management program activities. Groundwater management requires specialized model tools. Models that are used by the district in management program activities include models of district groundwater reservoirs, wells, surface water resources and economy. They are necessary management tools. The nature of models is that they are a work in progress. It is critical to the success of the district management program to create and update models based on the most up to date information available. Each model is a tool designed to represent a simplified version of reality. The reliability of the tools depends on how well the model approximates field conditions. Keep in mind that some extreme events or conditions may be beyond the calibration of a model. But wise application of model data can account for this. The following R & D activities have been identified without limit to the management program activities:

1. **Resources for new models and model updates.** GMD3 will work with state and other partners to use and improve important analytical and numerical models that elevate the district groundwater knowledge base and improve water application evaluations and management activities for GMD3 members and partners.

2. **GMD3 area Ogallala/High Plains Aquifer model update.** The KGS groundwater model for the GMD3 area is slated to begin updating in 2020. GMD3 will partner with the KGS, KWO, DWR and others to complete a successful update project. Additional data is needed for improving the model function and utility. They include:
   a. Index well measurements of groundwater exchange between formations.
   b. Groundwater gage measurements of recharge benefits from surface water flow.
   c. Groundwater gage measurements of lateral flow and quality or usability.
   d. Data needed for improved model calibration.
   e. Graphical user interface tools to connect members to model information.
   f. Critical well evaluation and water project supply information tool.
   g. GMD3 Upper and Lower Ark GMA area boundaries and conjunctive use tool.
   h. OHP Groundwater reservoir water use and recharge estimate tool.

3. **Additional groundwater reservoir data.** New groundwater reservoir information and data developed by GMD3 will be shared with state and other partners to assist in the development of the best possible models. This information may include, but is not limited to, member test hole contributions, flowmeter and well tests, and use evaluation information. New information benefits the recalibration of supply and economic models as tools needed for implementing the management program.
4. **Economy and water valuation models.** Economic and valuation models are a growing and critical source of information used to advise and assist management program activities. GMD3 will look to develop and update economic models to include without limit the following: water value projections of the Docking Institute Study of 2000, long term lost opportunity cost projection of Apparat Analytics LLC., evaluation of major water marketing and transfers benefits with state, reclamation and other partners, past and existing federal law authorizations of the High Plains Study and the Colorado River Project Act (Public Law 90-537), evaluation of Cost Depletion Allowance under federal tax code, and other needed economic studies.

5. **Managed Groundwater Reservoir Recharge**. Managed groundwater reservoir recharge activity may involve both projects that use natural infrastructure and delivery activity and projects using artificial or constructed infrastructure and delivery. GMD3 will encourage both natural and artificial project feasibility investigations and collaborative means to increase the amount and/or usability of water inventories. Application of groundwater recharge flows in classified streams should prevent "statistically significant increase[s] in the concentration of any chemical or radiological contaminant or infectious microorganism in groundwater resulting from surface water infiltration or injection" (K.A.R. 28-26-28d(b)(5) and 28-16-28e(c)(5)).

6. **Water importation**. Western Kansas and the Great Plains region offers the nation a large food production area which has not reached its production potential to grow the established economy and facing groundwater reservoir level decline. Other western states are in the same boat, also experiencing significant water supply decline. The major limiting factor in saving this National Water Reserve and food security potential is the transportation of excess water west across Kansas. Since present water supplies are inadequate to assure the production potential and water values for these areas, transient water with little or negative value may be conserved from loss to the Gulf of Mexico in eastern water sheds made available for conservation storage in available vast groundwater reservoir space of the southern High Plains and adjacent western basins to closed the water gap in adding flood protection, stable reservoir levels, drought and ecological resiliency.

   Importation of water from other areas under conditions of surplus local supply seem to be technically feasible under present declining energy cost projections if the right to move the water can be resolved. Some problems are legal in nature and deal with issues such as inter/intra basin transfers. GMD3 will take a leadership role with partner agencies and organizations to continue the long-range planning and study for projects which may become economically feasible and wise under future water value returns and which offer potential for added water importation into southwest Kansas to meet future resource service needs.

7. **Water exports**. The Board shall involve itself with any proposed direct exportation of groundwater from the district to any area or location outside the district to ensure that all management program purposes are met and to seek opportunities to meet the needs for present and future water supply in adjoining areas in the public interest. Exported water use may be evaluated to consider assessing higher user fees than for in-district uses or for net use between imported supplies and those exported out of state.

8. **Federal Farm Programs**. As we look at the present and next farm bill through the lens of the field and farm economy, innovation and local authority implementation will remain essential for effective use by district farmers and ranchers to continue producing more food and fiber with less water. The federal farm bill research and other programs provide significant support to the implementation of the GMD3 management program for members and partners.

   a. GMD3 will engage farm bill development, adoption and implementation, working with industry and other partners to guide national funding and program commitments that support the district groundwater management program.
   b. GMD3 will participate in farm bill development in implementing policies to preserve and enhance water conservation for the district. Water conservation programs should

incentivize and reward measurable water conservation. Using historic water usage apart from credit for conserve-to-preserve water conservation accounting may incentivize maximum water use prior to enrollment, which is action contrary to the management program. Those who already work to steward Type (2) groundwater conservation in their declining supply have a greater burden to achieve added conservation that should be properly valued in addressing resource concerns.

c. Risk management is a key influence of the farm bill on the district groundwater management program activities. Input and potential partnerships with RMA and others will be encouraged to further develop useful risk management products for limited irrigation and supported to limit unnecessary irrigation in declining groundwater areas.

d. GMD3 will advocate for flexibility in the use of field level crop bases to encourage conservation of water use over program elements that economically force members to continue high water use to preserve crop bases.

9. **The Conservation Reserve Enhancement Program (CREP)**. As of September 30, 2017, a total of 112 state CREP contracts on 18,659 acres have been approved by the State of Kansas (with the addition of 385 acres this year). These contracts have resulted in the permanent retirement of 37,999 acre-feet of annual water appropriation on 135 water rights from 166 wells, mostly in GMD3. The contracts represent a total of $1,210,511 in state sign-up payments to producers over the past ten years. These payments are matched by annual rental payments to producers from FSA totaling about $2,191,213 in FY2017.

10. **State water conservation incentive programs.** GMD3 will continue to encourage and develop additional partner activities in state sponsored water conservation incentive programs made available to members and investigate opportunities to leverage management program activities with incentivized conservation activities that further the purposes of the management program for district members.

11. **Regional Conservation Partnership Program** (**RCPP**). The GMD3 RCPP promotes coordination of NRCS conservation activities with GMD3 and other partners that offer value-added contributions to on-farm, watershed, and regional natural resource concerns. Through RCPP, NRCS seeks to co-invest with GMD3 and other partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns of the management program.

12. **Brackish water use technology and feasibility.** Brackish water or briny water is water more saline than fresh water, but not as much as seawater. In GMD3, it may occur in deep geologic formations or in Arkansas River surface water from Colorado or in Cimarron river flows from the district into Oklahoma. Brackish waters are viewed recently as potential and viable resources to alleviate water scarcity and overcome water budget deficits for some project uses. Kansas law requires consideration of such water sources used first during water appropriation permitting per K.S.A. 82a- 711, where " *…the chief engineer shall not approve any application submitted for the proposed use of fresh water in any case where other waters are available for such proposed use and the use thereof is technologically and economically feasible*." The evaluation of various desalination technologies will be explored with reclamation and other partners for options to develop district surface and groundwater supply.

13. **Private well safe drinking water study.** High radio nuclei and other mineralization pollutants in some groundwater supply areas of the district require added study to determine the best management practices to secure safe drinking water. Programs that will adequately safeguard the health, safety and welfare of district members will be supported, working with state water agency partners that include KDHE, KDA, KWO and KGS.

14. **Strategic local area planning.** GMD3 support of planning efforts by local authorities and their targeted interests in water related economic development and environmental protection activities is an important activity to effectively implement the management program. Coordinating with other local government units provides efficiency of resource management in support of members and the leadership of cities, counties and special districts affecting the management program to sustain member health, safety and welfare.

15. **Water reuse information support.** Since first use of water is the use authorized and reported under water rights, little comprehensive data is available on water reuse in the district. The management program supports the efficient first use and appropriate reuse of water resources for irrigation. Efforts to increase water use value through reuse is an important response to dwindling local supplies and increasing water costs. Water reuse can also be a source of depletion of historical return flows to local groundwater reservoir areas that may be an important sustaining source for other water rights. In recognition that GMD3 can't manage what isn't measure, GMD3 will work to develop methods for tracking the extent of water reuse and assist in developing feasibility studies and researching water recycling projects as requested by members or required by grant opportunities to benefit the management program.

16. **Data Collection and exchange.** Data needs range from water quantity and water quality questions to research and investigations. Land ownership record app's and socio-economic and use value studies will be considered as necessary to implement the groundwater management program and Board initiatives. District data sets and those of water management partners will be exchanged to accomplish the purposes of the groundwater management program and partner initiatives. Such cooperative efforts with partner organizations will assure an efficient use of GMD3 manpower, technical and financial resources.

17. **Smart Device Applications.** GMD3 will support efforts to improve data base access through application tools needed to provide field sensor information for use by member water managers. Significant opportunity exists to serve the water project manager with smart device application tools for near real time decisions and the records they need to adopt and account for practices that save water and costs. Soon to come are apps that can use a picture of a flowmeter from a smart device to access water allocation, climate, soil moisture, crop, and financial information, including water use information from similar projects in the region.

GMD3 Water Quality Protection Assistance

Water quality is both a water usability question and public health, safety and welfare concern for Kansas citizens, including members of GMD3. GMD3 will monitor and look to implement and address the following water quality activities in coordination with local, state and federal partners:

1. **Existing Pollution Problems.** Known pollution problems that pose a direct threat to the usability of groundwater supply within the district will be researched and evaluated by staff, in conjunction with KDHE programs and/or other partners to seek adequate mitigation and/or remediation for improving and protecting supply conditions. Where identified concerns exist, staff will present its recommendations to the Board for consideration of appropriate policy and other advisable action.

