

**WRITTEN TESTIMONY**

**OF THE WESTERN KANSAS GROUNDWATER MANAGEMENT DISTRICT #1**

**To Hearing Officer Earl D. Lewis, Jr., Division of Water Resources,**

**Kansas Department of Agriculture,**

**For the Second LEMA Hearing, Scheduled November 20, 2020.**

**Submitted by: Kyle Spencer, Manager**

This written testimony is from the Western Kansas Groundwater Management District #1 (“GMD 1”) regarding its proposal for a Local Enhanced Management Area (“LEMA”) for portions of Wichita County, Kansas. It has been approved by the GMD 1 Board of Directors.

GMD 1 submits this testimony in support of the Chief Engineer finding that the proposed Local Enhanced Management Area (LEMA) will serve the public interest by implementing necessary corrective controls to conserve water and facilitate further conservation methods to extend the life of the High Plains Aquifer.

In this testimony, GMD 1 provides a short history and overview of supporting statutes and the previous actions taken in this proceeding. Then, GMD 1 provides an overview of key elements of its LEMA plan, including a re-statement of its goal and shows how the corrective control measures should reach the goal. Finally, this testimony addresses specific provisions, and how those provisions are both legal and proper to achieve the LEMA’s goals.

**1. Legal Standards and History of These Proceedings**

There are three main phases to the approval of any proposed LEMA: the initiation of the proposed LEMA, the initial public hearing, and the subsequent hearing (or hearings). KAN. STAT. ANN. § 82a-1041.

a. *Initiation of the Proposed LEMA*

Whenever a proposed LEMA plan is submitted to the Kansas Department of Agriculture, Division of Water Resources (DWR), the Chief Engineer reviews the proposed LEMA plan to see if the plan is acceptable for consideration by including the following elements: 1) proposes clear geographic boundaries; 2) pertains to an area wholly within the groundwater management district; 3) proposes goals and corrective control provisions adequate to meet the stated goals; 4) gives due consideration to water users who already have implemented reductions in water use resulting in voluntary conservation measures; 5) includes a compliance monitoring and enforcement element; and 6) is consistent with state law. KAN. STAT. ANN. § 82a-1041(a).

On March 26, 2020, GMD 1 submitted its proposal for the Wichita County LEMA. The plan and corresponding documents were submitted to the Division of Water Resources (“DWR”) for consideration. On April 7, 2020, the Chief Engineer found the proposed LEMA acceptable for consideration, and set the matter for the initial hearing.

b. *Initial Public Hearing*

At the initial public hearing, the Chief Engineer allows comments and evidence on the question of designating the area in the Proposed LEMA in accordance to the submitted plan. KAN. STAT. ANN. § 82a-1041(b). Specifically at this initial hearing, the Chief Engineer is tasked with resolving the following factual issues: 1) Whether one or more of the circumstances specified in K.S.A. 82a-1036(a) through (d), and amendments thereto, exist; 2) whether the public interest of K.S.A. 82a-1020, and amendments thereto, requires that one or more corrective control provisions be adopted; and 3) whether the geographic boundaries are reasonable. *Id.*

After timely notice, on August 14, 2020, the initial hearing was held. GMD 1 submitted its written statements in support, along with further supporting written testimony from Brownie

Wilson with the Kansas Geological Survey, Lane Letourneau and Mike Meyer with the Division of Water Resources, and Frank Mercurio with the Upper Smoky Hills Regional Advisory Committee, and Tammy Simons with the Wichita County Water Conservation Area. Oral testimony was provided at the hearing by some members of the same organizations.

GMD 1 specifically set forth both oral and written testimony in support of elements a) and b) of K.S.A. 82a-1036: that groundwater levels in the Proposed LEMA were declining and have declined excessively, and that the rate of withdrawal in the Proposed LEMA exceeded the rate of recharge. It further submitted both written and oral testimony that the Proposed LEMA was in the public interests and that its proposed geographic boundaries are reasonable. All other individuals submitting testimony spoke in support of these elements.

On September 9, 2020, the Chief Engineer issued his Findings and Order that all of the initial requirements from the initial hearing were met, and set the matter for subsequent hearing. Specifically, based on the hearing record and its resulting findings of fact, he found that, as a matter of law, groundwater levels in the Proposed LEMA are declining and have declined excessively, that the rate of withdrawal in the Proposed LEMA exceeded the rate of recharge, that the Proposed LEMA is in the public interest, and that the geographic boundaries of the Proposed LEMA are reasonable.

c. *Subsequent Hearing or Hearings*

If the findings from the initial hearing are favorable, the Chief Engineer conducts a subsequent hearing, or multiple subsequent hearings if necessary. Kan. Stat. Ann. 82a-1041(b). This hearing is limited solely to the Proposed LEMA plan, whether it is sufficient to address any of the conditions found under K.S.A. 82a-1036 by the Chief Engineer in the initial hearing and whether it should be adopted as proposed. *Id.* at (d)(1).

So, the mixed questions of fact and law for this hearing is: whether the Proposed LEMA's plan and its corrective controls are sufficient to address the declining groundwater levels in the Proposed LEMA and the imbalance between the rate of withdrawal and the rate of recharge within the Proposed LEMA.

It is, and it will.