2. **Contamination risk.** The water quality protection activity of GMD3 will work with member water watchers and business interests to identify the major sources of water usability depletion, and address concerns in targeted areas to minimize water risk from contamination of district groundwater or surface water supply and to work with partners to protect public health, safety and welfare. A practical resource for careful land use considerations can be referenced at: http://www.kdheks.gov/nps/downloads/nwpwqppfrm_2017.pdf and project manager considerations for WATER QUALITY PROTECTION PLANS. Practical assistance to members and industry management review and recommendations will be provided in harmony with actual conditions and enforceable water policies. An example of subsurface well construction assistance is the implementation of the special saltwater intrusion rule area in Seward and Meade counties. Within the domestic beneficial use classification is a sub-group containing nonpublic household water wells. Management program activities will advance drinking water quality monitoring and supply protection with recommended triggering events for drinking water well inspection and for testing water quality.

3. **Oil and gas industry water use and supply risk**. GMD3 should consider accessing data on historical oil and gas activity in the district for review of information with appropriate state officials to screen for inter-aquifer groundwater connection that can create waste of water freshwater drains to deeper less-fresh formations and water usability depletion. Also, opportunities for new technology-based water treatment will be evaluated to encourage usability of low-quality water and safe waste disposal will be reviewed periodically.

4. **Abandoned water wells and test holes**. With about 1/4th of non-domestic wells idle per annum, GMD3 will assist KDHE Bureau of Water in their implementation of the Groundwater Exploration and Protection Act and permitting of temporarily abandoned water wells and assist members in the management of wells and boreholes. GMD3 will advise and assist member to manage well equities, groundwater protection, monitoring well data collection opportunities and on-site safety concerns.

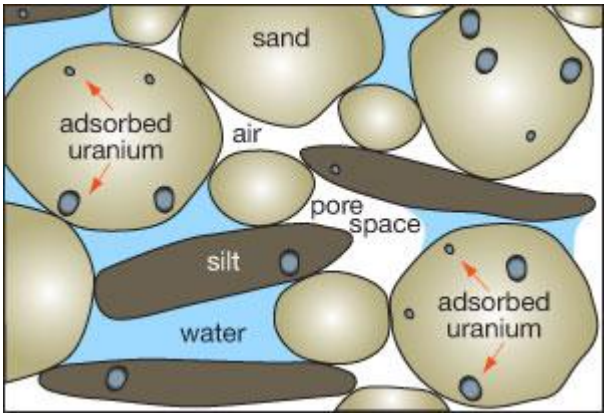
5. **Groundwater gage network**. GMD3 will continue to develop a district monitoring well network and obtained water samples to be analyzed for contaminants. GMD3 has worked with partners to establish Stateline groundwater gages that provide quantity and quality data to support interstate supply management and secure cooperative agreements and funding sources for needed gage data. GMD3 continues work to set up a network of observation wells in any area that additional water level, flow and water quality data is needed to support the management program and partner water risk needs.

6. **The Local Environmental Protection Program (LEPP)**. LEPP, established in 1990, has been supported by GMD3 staff and board. The State Water Plan, through the LEPP provided

funding to enable local authorities to develop environmental code and water protection plans that complemented other water quality efforts of other local, state, and federal agencies. State Water Plan Funding to counties was discontinued in 2012. Adoption and enforcement of county environmental code with an emphasis on Onsite Waste Water Systems (OWWS) and Private Water Wells (PWW) is an activity of each county's sanitary code. The management program will support efforts of county sanitarians and partners as needed with available resources.

7. **Ark River and other recharge areas.** Significant need exists to address the water quality issues of the Arkansas River basin or other key recharge areas affecting both drinking water safety and agribusiness productivity. In-state, interstate and federal partnerships are needed to address interstate poor quality surface inflows into GMD3 that are impacting and threatening public and private water supply wells and land resources along the Arkansas River corridor and over the Ogallala Groundwater reservoir. Additional protection of the fresh groundwater in the region is critical for safe drinking water and for municipal, industrial, and agricultural uses. Kansas 2019 legislative resolutions HR6018 and SR1729 (see copy in appendix) passed seeking congressional action and interstate cooperation to address this major multi-state contaminated basin water concern. GMD3 will participate in study and project activity supporting the 2019 resolutions.

8. **Uranium, Radium and Radon.** According to the Kansas Geological Survey, Radon and its immediate parent radium largely occur where uranium is present in rocks, soil, or ground water (Felmlee and Cadigan, 1979). All rocks contain small amounts of uranium. Uranium can also be present as a solid attached to mineral coatings on sand and silt (image at right). Uranium is very soluble and easily weathered into solution—similar to dissolved salt or sugar. Some groundwater in the district is known to have naturally occurring uranium and radium. Where these occur, close cousin Radon may also occur. For more information, see: http://www.kgs.ku.edu/Publications/PIC/pic25.html



KGS, Public Information Circular (PIC) 25

GLOSSARY OF TERMS AND DEFINITIONS

Acre-foot: bulk measurement consisting of 325,851 gallons of water.

Alluvium: the gravel, sand, silt, and clay and similar unconsolidated material deposited in comparatively recent geologic time by a stream or other body of running water as sorted or semi sorted sediment in the bed of the stream or on its floodplain or delta. 1

Appropriation right: is a right, acquired under the provisions of article 7 of chapter 82a of the Kansas Statutes Annotated and acts amendatory thereof and supplemental thereto, to divert from a definite water supply a specific quantity of water at a specific rate of diversion, provided such water is available in excess of the requirements of all vested rights that relate to such supply and all appropriation rights of earlier date that relate to such supply, and to apply such water to a specific beneficial use or uses in preference to all appropriations right of later date. K.S.A. 82a-701 (f).

Aquifer: any geological formation capable of yielding water in sufficient quantities that it can be extracted for beneficial purposes. K.S.A. 82a-1021. A geologic formation, a group of formations, or a part of a formation that is water bearing. 1

Aquifer, Alluvial: an aquifer comprised of unconsolidated materials, usually gravel, sand, silt, and clay that have been deposited by running water in comparatively recent geologic time. 2

Aquifer, Bedrock: Dakota aquifer system shall include the Dakota formation, the Kiowa formation, the Cheyenne sandstone and where hydraulically connected to the Morrison formation. K.A.R. 5-1-1 (t).

Aquifer, Confined: an aquifer which is bounded above and below by formations of impermeable or relatively impermeable material. 1

Aquifer, Unconfined: an aquifer made up of loose material, such as sand or gravel that has not undergone lithification (settling). 1 Unconfined Dakota aquifer system means that portion of the Dakota aquifer system not overlain by Graneros shale. K.A.R. 5-1-1 (aaaa).

Aquifer, Ogallala/High Plains:

Augmentation:

Bedrock: a general term for solid rock that lies beneath soil, loose sediments, or other unconsolidated material. 1

Chief Engineer: the Chief Engineer of the Division of Water Resources of the Kansas Department of Agriculture. K.S.A. 82a-701 (b).

Conservation, Aquifer Maintenance: Type (2) conservation

Conservation, Use Efficiency: Type (1) conservation

Conserve-to-preserve factor:

Demand management: cost-effective strategies that assist members in managing water risk through reduced water demand.

District: the Southwest Kansas Groundwater Management District No. 3, Garden City, KS.

DOC: the Division of Conservation and state conservation commission of KDA, Manhattan, KS.

Domestic use: the use of water by any person or by a family unit or household for household purposes, or for the watering of livestock, poultry, farm and domestic animals used in operating a farm, and for the irrigation of lands not exceeding a total of two (2) acres in area for the growing of gardens, orchards and lawns. K.S.A. 82a-701(c).

DWR: the Division of Water Resources, Kansas Department of Agriculture, Topeka, KS.

Eligible voter: A natural person 18 years of age or older, or a public or private corporation, municipality or any other legal or commercial entity that:(A) Is a landowner that owns, of record, any land, or any interest in land, comprising 40 or more contiguous acres located within the boundaries of the district and not within the corporate limits of any municipality; or (B) withdraws or uses groundwater from within the boundaries of the district in an amount of one acre-foot or more per year. Most domestic users are assumed to use

GMD3: Southwest Kansas Groundwater Management District No. 3, Garden City, KS.

Groundwater: water below the surface of the earth. K.A.R. 5-1-1 (gg).

Groundwater Gage:

Groundwater Management District Act: A body of Kansas groundwater law described in K.S.A. 82a-1020 et seq., and amendments thereto.

Hydrogeologic: those factors that deal with subsurface waters and related geologic aspects of surface waters. 1

Hydrogeologic parameters: numerical parameters that describe the hydrogeologic characteristics of an aquifer such as porosity, permeability, and transmissivity. 1

Hydrogeology: the part of geology concerned with the functions of water in modifying the earth, especially by erosion and deposition, geology of groundwater with particular emphasis on the chemistry and movement of water. 1

Hydrologic: of or pertaining to hydrology, that is the science dealing with water, its properties, phenomena, and distribution. 1

Hydrologic Community of Interest:

Impaired water right:

K.A.R.: Kansas Administrative Regulations - Standards, statements of policy or general orders, including amendments or revocations thereof, of general application and having the effect of law, issued or adopted by a state agency to implement or interpret legislation enforced or administered by such state agency or official, or to govern the organization or procedure of such state agency (K.S.A. 77-415 (4)).

KCC: Kansas Corporation Commission, Topeka, Kansas.

KDA: Kansas Department of Agriculture, Manhattan, Kansas.

KDHE: Kansas Department of Health and Environment, with responsibilities for protecting Kansas's land, water, and air from pollution.

KGS: Kansas Geological Survey, Lawrence, Kansas.

K.S.A.: Kansas Statutes Annotated - the laws passed by the Kansas Legislature and signed by Governor.

KSU: Kansas State University, Manhattan, Kansas.

KU: Kansas University, Lawrence, Kansas.

KWA Act:

KWO/KWA: Kansas Water Office and Water Authority with duties of water planning, State Water Plan Storage and Water Assurance from federal reservoirs.

Member of GMD3: A GMD3 member is an eligible voter described in K.S.A. 82a-1021(a)(5)

Navigable Stream: According to the Land Title Institute (2001), navigability (For Title Purposes) means a body of water, existing naturally at the time of statehood that was used or is susceptible of being used in its ordinary condition, for commerce, navigation, fisheries, and more recently in other general statewide public uses such as canoeing, swimming, diving and similar related uses.

Non-domestic: all other beneficial uses of water including stock watering, municipal, irrigation, industrial, recreation, waterpower, artificial recharge, hydraulic dredging, contamination remediation, dewatering, fire protection, thermal exchange, and sediment control in a reservoir. K.A.R. 5-1-l(o).

Over-appropriation: water use that exceeds the long-term sustainable yield of the water supply, including hydraulically connected surface and ground water.

Overpumping: common or slang expression referring to the unlawful diversion or pumping of groundwater in excess of the authorized annual or account quantity of water.

Public Interest: Based on declarations and purposes of the GMD Act (82a-1020 et seq.), the management program document and recommendations of the elected governing body of GMD3, also known as the Board of directors, are considered the local formal expression of public interest relative to groundwater management issues and associated endeavors within the district.

Pulse flows:

RAC: Regional Advisory Committee – volunteer committee members are appointed by practice of the KWO/KWA to assist the agency in carrying out its mission.

Recharge: the natural infiltration of surface water or rainfall into an aquifer from its catchments area. K.A.R. 5-1-1 (fff).

Revised Management Program: A document to be adopted before a GMD undertakes management activity and revised as needed to describe the characteristics of the district and the nature and orderliness of thought and behavior (methods) for dealing with groundwater supply problems of the district, and containing information as to the groundwater management program

to be undertaken by the district and such maps, geological information, and other data as may be necessary for the formulation of such a program public interest. (K.S.A.82a-1028)

Saturated Thickness: the thickness of the portion of the aquifer in which all pores, or voids, are filled with water. In a confined aquifer this is generally the aquifer thickness. In an unconfined aquifer this is the distance between the water level and the base of the aquifer. 1

Static Water Level: the depth below land surface at which the top of the groundwater is found when not affected by recent pumping. K.A.R. 5-1-1 (rrr).

Surface Water: water in creeks, rivers, or other watercourses, and in reservoirs, lakes, and ponds. K.A.R. 5-1-1(zzz).

Sustainable: What is good for the economy, the environment, and people.

Unconsolidated regional aquifer system: a body of mostly unconsolidated and heterogeneous water bearing deposits that are hydraulically and geologically contiguous and are capable of yielding water in sufficient quantities for beneficial use. K.A.R. 5-1-1 (bbbb).

Waste of water: any act or omission that causes the application of water to an authorized beneficial use in excess of the needs for this use in connection with the place of use authorized by a vested right, an appropriation right, or an approval of application for a permit to appropriate water for beneficial use. Parts of K.A.R. 5-1-1 (cccc).

Water Appropriation Act: the Kansas Water Appropriation Act, K.S.A. 82a- 701 et seq., and amendments thereto.

Water Balance: the method of determining the amount of water in storage in a basin storage area by accounting for inflow to, outflow from, and changes in storage in that basin storage area.

Water Usability Depletion: the pollution or degradation of water quality so as to render the supply less usable or necessitating treatment strategies to mitigate or restore the original or standard quality of water supply.

Waters of the state:

Water risk: The four water management dimensions that members face in water-related risk, which are: 1) Physical usable water - the risk that a region may lack sufficient stable supply from wells or that the local water supply might be of poor or unstable quality, 2) Sufficient replenishment - recharge to replace what is consumed, degraded or exported, 3) Water regulations - regulatory change or lack of regulatory surety that can challenge members' ability to plan, manage and do business, and 4) Reputation – members may need to consider how their use of water will be viewed by others and the broader market communities.

WEP Act: Water Exploration and Protection Act body of well construction and groundwater protection law administered by KDHE.

APPENDIX

Kansas water law and planning legislation history notes.

Selected from work by **John Peck** who provides a water rights and planning history outline in his writing on drought concern and Kansas water law: ***Legal Responses to Drought in Kansas,*** Kansas Law Review, Vol. 62, No. 1141, 2014, University of Kansas - School of Law.

Legislation

A. Pre-1945 water statutes: Drought not mentioned specifically, but perhaps can be inferred as one of the background reasons for some legislation:

1. 1866 (irrigation companies empowered to construct canals)
2. 1886 (stream water may be used for irrigation by appropriation, and first in time is first in right)
3. 1889 (ditch and canal companies empowered to condemn water rights)
4. 1891 (waters west of 99th meridian to be devoted first to irrigation use, subject to domestic, 2nd to industrial use; irrigation districts may be created)
5. 1899 (irrigation companies empowered to condemn to aid in establishing reservoirs, lakes, or ponds for water storage)
6. 1917 (Kansas Water Commission established to investigate problems of, *inter alia*, domestic water supply and irrigation; to establish river gaging stations; to make general plan for development of river basins; repealed 1927)
7. 1919 (Division of Irrigation created in State Board of Agriculture (BOA), under control of commissioner of irrigation; duties of commissioner included gathering data, visiting sites, and making quarterly reports to BOA)
8. 1927 (legislature abolished Water Commission and Division of Irrigation; Division of Water Resources (DWR) created to take over duties) [chief engineer position created]
9. 1933 (Chief Engineer made head of DWR)

B. The 1945 Water Appropriation Act: Activity related to and resulting from 1930s drought: Richard Pfister, WATER RESOURCES AND IRRIGATION, PART IV OF ECONOMIC DEVELOPMENT IN SOUTHWESTERN KANSAS, KU School of Business (March 1955)

1. 1940 (Governor appointed committee and held conference to study problems and make recommendations; committee report recognized need for a state plan to control the water resources)
2. 1941 (legislature repeals part of 1886 Act and established administrative procedures for handling applications for water appropriations)
3. 1944 (*State ex rel. Peterson v. Kansas State Board of Agriculture*, 158 Kan. 603, 149 P.2d 604 (1944) (affirmed common law doctrine of absolute ownership for groundwater; concluded that the chief engineer had been given no power over groundwater allocation))
4. 1944 (Governor appoints committee to study state water law, which produces "The Appropriation of Water for Beneficial Purposes: A Report to the Governor" (Dec. 1944) recommending adoption of Doctrine of Prior Appropriation)
5. 1945 (legislation adopts the Water Appropriation Act (WAA)) [Now all Kansas water rights to follow one doctrine and unused water is dedicated to the people of the state subject to beneficial appropriation as provided in WAA]
6. 1956 (clarify water rights as changeable real property that must tolerate reasonable economic effects between users)

7. 1972 GMD Act (legislature dedicates local groundwater management rights)
8. 1978 (legislature restrict all non-domestic use without first obtaining state permission and adds Intensive Groundwater Use Control Area provision in GMD Act)
9. 1986 (mandated annual water use reports by March 1st each year subject to fines)
10. Water right management tools developed since then.
    [2012: Local Enhanced Management Areas (LEMA's) allowed]
    [2012: Eliminating forfeiture of groundwater rights for non-use in closed areas]
    [2015: Water Conservation Areas (WCA's) allowed]
    [2015: Requirement for chief engineer to give due consideration of past management and voluntary conservation in new conservation programs.]

Kansas Water Planning Acts

1. 1917 (Kansas Water Commission established to investigate problems of, *inter alia*, domestic water supply and irrigation; to establish river gaging stations; to make general plan for development of river basins; repealed 1927)
2. 1955 (Kansas Water Resources Board and executive director established)
    a. Charged with working on and working out a state water plan of water resources development.
    b. Background: "The State of Kansas had no sooner recovered from the spectacular floods of 1951 when it plunged into one of the most severe droughts in Kansas history from 1952 through 1956. This sequence of disasters led to legislative creation of the Kansas Water Resources Board in 1955 as a move to try to do something to avert or at least alleviate future crises through aggressive planning.

3. 1963 (State Water Plan Act, 82a-901 *et seq.)*
4. 1981 (Kansas Water Resources Board replaced by the Kansas Water Authority, the Kansas Water Office, and the director of the Kansas Water Office)
5. 1984 (State Water Resource Planning Act: major amendments to K.S.A. 82a-901a, *et seq.*)
6. 1985 (K.S.A. 82a-906 amended to provide dynamic planning process, under which KWO presents annual water plan and recommendations to the legislature)

End of Legislation History notes.

Maps and groundwater model information

The following maps provide map that inform management program activity.

The High Plains Aquifer Atlas can be found at:
http://www.kgs.ku.edu/HighPlains/HPA_Atlas/Water%20Rights%20and%20Water%20Use/index.html

The most recent GMD3 groundwater model information can be found at the following urls:

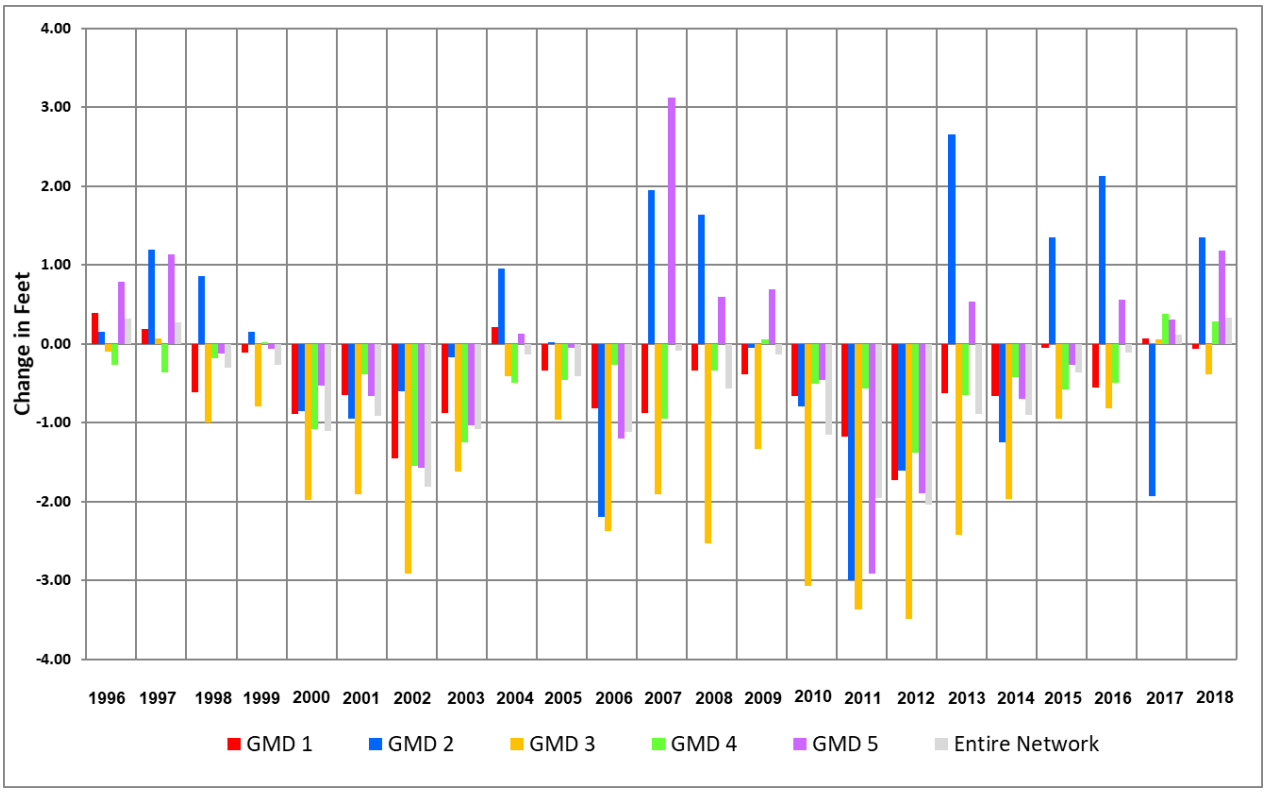
GMD3 Ground-Water Model: http://www.kgs.ku.edu/Hydro/Publications/2010/OFR10_18/

GMD3 Model Future Scenarios: http://www.kgs.ku.edu/Hydro/Publications/2012/OFR12_3/

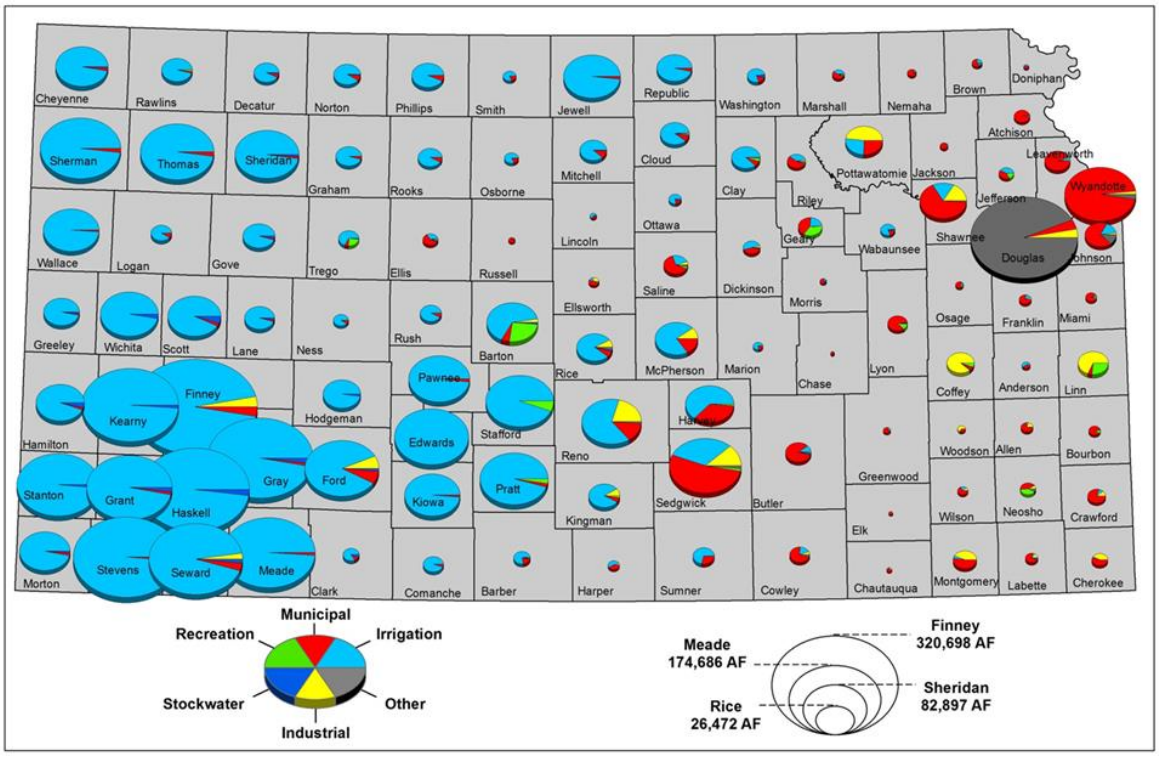
Potential economic impacts of water-use changes in Southwest Kansas:
http://www.tandfonline.com/doi/abs/10.1080/19390459.2013.811855

Section level percent decline in storage (since 1950) of the OHP Aquifer in GMD3.
Source: KGS, http://www.kgs.ku.edu/Publications/pic18/index.html

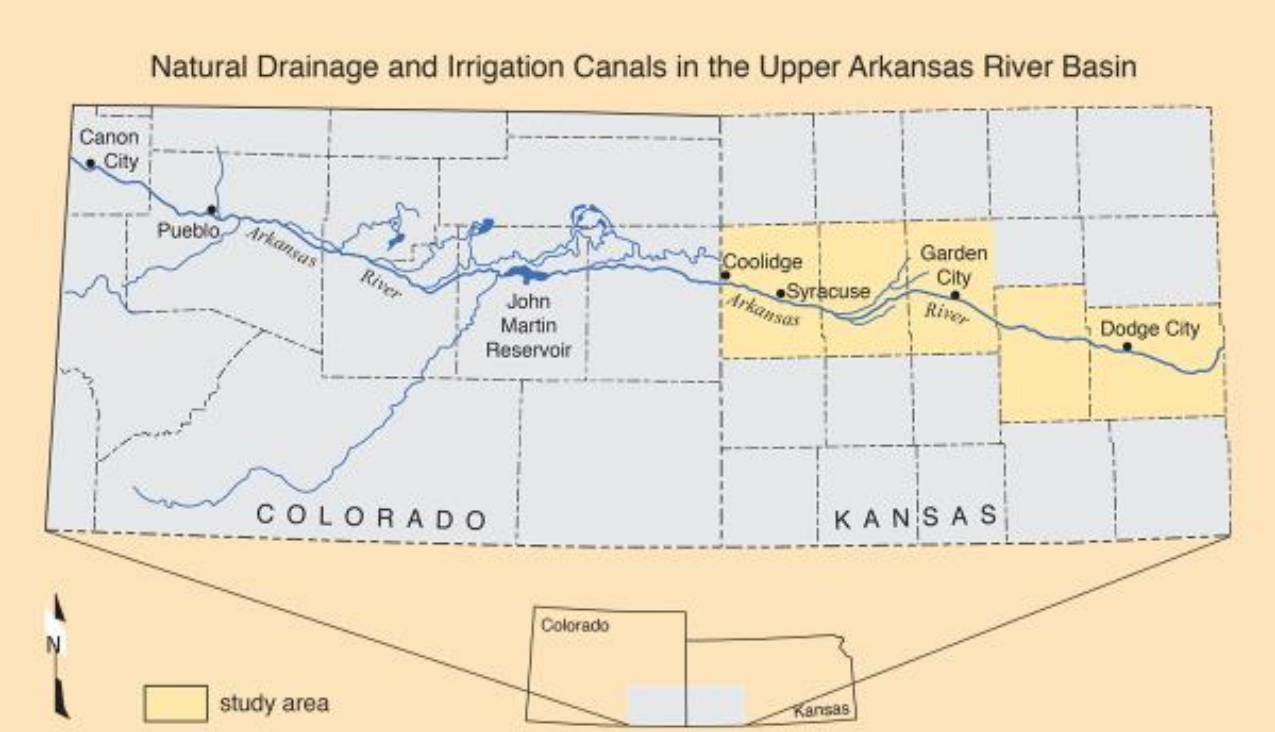
Saturated Thickness of the Ogallala/High Plains Aquifer, 2015.Source: KGS,
http://www.kgs.ku.edu/Publications/pic18/index.html



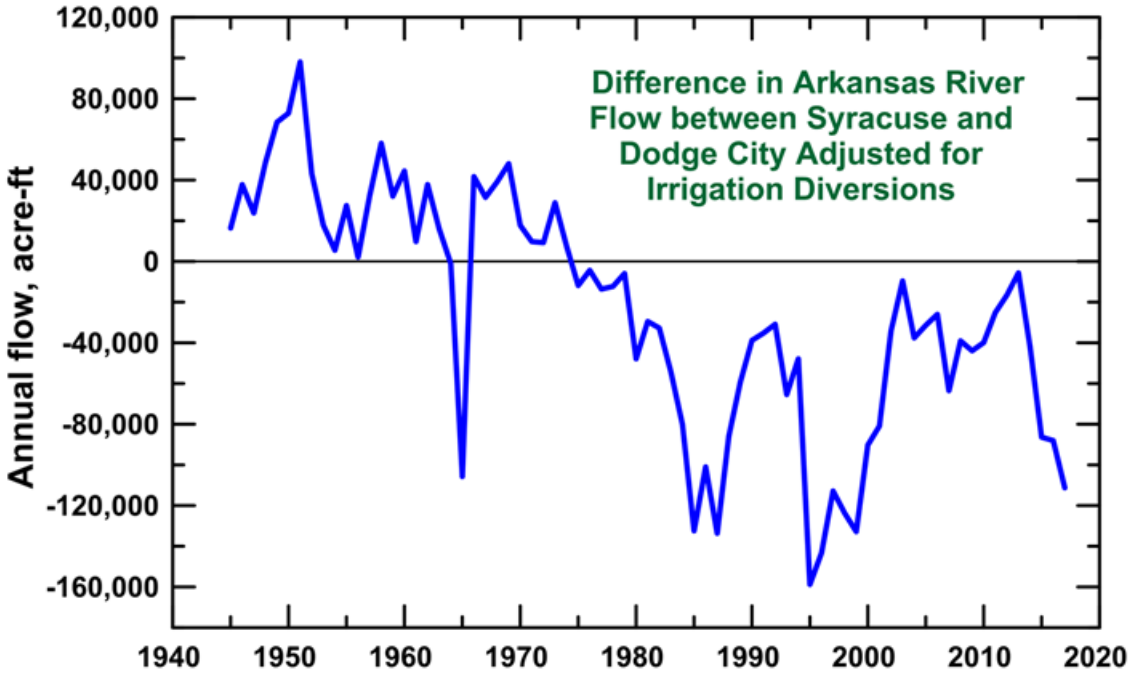
Average change results above are based only on the cooperative network (KGS and KDA-DWR) and do not include sub-regional networks from the KDA-DWR, KGS, or local GMDs. 2019 water levels are provisional data.