## 2. Overview of the LEMA Plan and its corrective controls

The following is as a summary of the major provisions of LEMA plan and a discussion of the LEMA Plan's goal:

- **Time Period.** The LEMA period is from 2021 to 2025. Exhibit "A", *Wichita County LEMA Request*, at 2.
- **The LEMA Goal and allocation principles.** The LEMA goal is to limit irrigation withdrawals to 246,882.786 acre-feet during the five-year LEMA period. *Id.* This number is the sum of the allocations provided in Attachment A to the LEMA plan, assuming no voluntary enrollment of Vested Rights. *See* Appendix "A" (providing a more detailed summary of how the allocations in Attachment "A" of the LEMA plan were developed). The LEMA allocations provides up to a 25% reduction of reported use of the 2009 – 2015 period, provided:
  - Years of no reported use are excluded from the calculation of legal average use, which is the basis of the LEMA allocations. *Id.* at Section 2.
  - Where the legal average use is below 20% of the annual authorized quantity, the allocation is based on the legal average use, without reduction. *Id.* at Section 3.
  - Where the legal average use is above 20% of the annual authorized quantity but a 25% reduction of the legal average use would result in less than 20% of annual

authorized quantity, the allocation will be 20% of annual authorized quantity times five. *Id.* at Section 5.

- **Allocations.** Allocations provided under the LEMA will be given a five-year amount. In any year, the average annual LEMA allocation may be exceeded but not the water right's annual authorized quantity. *See* Exhibit "A" at 4-5.
- **Carryover.** Any unused LEMA allocation will be recommended as allowable carryover to a new LEMA plan without the carryover quantity being subjected to the new LEMA's conservation factor. *Id.*
- **Combined Well Units.** The LEMA Plan allows for the creation of Combined Well Units, for multiple wells diverting water from the same source of supply and physically tied together for the distribution of water. In such cases, allocations for the group can be moved between wells, provided no well is allowed to pump more than its annual authorized quantity. Water Right changes may be required to gain approval. *Id.* at 7.
- **Vested Rights.** Vested Water Rights are exempt from the LEMA's corrective controls (allocations) but cannot be combined with other water rights unless voluntarily enrolled, except where authorized pursuant to approved DWR water right change applications. Any vested rights voluntarily enrolled will be subject to the LEMA's corrective control provisions and may be part of the LEMA's Combined Well Units. *Id.* at 5-6.
- **Voluntary Conservation Consideration.** Where water users have implemented voluntary conservation during the 2009-2015 period, they may appeal their allocation.
  - For years in which the owner documents their past voluntary conservation, a flow rate test will be conducted by GMD1 or DWR to determine if the capability of the well(s) under appeal exceed their Historical Use. The resulting flow rate will be multiplied by 150 days to establish a test-result quantity. *Id.* at 9-11.

- The greater of Historical Use or test result quantity shall be reduced by the 25% Conservation Factor.
- Water Rights on land not owned, leased or otherwise previously controlled or pumped for any of the years, 2009 thru 2015, by the Farm Services Agency (FSA) producer of record as of January 1, 2020 shall be allowed an appeal with a flow test. *Id.*

Should the allocations allowed under the LEMA plan be fully utilized in the five-year period, the average water use during 2021-2025 will be reduced approximately 14.7% percent from the average use of 2009-2015. As these allocations include full use by vested rights of their annual authorized quantity each year and does not consider additional reductions to pumping due to the County's Water Conservation Areas, it is expected that actual reductions from historic use will be greater. See further discussion of these matters in Section 3(c) below.

Conversely, the allocations provided in Attachment A to the LEMA plan do not include the potential results of appeals allowed pursuant to the Plan which could increase those allocations and water use. As the goal of the LEMA is limiting irrigation use to the sum of the allocations provided in Attachment A to the LEMA plan, but the appeal procedure may allow an increase in allocations where past voluntary conservation is demonstrated, the testimony provided below provides GMD 1's evidence that the stated goal can reasonably be expected to be achieved.

**3. The corrective controls measures in the Proposed LEMA are sufficient to address the declining groundwater levels and the imbalance in the rate of withdrawal, because they are specifically tailored on reliable data to accomplish the LEMA's stated goal.**

The Proposed LEMA is tailored to adequately meet its goal of addressing the excessive water level declines and withdrawal rates exceeding recharge by reducing water use in the areas of Wichita County within GMD 1. GMD 1 has set a goal tailored specifically to reduce declines within the High Plains Aquifer of Wichita County, thereby extending the aquifer's useful life for the long-term benefit of the area. The goal was developed using reliable geological and hydrological data. The Proposed LEMA reduces water use to the level necessary to meet that goal; additionally has an appeal process, and contains special considerations for unique cases, thus safeguarding the rights of its users while accomplishing its goals.

a. *The corrective controls will limit irrigation withdrawals to 246,882.786 acre-feet during the five-year LEMA period and are sufficient to address the declining groundwater levels and the imbalance in rate of recharge and withdrawal.*

As described above, the Proposed LEMA's corrective controls will reduce the historical use of Appropriation Water Right Holders ("Holder") in the subject area by limiting irrigation withdrawals to 246,882.786 acre-feet during the five-year LEMA. *See Exhibit "A" at 2; see also Exhibit "B", Proposed Allocations for the Wichita County LEMA (revised November 9, 2020).* As is described further in Appendix "A" to this testimony, these historical water use numbers forming the basis of the allocations were collected by DWR and reviewed by the Garden City Field Office of the DWR, and each Holder's specific allocations were calculated by that office as well. *See generally Appendix "A".* These historical use numbers are from the period of 2009-2015, which represents a recent representative period for establishing the corrective controls.

The goal of limiting irrigation withdrawals to 246,882.786 acre-feet of withdrawals during the five-year LEMA was specifically tailored in light of available data. At the initial

hearing, Brownie Wilson with the Kansas Geological Survey (KGS) reported on the result of KGS's study that found a 20.02% reduction in the average annual withdrawals from the aquifer would stabilize the water levels for the coming decade or two. *See Exhibit "C", Written Testimony from Brownie Wilson*, at 5. Thus, the full use of allocations under the LEMA's proposed corrective controls will accomplish a significant part of the reductions needed to address the declining groundwater levels.

However, the Proposed LEMA plan provides for an appeal process that could result in greater allocations and withdrawals than the LEMA's goal. GMD 1 has considered the potential impact of these appeals on allocations and use, and believes the plan is still sufficient to achieve its stated goal due to counterbalancing considerations below.

b. *The impacts of the appeal process on allocations and water use are expected to be small.*

The Proposed LEMA allows for an appeal process for Holders who have implemented voluntary water conservation during the 2009-2015 period and wish to seek an increased allocation as a result or who claim error in calculations made. Exhibit "A", at 9-11. The Proposed LEMA also allows special considerations to be given via the appeals process for water rights not owned, leased or controlled during the 2009 -2015 period by the FSA producer of record as of January 1, 2020. *Id.* Acknowledging it is difficult to quantify how many appeals will occur or to what extent they may impact the Proposed LEMA's goal of limiting irrigation withdrawals, we expect their impacts to minimal compared to the counterbalancing elements noted below. Additionally, allocations will be granted only to the extent that pump tests demonstrate the water can be pumped, and the additions will only be applied to specific years. Finally, the additional allocations granted by the appeal procedures will not necessarily correspond to increased use of the same amount.



c. *It is reasonable to conclude that counterbalances noted below to potential increases in water use due to appeals will outweigh these potential increases, and thus the LEMA Plan will likely result in greater conservation than the goal of the Proposed LEMA.*

First, the Proposed LEMA exempts vested right holders, and assumes, for purposes of achieving its stated goal, that each vested right will use 100% of their annual authorized quantity. Exhibit “A” at 2-3. This results in a potential withdrawal of 4,129 acre-feet per year, or 20,645 acre-feet over the five-year LEMA period. *See generally* Exhibit “B”.

However, vested right holders are unlikely, if not incapable due to physical constraints, of significantly expanding their use during the LEMA period. Thus, pumping from vested right users is far less than the 20,645 acre-feet assumed use over the Proposed LEMA period. No vested right holder in the Proposed LEMA has an average use of more than 71% of their annual authorized quantity during the period of 2009-2015, and many used significantly less. *Id.* Summing the Legal Average Use values of Exhibit “A” for all Vested Rights yields an average use during that period of 1,081.683 acre-feet per year, or 3,047.317 acre-feet per year less than authorized and approximately 15,236 acre feet less than the assumption in the Plan’s goal over the Proposed LEMA period. *Id.* Additionally, vested right holders may voluntarily enroll in this LEMA, the Wichita County WCA, or develop their own WCA further reducing water use. Exhibit “A” at 2.

Second, roughly 20% of Holders in the Proposed LEMA are enrolled in the Wichita County WCA. *See* Exhibit “D”, *Enrollment and Selected Provisions of the Wichita County WCA*. Those users are voluntarily reducing their water use by 29% or more in the initial seven-year period of that conservation area, with the reduction ultimately increasing to 36% during the LEMA period. *Id.* Like vested rights above, the allocations in the LEMA Plan do not account for less use by water rights enrolled in the WCA. An analysis by DWR comparing the WCA allocations and LEMA allocations for those water rights enrolled in the Wichita County WCA

shows the WCA's additional restrictions can be expected to reduce use by 5,326 acre-feet more than the assumed LEMA Plan's allocations over the 5-year period. *Id.* Additionally, enrollment for the WCA is still open, and there may be new participants over the period of the Proposed LEMA, resulting in further use reductions. *Id.*

Third, the Proposed LEMA plan assumes, for the sake of safe planning, that all Holders will use 100% of their LEMA allocations. This is factually unlikely. Past results from multi-year allocation programs such as LEMAs have shown most participants typically use less than allocated when enrolled in flexible use plans. *See David Barfield, DIV. OF WATER RES., 2020 Report on Implementing Legislative Tools to Extend the Life of the Ogallala Aquifer (Jan. 2020)* (noting the Sheridan LEMA achieved water use savings of 32%, over the planned 20%). Additionally, given the strong public support for preserving the High Plains Aquifer—and the strong support for this LEMA—it is a fair assumption that Holders in this area will continue efforts to reduce their irrigation water use, and thus these voluntary actions will assist in meeting the Proposed LEMA's goals.

Fourth, the historical use period used as the basis for calculating the proposed LEMA allocations contains two years (2011 and 2012) when a major drought impacted Wichita County necessitating much greater withdrawals during those years. Including these years will provide water users with increased ability to deal with another drought during the LEMA Period via a relatively generous allocation. It is also reasonable to assume that, absent another drought, the Proposed LEMA's target goals will be easier for these agricultural users to reach as the absence of a drought during the Proposed LEMA period will create a buffer for users under the plan.