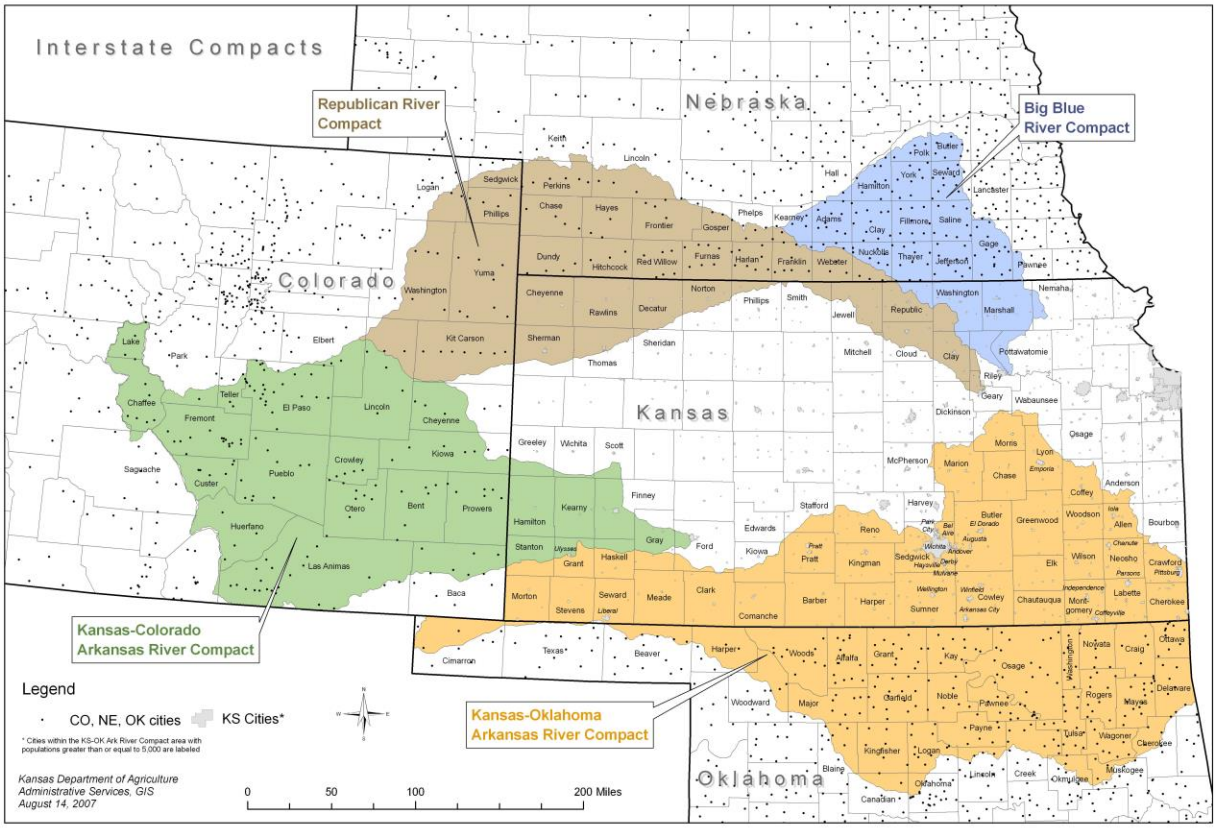
Average annual reported water uses 1995 to 2014 are influenced by precipitation patterns and available groundwater. “Other” use is primarily flow through hydropower. Source: KGS.

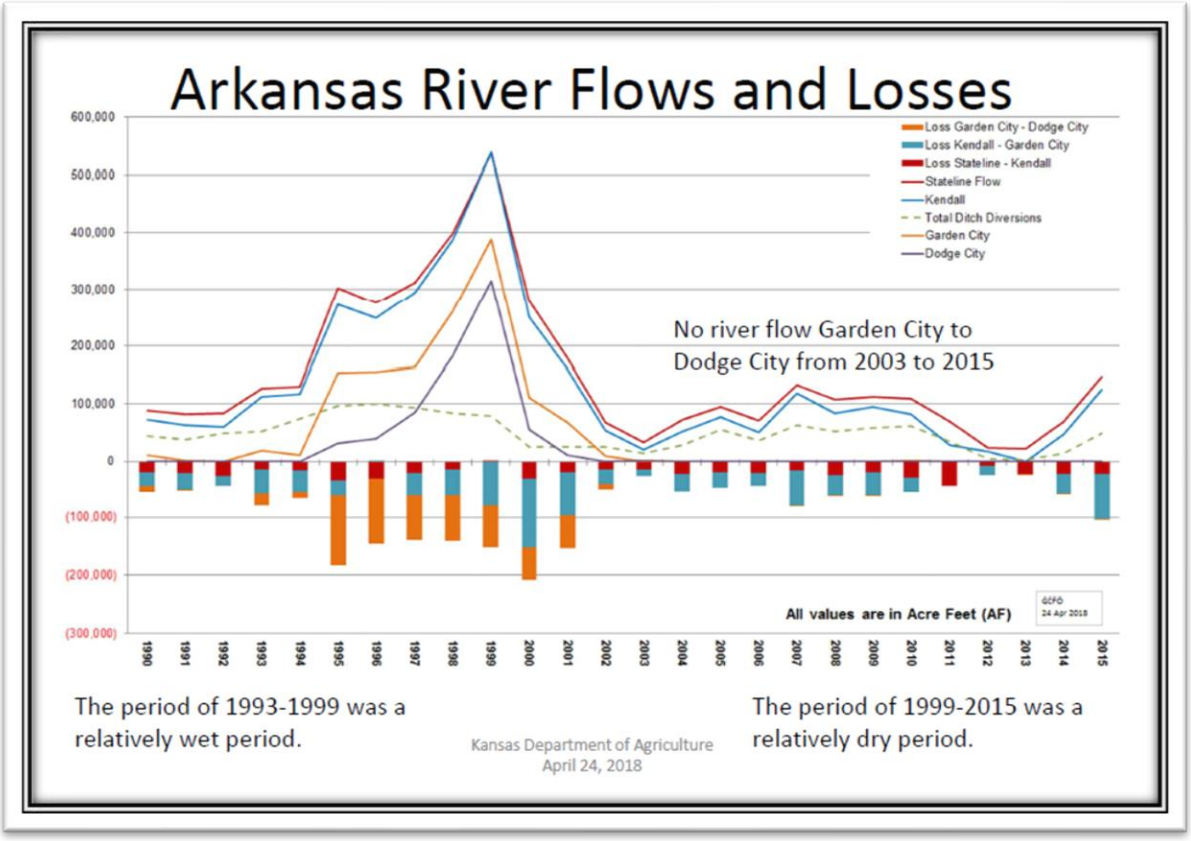


Evapotranspiration in the area of irrigation diversions and reservoirs in eastern Colorado substantially decreases the river flow before it enters Kansas. A smaller extent of irrigation ditches also divert river water in the GMD3 area.

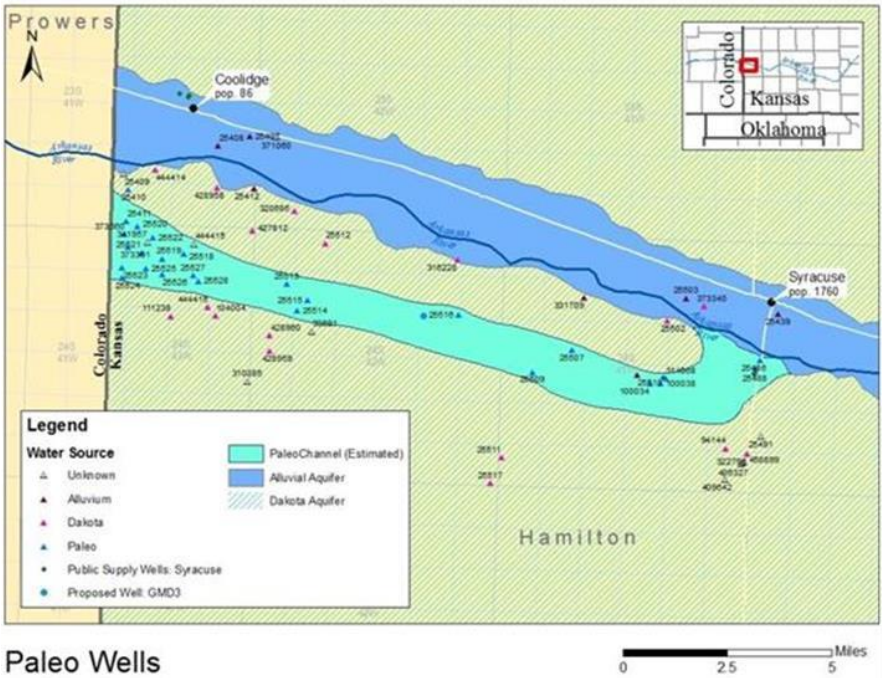


Before the mid-1970s, the Arkansas River nearly always gained flow (represented by positive values on the graph) between the area of ditch diversions and Dodge City. Now the river recharges the HPA, with recharge exceeding 100,000 acre-ft during years of higher flows. We've created a closed basin (KGS 2018). GMD3 has identified this hydrology setting to be surface water natural storage into available groundwater reservoir space.