Fifth and finally, the benefit to the brief five-year period of the Proposed LEMA allows for modification to address any “unknown unknowns” that may arise. If the corrective controls are ultimately found to be inadequate to achieve the limitation in pumping needed to address the

declining groundwater levels, or if the variances result in a much greater water use than anticipated, these can be addressed should GMD 1 apply to continue a LEMA in Wichita County in the future.

Ultimately, while the amount of additional water to be allocated via the appeal process is unknown, GMD 1 asserts that it is reasonable to assume the significant counterbalances noted above will more than outweigh the additional use that might occur under the appeal process. And because they outweigh the variances, the Proposed LEMA's goal of limiting irrigation withdrawals to 246,882.786 acre-feet of irrigation during the five-year period is very likely to be met, and it is likely that withdrawals during this period will be even lower due to these counterbalances.

**4. The Appeal Process is reasonably tailored to give due consideration to voluntary conservation measures and protect property rights, while ensuring the goals of the Proposed LEMA are met.**

Holders are given the ability to file an appeal with the GMD 1 Board of Directors regarding their allocation amount under the Proposed LEMA. Exhibit "A" at 9-11. These appeals are limited to: a) ensuring that due consideration to prior conservation is properly considered, b) issues of improper calculation of allocation, or c) for transfers of ownership as of January 1, 2020. *Id.* Following a timely appeal, Holders may present to the GMD 1 Board all evidence to support their appeal basis; and following the receipt of all evidence, the GMD 1 Board may grant the appeal, deny the appeal, authorize a flow rate test to clarify any discrepancies, or issue a new allocation to the Holder based on the evidence presented, or other evidence available from the DWR or other official sources. *Id.*

This satisfies Procedural Due Process under the Constitution. Due Process requires both notice and a hearing before any governmental deprivation of property or other protected

right. *Matthews v. Eldridge*, 424 U.S. 319, 333 (1976); *Baldwin v. Hale*, 68 U.S. 1, 223, 233 (1863). Here, all Holders have been kept well-informed of the Proposed LEMA, and will continue to be informed by GMD 1, thus satisfying the notice element. This appeal process also allows for a fair opportunity for each Holder to be heard if they believe themselves aggrieved, and allows them to present their evidence and their appeal be held on the merits of that evidence, thus satisfying the hearing portion of Due Process.

Restricting the appeal process to *allocation* further ensures the goals of the Proposed LEMA are met. Any Holder wishing to generally contest the Proposed LEMA has the opportunity to do so through the LEMA approval process. Thus, limiting the appealable issue to allocation ensures that the goals of the Proposed LEMA are met, as the corrective controls contain counterbalances to any potential expansion of water right use.

Finally, allowing appeals based on prior conservation ensures that due consideration is given to water users who have already implemented reductions in use. This is a requirement under K.S.A. 82a-1041(a)(5), and that requirement is met with this provision. KAN. STAT. ANN. § 82a-1041(a)(5). If a Holder feels his allocation has not accounted for voluntary reductions, that Holder is allowed an appeal solely on those grounds. On a broader note, GMD 1 has been very supportive of its Holders who wish to conserve water, as the entire Wichita County community is well aware of the declining water levels in the High Plains Aquifer. GMD 1 is committed to ensuring that any Holder who has voluntarily curbed their own water use for the benefit of the community isn't penalized for doing so under the corrective controls of this LEMA.

**5. Non-irrigation water users are not given allocations under the Proposed LEMA because their impact on aquifer use is minimal.**

The Proposed LEMA does not apply corrective controls to non-irrigation users, but encourages them to develop best practices, which many have already done in light of the declining water supply. The combined total use of stock, municipal, and industrial withdrawals from the aquifer account for only 3.62% of the total water use during the Historic Period. Because these users' withdrawals are minimal, and because the goal of stabilizing the aquifer can be met through other corrective controls, no restrictions were placed on these users.

However, the Proposed LEMA does provide recommendations for each type of use, and states that the Board will review the annual water use reports of each type of user. Should any non-irrigation user start withdrawing water from the aquifer at an increased rate that would negatively impact its longevity, the Board can address this impact should it renew the LEMA after the five-year period.

Finally, stock and industrial users are common—and sometimes primary—economic drivers of Wichita County and the surrounding area, and are oftentimes the end user of many of the commodities created by the irrigation water users. This Proposed LEMA was specifically tailored to minimize economic disruption in Wichita County, and the Board fears that placing restrictions on these end users may have unanticipated economic “upstream effects” in Wichita County. Because of this, and because these non-irrigation users' impacts on the aquifer are already minimal, the Proposed LEMA does not contain any corrective controls for non-irrigation users.

**6. While the Proposed LEMA does not contain specific consideration of the priority of water rights in its allocations, it contains sufficient explicit and implicate provisions to consider priority and protect property rights.**

While the Proposed LEMA does not specifically address the priority of water right users in its corrective controls (allocations) other than exempting Vested Rights, priority of water rights are explicitly and implicitly considered and protected in the plan.

Explicit in the plan is that, should any user under the Proposed LEMA claim impairment, the plan expects the Chief Engineer to investigate and exercise his authority to address that impairment, *including giving consideration to water right priority*. Exhibit “A”, at 9. This provides the Chief Engineer the ability to make decisions regarding impairment on a priority basis, thus safeguarding the priority rights of users.