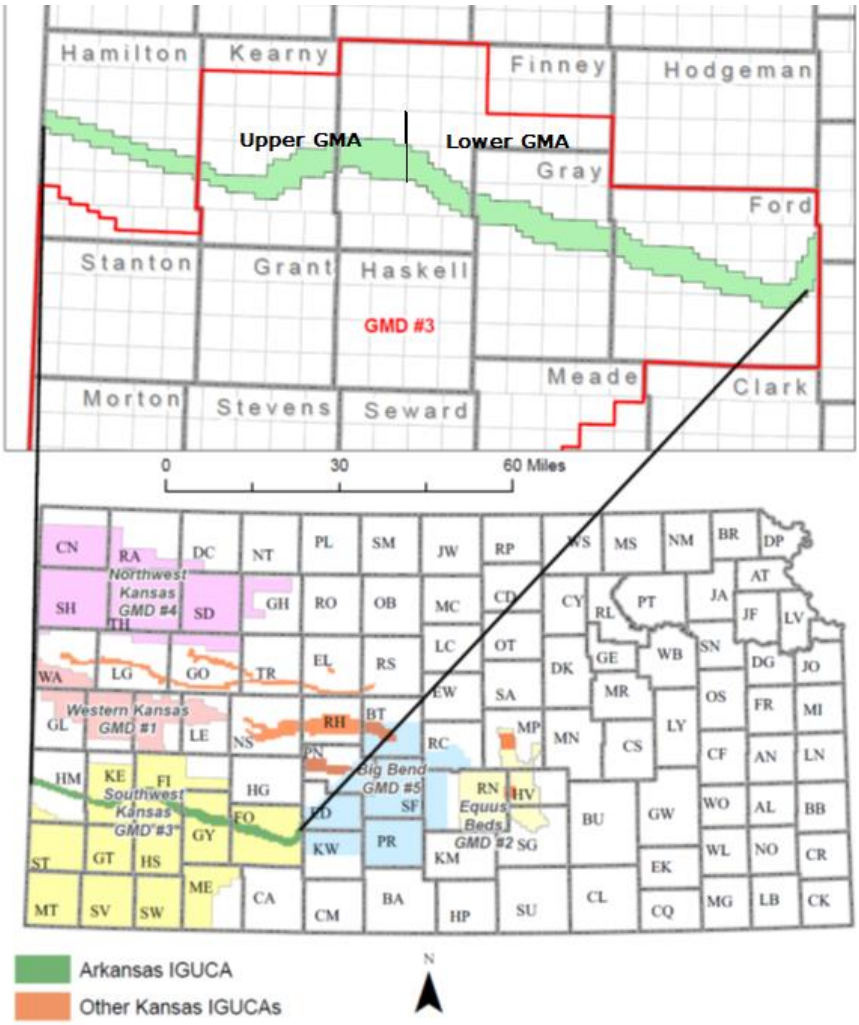
Arkansas River flow/loss chart. Source: DWR



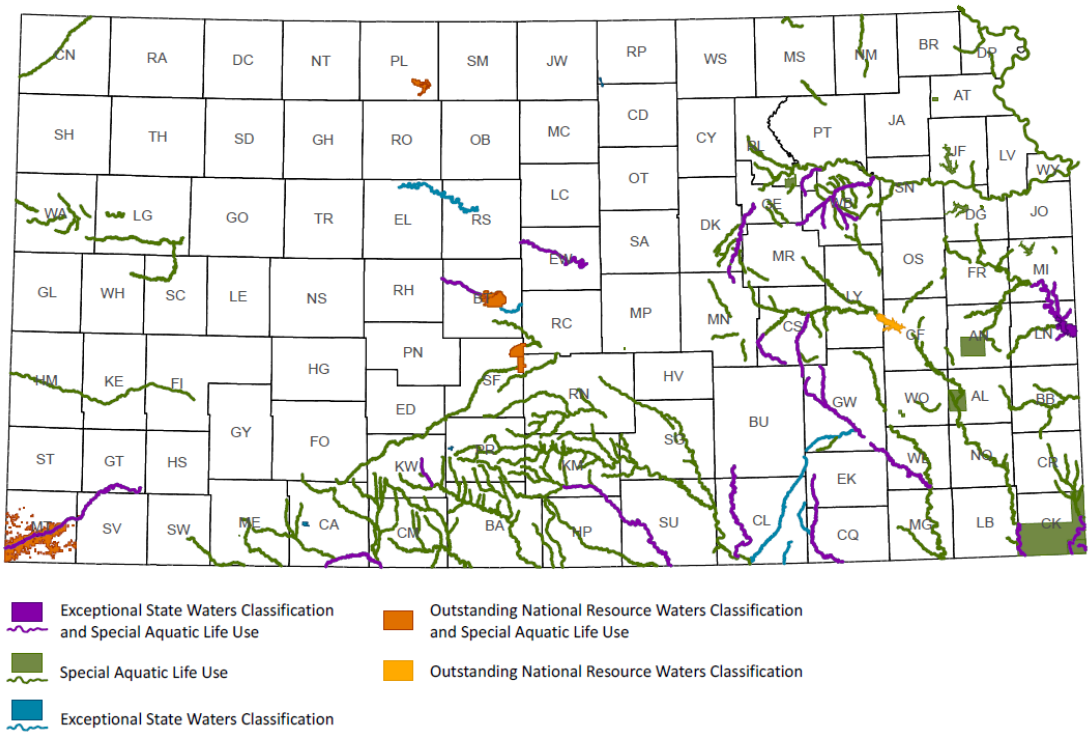
Paleo Wells

Palio-river channel Hamilton County fresh groundwater reservoir source of drinking water to be managed.

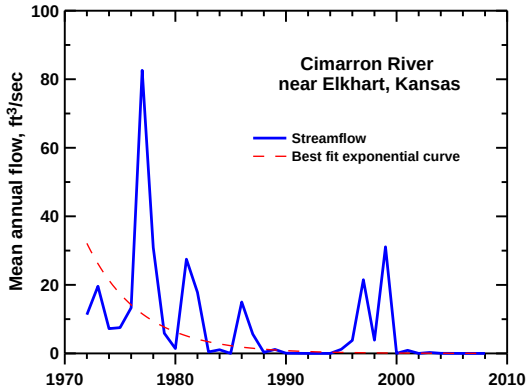
Ark River IGUCA



High Value Surface Water Designations within Kansas



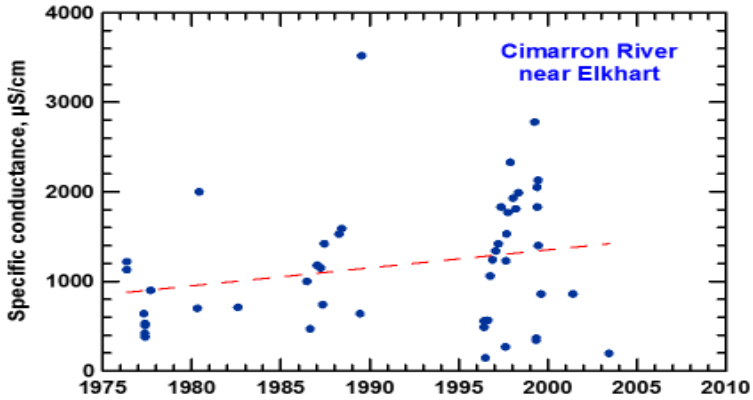
Map showing Exceptional State Waters and Outstanding National Resource Waters of the Cimarron River and National Grassland. Source: KDHE, 2010



Cimarron River entering Kansas in Morton County

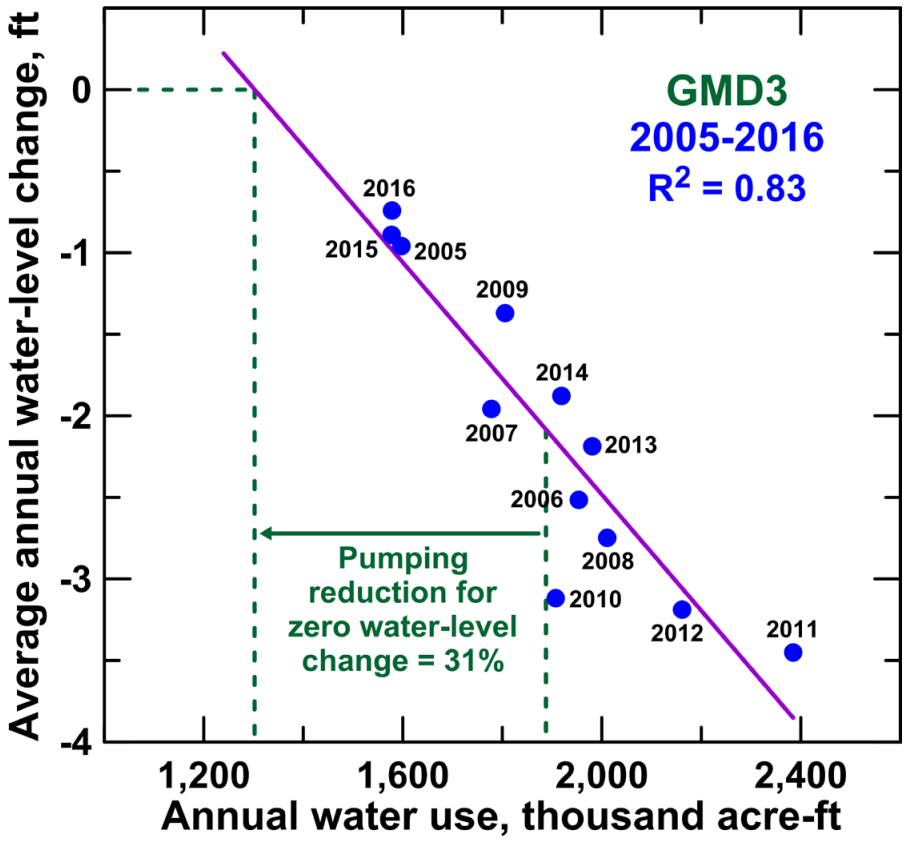
Water use in the Cimarron River valley upstream of the Kansas Stateline has decreased flow and increased salinity of the river system entering Kansas. The river no longer flows except occasionally.

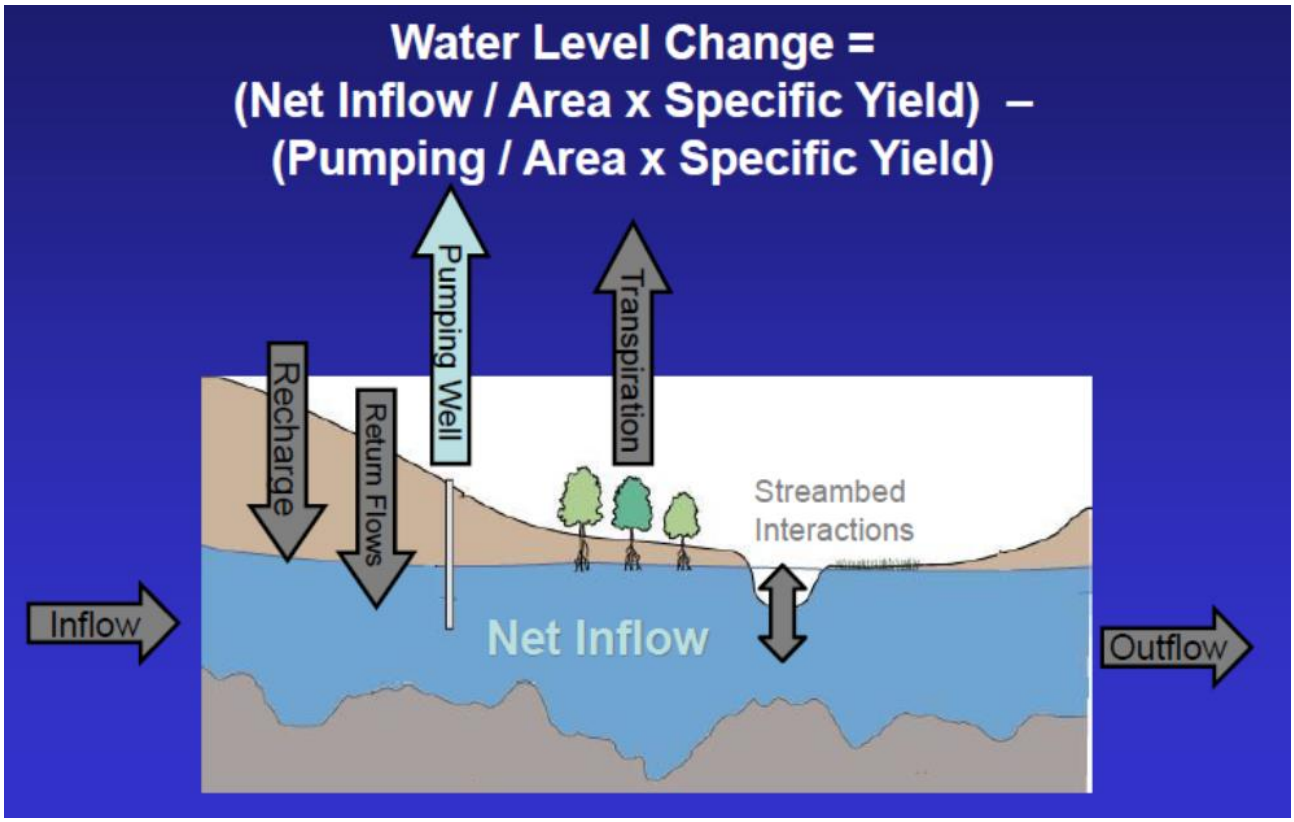
From Kansas Geological Survey Open File Report 2005-27



From Kansas Geological Survey Open File Report 2005-27

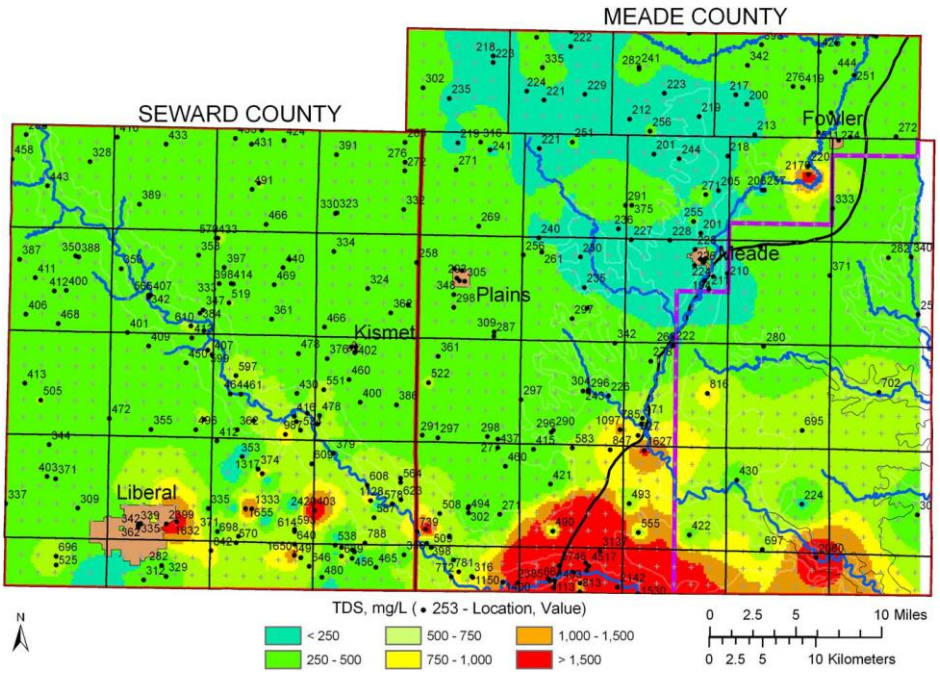
How close to sustainable? Average annual water-level change versus annual water use for GMD3 for 2005–2016. Water-level data are for KGS-DWR cooperative network wells measured each winter during the period. The solid line is the best-fit straight line to the plot. The pumping reduction from the average water use for 2005–2016 to that needed to achieve a zero water-level change is shown by the vertical dashed green lines. From *Status of the High Plains Aquifer in Kansas* | Whittemore, Butler, & Wilson, KGS Technical series 22, 2018. 31% = about 776,000 acre-feet.



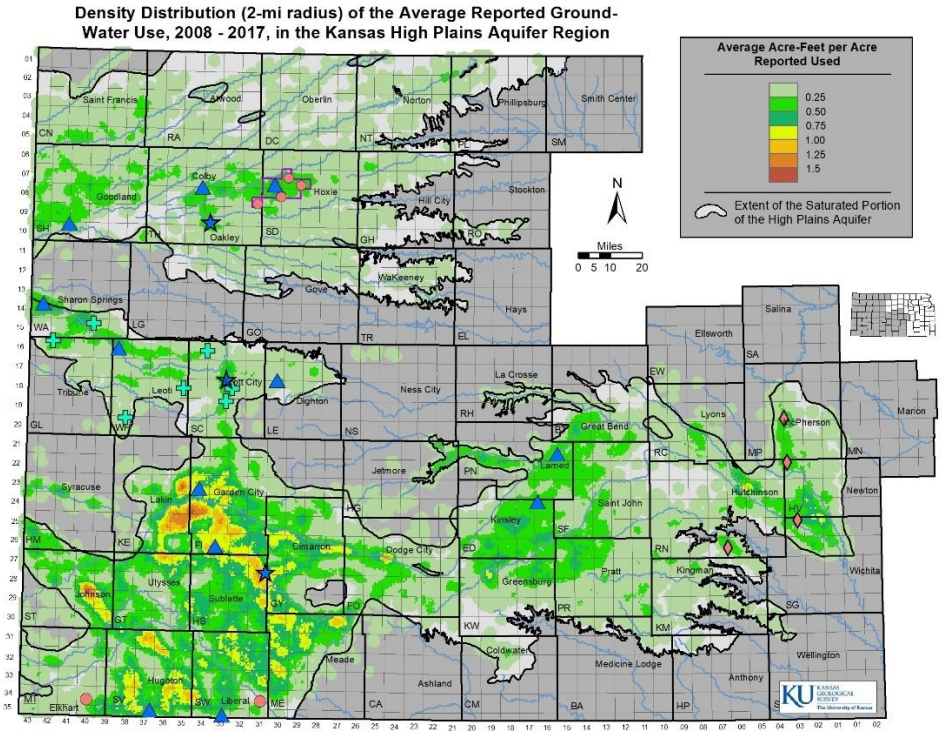


Source: Kansas Geological Survey

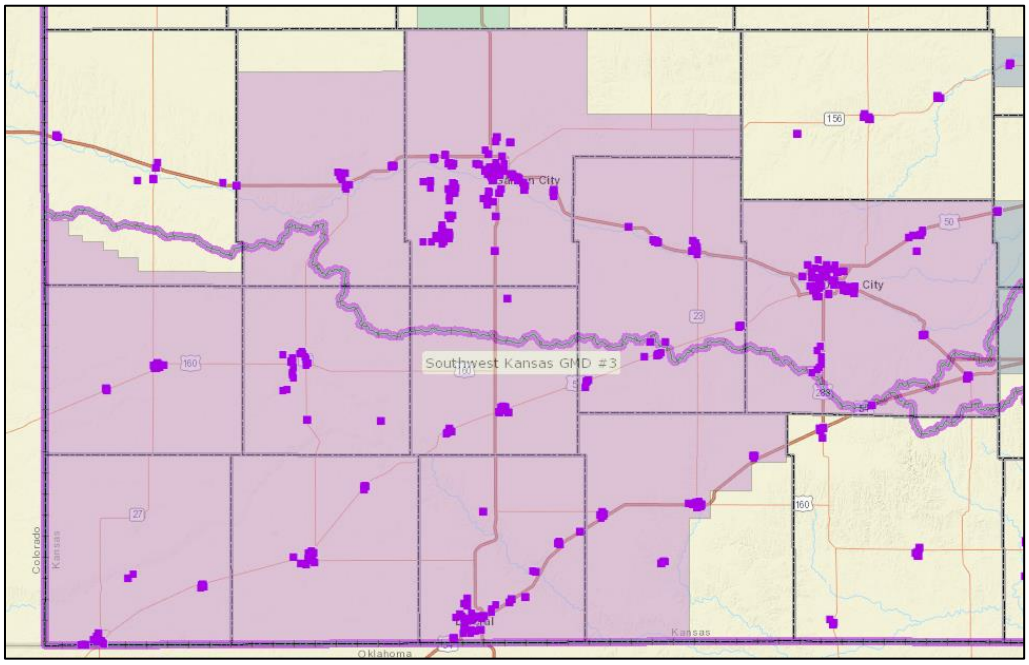
GMD3 Special Rule GMA (Water Quality Control Area)