Beyond that, however, the Proposed LEMA implicitly safeguards priority rights. The Plan’s proposed corrective controls will reduce pumping from the aquifer—and the resulting effect of stabilizing the aquifer—delays and reduces potential future impairment, as it continues to allow users to withdraw water from the aquifer at the quantities allotted. Priority of water rights become legally important when impairment occurs, and one user asserts a legally superior claim to water use over another. But if no impairment occurs, then there is no need to consider priority: and that is what this Proposed LEMA will accomplish through stabilizing the aquifer.

Finally, this Proposed LEMA need not explicitly address priority beyond the considerations noted above, because the term of the Proposed LEMA is a temporary five-year period, and it does not completely deprive any user from their ability to withdraw from the aquifer. The Proposed LEMA is not a government taking that would rise to the level of a constitutional violation. Under the *Penn Central* test, a regulatory restriction is only considered a government taking when the taking is permanent, or when the taking completely

deprives the owner from use of their property. *Frick v. City of Salina*, 290 Kan. 869, 885 (Kan. 2010) (confirming Kansas's following of Supreme Court precedent in *Penn Central* on governmental taking). When those elements do not exist, a Court may look to other factors to determine if a property owner is owed other compensation; but critically, "[w]here the government reasonably concludes that the health, safety, morals, or general welfare would be promoted by prohibiting particular contemplated uses of land, compensation need not accompany a reasonable prohibition." *Garrett v. City of Topeka*, 259 Kan. 896, 916 (Kan. 1996).

Here, there is no governmental taking: the Proposed LEMA's plan is temporary—only five years—and it does not completely deprive any user in Wichita County from complete withdrawals from the aquifer, but merely the 25% necessary to stabilize it. And there is no need for further analysis under *Penn Central* test: the entire purpose of this Proposed LEMA is for the general welfare of all Wichita County residents by ensuring the long-term health of the High Plains Aquifer.

So, because the Chief Engineer still retains the authority to address impairment through water right priority should it occur, and because the Proposed LEMA implicitly avoids any such impairment claim by stabilizing the aquifer, the plan need not specifically set out a scheme for addressing water right priority. And legally speaking, it is not required to: because there is no governmental taking that would give rise to a constitutional claim, and because this Proposed LEMA exists to secure the general welfare of all residents and users under its plan, there is no need for the Proposed LEMA to contain special provisions to address the priority rights of its users.

**7. The Proposed LEMA contains a compliance monitoring and enforcement element sufficient to ensure the goals of the plan are met.**

The Proposed LEMA requires all monitoring to continue under state guidelines. This includes individual responsibility for ensuring water flowmeters are in good working order, and that annual reporting is completed. Should these items not be met, the well in question shall be assumed to have pumped its full authorized quantity of water, along with any other corrective provisions recommended by the Chief Engineer.

Additionally, should a Holder be found to have exceeded their allocation, or otherwise intentionally disrupted the discovery of actual water withdrawals, the Holders are subject to the provisions of K.A.R. 5-14-10 and K.A.R. 5-14-12, which include potential civil penalties and monetary fines. KAN. ADMIN. REGS. §§ 5-14-10, 12.

These compliance monitoring and enforcement elements should not cause undue burdens on the Holders under this Proposed LEMA, as they are requirements these users have or should have been in compliance with prior to LEMA implementation. Additionally, the penalties are ones already established by state statute and regulation, and thus impose no additional measures that could potentially be found punitive or otherwise unenforceable.

**8. While the LEMA's proposed corrective controls will bring short-term restrictions, they are necessary due to the current status of the water supply and are carefully crafted to meet short-term needs while extending the life of the Ogallala Aquifer for the benefit of both individual water users and the Region.**

The proposed controls in the Proposed LEMA are necessary to reduce pumping in Wichita County to protect existing water rights and extend the useful life of the Ogallala Aquifer. Within Wichita county 225 water rights comprising 448 wells have been dismissed as a result of the lack of supply and an additional 346 points of diversion had no pumping during the 2009-2015 period. This indicates the area needs management for long-term benefit.



The Board carefully crafted its plan to reduce use. While a significant number of water rights will have five-year allocations based on 75% of their average use during the 2009-2015 period, this remains reasonable as the period includes two years of severe drought. Also, as pumping rates continue to gradually decline over time, using water use history of the 2009-2015 period as basis for 2021-2025 allocations period will lessen the actual impact to water users.

An important element of the LEMA plan is its 5-year allocations, wherein water users can plan for the best use of their full supply to maximize the economic return from this water. As has been demonstrated in the Sheridan 6 LEMA, Wet Walnut Creek IGUCA, and elsewhere, in such cases, water users adapt from the mindset of maximum annual returns to maximizing economic return per acre-foot pumped. *See* Exhibit “E” at 6 (indicating a 23% reduction in groundwater use resulting in a mere 1.2% reduction in corn output). Also, results from those areas indicate users often employing a strategy of maintaining as many acres as possible, using less inches per acre and increasing the value of water per acre-foot applied. *See* Exhibit “F” at 183 (noting users adapting to water restrictions by utilizing water- and cost-saving irrigation technology and other efficiency-improving techniques). Finally, statistical analysis from the Walnut Creek IGUCA showed no significant short-term or long-term decreases in property values due to water-use restrictions. *Id.* at 183-84.