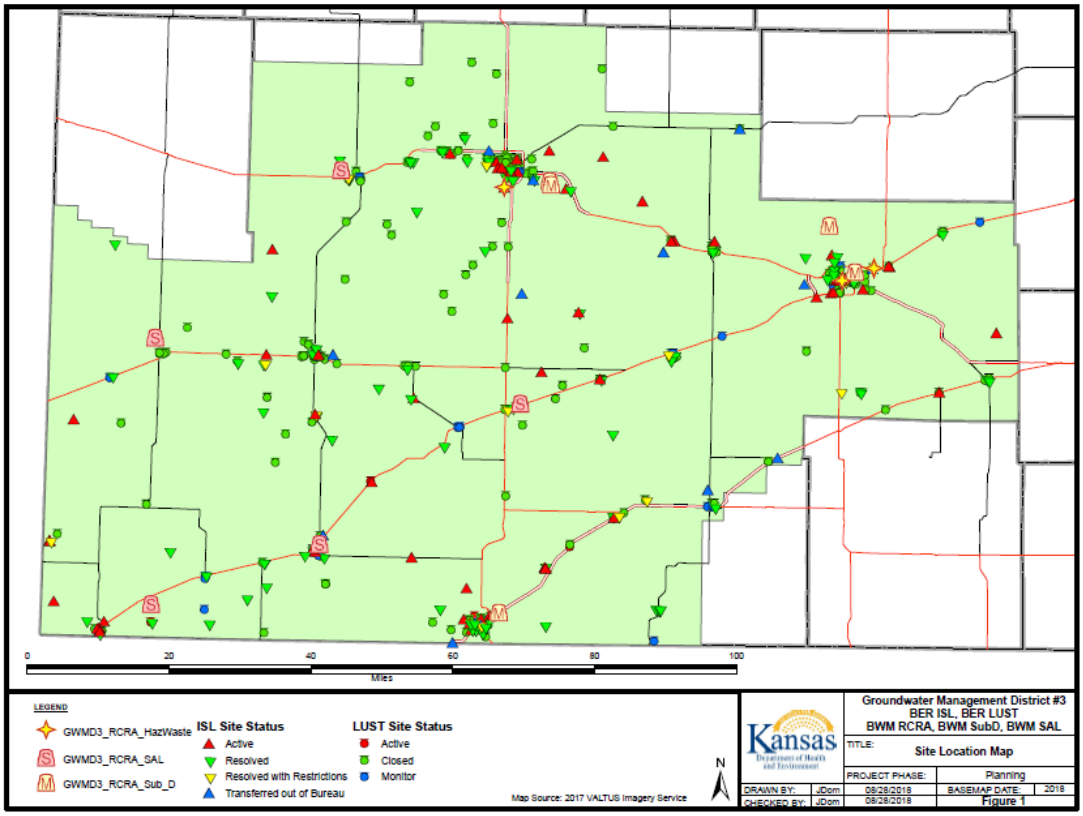
Distribution of chloride concentration in groundwater in groundwater reservoirs in Seward and Meade counties. The blue line extending from northwest to southeast Seward County and through southwest Meade County is the Cimarron River. Most of the blue lines in northern, central, and southeast Meade County are streams that are part of the Crooked Creek drainage basin. The vertical red line is the boundary between Seward and Meade counties. The purple line within Meade County is part of the eastern boundary of GMD3. The black line extending from southwest to northeast Meade County represents the eastern extent of the saturated part of the High Plains Aquifer in the figure. From KGS Open File Report 2005-27.



Kansas High Plains Groundwater reservoir detailed pumping density and location of KGS index wells in 2019.



2018 KDHE map of the 67 public water system infrastructure locations within or near GMD3. Map includes the boundary through the district between the Upper Ark and the Cimarron basins. Southeast Ford County includes the upper Rattlesnake Creek basin.



KDHE 2018 map of contaminated sites documented in the Identified Site List (ISL) and Leaking Underground Storage Tanks (LUST). A subset of these are "orphaned sites" with no identified responsible entity for site cleanup, including groundwater remediation.

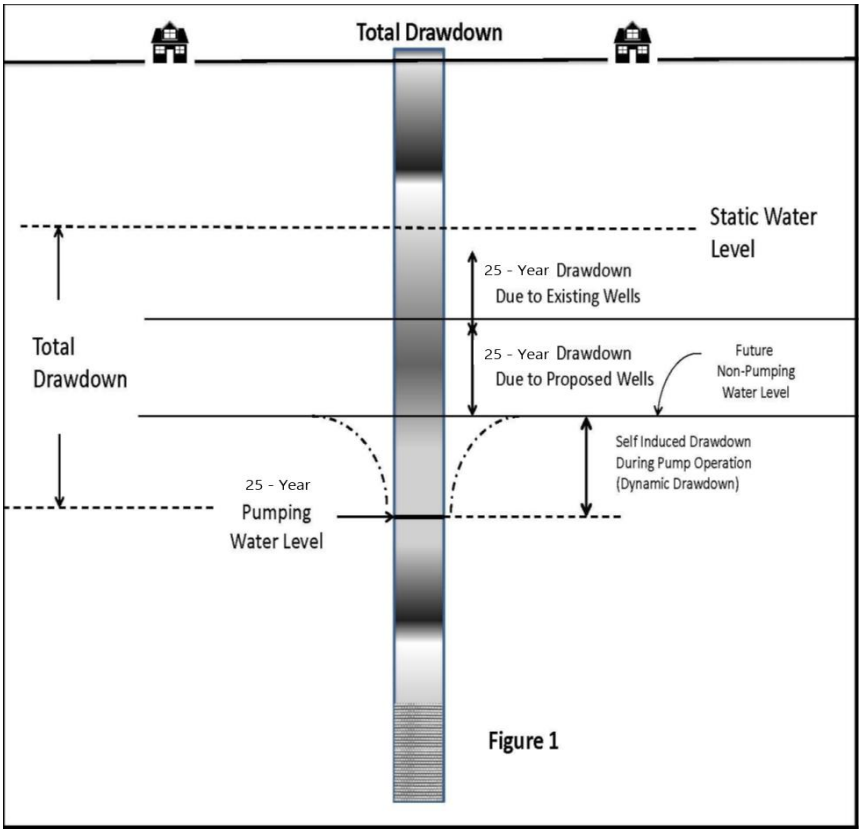


Figure 1 is adapted from *Guidelines for the Assessment of Drawdown Estimates for Water Right Application Processing* (New Mexico Office of the State Engineer Hydrology Bureau Report 05-17, May 10, 2017, by Tom Morrison, et. al.). GMD3 may use a 25-year period of pumping to be consistent with GMD3 Board policy on maximum allowable rate of groundwater reservoir depletion.

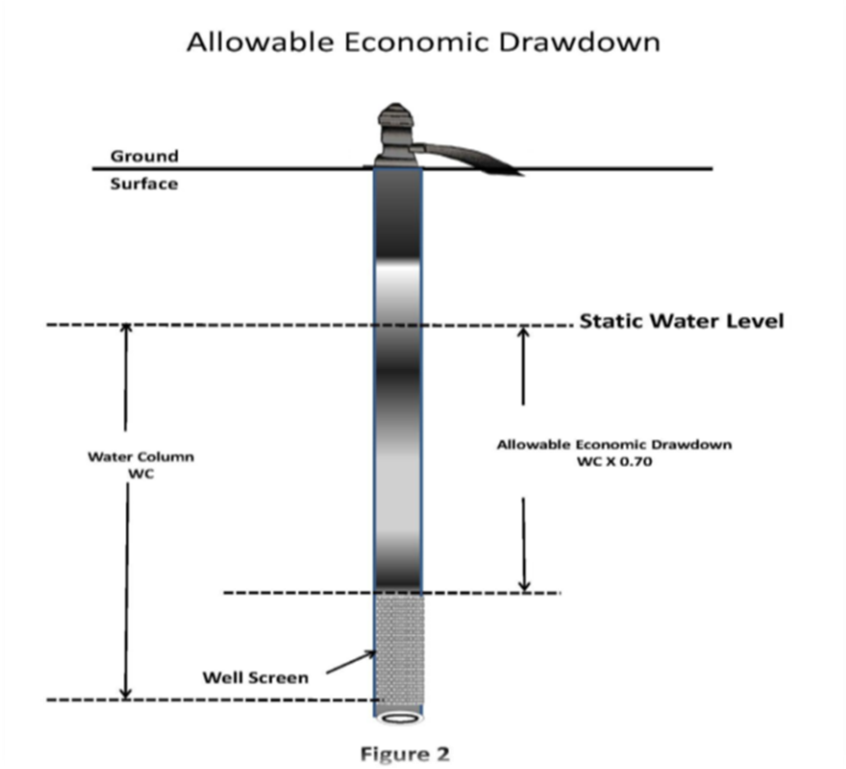


Figure 2 is addapted from: *Guidelines for the Assessment of Drawdown Estimates for Water Right Application Processing* (New Mexico Office of the State Engineer Hydrology Bureau Report 05-17, May 10, 2017, by Tom Morrison, et. al.).

- The Theis equation estimates drawdown in the aquifer but not inside of the well casing.
- Dynamic drawdown represents drawdown inside of casing, including well inefficiencies.
- Dynamic drawdown represents fluctuating drawdown as pumps are cycled on and off.

See: http://www.gmd3.org/wp-content/uploads/2019/04/DRAWDOWN-ASSESSMENT-GUIDELINES-for-GMD3-2019.docx