From all the above data, it is reasonable to expect the long-term benefits of the LEMA plan outweigh any potential short-term limitations, economic or otherwise.

**9. Conclusion**

This Proposed LEMA should be accepted and approved by the Chief Engineer. It has been specifically designed around reliable scientific data which support's the LEMA Plan's corrective controls to reduce irrigation water use to reduce declines in the High Plains Aquifer of Wichita County, extending the life of the aquifer there. The corrective controls are sufficient to meet the Plan's stated goal, contains counterbalances to increases in allocations from the Plan's appeal process.

Additionally, the Proposed LEMA complies with the law, and with the LEMA statute. It contains appeal provisions to ensure each Holder's constitutional rights are respected, and has compliance and enforcement provisions to ensure the rules of the LEMA are respected as well.

This Proposed LEMA represents a long and thoughtful process by GMD 1, and the water users of Wichita County, to conceive of a plan that will preserve the High Plains Aquifer, while still allowing productive and profitable agricultural use of the land. This Proposed LEMA also represents thoughtful input by the DWR, as it was willing to informally review this plan prior to submission to ensure it met all requirements under the law, and that informal review led to what we hope is a comprehensive and satisfactory plan that will allow the High Plains Aquifer to benefit Wichita County for years to come.

Thank you in advance for your consideration.

Respectfully Submitted,

/s/ Kyle Spencer  
Kyle Spencer  
Manager, GMD #1

## Exhibit List

- Exhibit A:** *Request for a Wichita County LEMA*, submitted to the Division of Water Resources March 26, 2020, *also available at:*  
[https://agriculture.ks.gov/docs/default-source/dwr-water-appropriation-documents/final-whcl-plan.pdf?sfvrsn=af978fc1\\_0](https://agriculture.ks.gov/docs/default-source/dwr-water-appropriation-documents/final-whcl-plan.pdf?sfvrsn=af978fc1_0)
- Exhibit B:** *Wichita County LEMA: Historical Use & Allocations*, originally submitted to the Division of Water Resources March 26, 2020, revised November 9, 2020, *also available at:*  
[https://www.gmdl.org/documents/Revised\\_Final%20of%20WC\\_LEMA\\_Allocation\\_GMD1.pdf](https://www.gmdl.org/documents/Revised_Final%20of%20WC_LEMA_Allocation_GMD1.pdf)
- Exhibit C:** *Written Testimony from Brownie Wilson*, KAN. GEOLOGICAL SURV., submitted July 21, 2020, *also available at:*  
[https://agriculture.ks.gov/docs/default-source/dwr-water-appropriation-documents/kgs\\_testimony\\_gmdl\\_whc\\_lem\\_a\\_20200814.pdf?sfvrsn=efef8dc1\\_0](https://agriculture.ks.gov/docs/default-source/dwr-water-appropriation-documents/kgs_testimony_gmdl_whc_lem_a_20200814.pdf?sfvrsn=efef8dc1_0)
- Exhibit D:** Enrollment and Selected Provisions of the *Wichita County WCA*, *also available at:*  
<https://agriculture.ks.gov/divisions-programs/dwr/managing-kansas-water-resources/wca/wichita-county-wca>
- Exhibit E:** Bill Golden, *Monitoring the Impacts of Sheridan County 6 Local Enhanced Management Area*, KAN. ST. AG. POLICY, November 15, 2018 (*selected provisions*), *also available at:*  
<https://www.agmanager.info/ag-policy/water-policy/monitoring-impacts-sheridan-county-6-local-enhanced-management-area>
- Exhibit F:** Bill Golden, *Impact Analysis of the Walnut Creek Intensive Groundwater Use Control Area*, 47 J. REG. ANALYSIS & POL. 177 (2017) (*selected provisions*), *also available at:*  
[http://www.jrap-journal.org/pastvolumes/2010/v47/jrap\\_v47\\_n2\\_a7\\_golden\\_leatherman.pdf](http://www.jrap-journal.org/pastvolumes/2010/v47/jrap_v47_n2_a7_golden_leatherman.pdf)

## **APPENDIX A—DETAILS OF ALLOCATION DEVELOPMENT**

The following provides more details on how the allocations proposed by the LEMA were developed with an explanation of Attachment A to the LEMA plan on Historic use and allocations to each water right.

The Division of Water Resources queried the Water Right Information System (WRIS) for basic water right information for irrigation water rights within the LEMA area as well as reported water use for each year, 2009-2015, inclusive.

Staff at the Garden City Field office reviewed the results from this query with records in their paper files, including water use reports, and corrected any water use information not consist with reported use as well as determining overlaps, limitations, and other circumstances affecting allowable use that is noted in Attachment A's QTY Limitation/Unit and KDA-DWR Notes columns.

### **Section 1: Water Right Information**

This section includes the following information obtained via the process noted above: water right number, point of diversion number (PVID#), annual authorized quantities, overlap groups (Unit#), as well as limitations and KDA-DWR Notes.

### **Section 2: Historic Use**

The data in the Historic Use section starts with the data query and review noted above. In addition, DWR staff compared the reported water use with the annual authorized quantity of the file. In any case where the reported use was in excess of the annual authorized quantity, it was reduced to the annual authorized quantity, to determine "legal" use.

"No use" in this section can mean either that there was no use reported in that year for that water right/point of diversion, or that its use was reported under another water right/point of diversion. "No use" years were NOT included in the averages computed in the column "Legal Average Use/PD."

The distinction in the "Legal Average Use/PD" column and the "Legal Average Use" in the next section is "Legal Average Use/PD" is reported use by point of diversion and "Legal Average Use" is by Water Right file.

### **Section 3: Average Use and LEMA Floor**

"Legal Average Use" combines the reported use under multiple points of diversion under one file number.

"Multiple PD's" indicates such cases as well as similar cases where a point of diversion is authorized by multiple water rights.

The columns titled “% Ave use of Auth” and “Min Est rate” are not used to determine LEMA allocations but are provide as a reference, the result being the required pumping test rate necessary to yield pumping over 150 days to equal the “Legal Average Use.”

The LEMA Floor Allocation column is 20% of the annual authorized quantity.

**Section 4: WR Info (a repeat of portions of Section 1)**

This section repeats selected columns of Section 1. See above for more information.

**Section 5: LEMA Allocations (w/ All Vested WR’s)**

The allocations provided in this section assume that the vested rights (highlighted in yellow) voluntarily enroll in the LEMA. In this case, the vested right are provided an allocation based on the same methods as the appropriation water rights.

The “25% Conservation” provides a computation of basis of the 5-year allocation in the following column, expressed as an average annual amount. Generally this is computed as the Legal Average Use time 0.75 (a 25% conservation factor). However, if the Legal Average Use is less than the LEMA Floor Allocation, the allocation is the Legal Average Use, without any reduction. If the Legal Average Use is greater than of the LEMA Floor Allocation, the allocation is the greater of the LEMA Floor Allocation or 75% of the Legal Average Use. “N/A” (not applicable) is used where there is a “Multiple PD” entry, meaning the allocation is on another water right/point of diversion combination.

**Section 6: LEMA Allocations (w/o any Vested WR’s)**

The allocations provided in this section assuming the vested rights (highlighted in yellow) do NOT voluntarily enroll in the LEMA. In this case, the vested rights right is not restricted and, for purposes of determining the amount of water allocated by the LEMA Plan, are assumed to pump their annual authorized quantity in each year.

For appropriation water rights with no overlapping point of diversion with a vested right, the allocation is computed in the same manner as discussed above. However, where an appropriation water right’s point of diversion overlaps with a vested right, an allocation is provided only to the extent that the Legal Water Use exceeds the vested right’s authorized quantity.

The resulting 5-year allocations are not show in the Attachment A attached to the LEMA plan, but are 5 times the “25% Conservation” column.

**APPENDIX B—EXPLANATION OF UPDATES TO THE LEMA PLAN’S ATTACHMENT  
A: LISTING OF WHCL WATER RIGHTS AND WHCL ALLOCATIONS**

Attached to this testimony is a slightly revised version of the LEMA Plan’s Attachment A (Here: Exhibit “B”), a listing of water right and allocations for each effected water right.

The updates include the following:

- Adds a “KDA-DWR Note” just above that table to better explain the meaning of the “25% Conservation” column.
- Add an additional “25% Conservation” column under the heading “LEMA Allocations (w/o any Vested WR's).”
  - In this new column, makes clear that vested rights not voluntarily enrolling are not provided a 5-year allocation but can use their full authorized quantity in each year.
- Updates the table in light of change applications approved since it was developed.
- Corrects error in the allocation for Water Right No. 11,129 (Unit 23) where overlapping Vested Right No. WH-05 is not voluntarily enrolling.

**Request for a Wichita County LEMA Submitted to the Chief Engineer,  
Kansas Department of Agriculture, Division of Water Resources**

**March 26, 2020**

**I. Definitions**

- a. “Annual Authorized Quantity or AAQ” - The maximum amount of annual water use assigned to a Water Right by DWR when the Water Right was approved or certified, and as modified by any subsequently approved changes, terms or conditions.
- b. “Appropriation Water Rights” - Pursuant to K.S.A. 82a -701(f), Water Rights that do not meet the conditions to be a Vested Water Right.
- c. “Board” - The GMD1 Board of Directors.
- d. “Chief Engineer” - The Chief Engineer of the Division of Water Resources, Kansas Department of Agriculture.
- e. “Comparison Years” - The years, 2009 through 2015, used to determine Historical Usage of a point of diversion.
- f. “Conservation Factor” - A 25% reduction applied to the Historical Usage for the calculation of a WHCL Allocation.
- g. “Combined Well Unit or CWU” - Multiple wells diverting water from the same source of supply and physically tied together for the distribution of water prior to the starting date of the WHCL.
- h. “Domestic Water Rights”- Shall mean the same as KSA82a-701 (c).
- i. “DWR” - Division of Water Resources, Kansas Department of Agriculture.
- j. “GMD1” - Western Kansas Groundwater Management District No. 1.
- k. “Historical Usage” - The average quantity of authorized water in acre-feet used by a point of diversion during the Comparison Years, excluding years of zero use from the seven-year average, used for the calculation of the WHCL Allocation.
- l. “K.A.R.” - Kansas Administrative Regulations.
- m. “KGS” - Kansas Geological Survey.
- n. “K.S.A.” - Kansas Statutes Annotated.
- o. “LEMA” - Local Enhanced Management Area.
- p. “LEMA Period” - A five year period that shall run from January 1, 2021 through December 31, 2025.

- q. "Management Plan" - A written plan required pursuant to K.S.A. 82a-1041 which serves as the basis of the order establishing this LEMA to promote the conservation of water and water use efficiency.
- r. "MYFA or Multi-Year Flex Account" - A type of Term Permit as defined in K.S.A. 82a-736.
- s. "Stakeholder" - Any Water Right owner within the WHCL boundaries.
- t. "Term Permit" - A DWR permit to appropriate water that is issued for a specified period of time and is automatically dismissed at the end of the period.
- u. "Vested Water Right" - Pursuant to K.S.A. 82a -701(d), a Water Right which was put to beneficial use prior to June 28, 1945.
- v. "Voluntarily Enrolled Vested Right" - A Vested Water Right which voluntarily enrolls in the WHCL Management Plan.
- w. "Water Rights"- means the same as defined in K.S.A. 82a-701(g).
- x. "WUC" - Water Use Correspondent.
- y. "WCA" - Water Conservation Area.
- z. "WHCL" - Wichita County Local Enhanced Management Area.
- aa. "WHCL Allocation" - The quantity of water in acre-feet allowed for each irrigation Appropriation Water Right and Voluntarily Enrolled Vested Right, assigned by point of diversion that may be diverted during the LEMA Period.
- bb. "WHCL Order of Designation" - The Order of Designation issued by the Chief Engineer pursuant to K.S.A. 82a-1041.

## **II. Management Plan Goals**

In order to meet the goal of extending the Ogallala Aquifer supplies for the long term benefit of the area included in the proposed WHCL, a public process was utilized. Specifically, the Board worked with Stakeholders during board meetings and other public meetings to develop a Management Plan based on the desires of the public.

The WHCL shall exist for a five-year period beginning on January 1, 2021 and ending on December 31, 2025. In order to address excessive water level declines and withdrawal rates exceeding recharge rates within the proposed WHCL boundaries, the goal of the Management Plan shall be to limit irrigation withdrawals to 246,882.786 acre feet during the LEMA Period.

## **III. Proposal**

The WHCL shall include all irrigation Appropriation Water Rights whose source is the Ogallala Aquifer within the WHCL boundaries. Pursuant to K.S.A. 82a-703 Vested Water Rights within the WHCL boundaries shall not be regulated except through voluntary enrollment. Once voluntarily enrolled in the WHCL, Vested Water Rights may not be



withdrawn for the remainder of the LEMA Period.

- a. Irrigation allocations were established for each Water Right thru an impartial process without deference to Water Right priority; however, Water Right priority is a consideration, if an impairment complaint is filed with the Chief Engineer.
- b. Non-irrigation uses will not be assigned a WHCL allocation due to their total combined water usage amounting to a minimal percentage of the total water use within the proposed WHCL boundaries. However, efficiency recommendations are provided for utilization in their management practices.
- c. The WHCL shall include the following townships:

Wichita County

- Township 16S, Range 35W, Sections 1 through 36
- Township 16S, Range 36W, Sections 1 through 36
- Township 16S, Range 37W, Sections 1 through 36
- Township 16S, Range 38W, Sections 1 through 36
- Township 17S, Range 35W, Sections 1 through 36
- Township 17S, Range 36W, Sections 1 through 36
- Township 17S, Range 37W, Sections 1 through 36
- Township 17S, Range 38W, Sections 1 through 36
- Township 18S, Range 35W, Sections 1 through 36
- Township 18S, Range 36W, Sections 1 through 36
- Township 18S, Range 37W, Sections 1 through 36
- Township 18S, Range 38W, Sections 1 through 36
- Township 19S, Range 35W, Sections 1 through 36
- Township 19S, Range 36W, Sections 1 through 36
- Township 19S, Range 37W, Sections 1 through 36
- Township 19S, Range 38W, Sections 1 through 36

This represents a LEMA boundary that is both clearly identifiable and entirely within the boundaries of GMD1, fulfilling the requirements of K.S.A. 82a-1041(a) (1), (2).

- d. All WHCL Allocation quantities shall be expressed in terms of total acre-feet for the LEMA Period and such quantity will be provided to each Water Right owner.
- e. Any unused WHCL Allocation, up to a maximum of five times the Annual Authorized Quantity, may be carried forward to a subsequent LEMA if designated by the Chief Engineer which commences in the year 2026 and the carryover quantity will not be subject to the new LEMA's conservation requirements.
- f. No point of diversion shall receive more than five times the Annual Authorized Quantity for the LEMA Period.
- g. WHCL Allocations are shown in Attachment A.
- h. WHCL Allocations for Water Rights subject to a DWR penalty order effecting permitted withdrawals from 2009 through the LEMA Period will be adjusted accordingly by DWR, and such order may not be appealed within the WHCL appeal process.

- i. Applications to change a Water Right filed with DWR will be processed under existing laws, rules, and regulations; and should be reviewed for consistency with the goals of the WHCL during the LEMA Period.
- j. Water Rights will not be permanently altered by a WHCL Order of Designation but will be subject to the terms and conditions of the WHCL Order of Designation for the duration of the LEMA Period.
- k. Water Rights currently in their perfection period shall not be restricted by the Management Plan while in their perfection period.
- l. New Water Right applications will be considered by the Board on a case-by-case basis.

#### **IV. WHCL Allocations**

WHCL Allocations shall be assigned to each point of diversion and shall apply to all irrigation Appropriation Water Rights and Voluntarily Enrolled Vested Rights, subject to Section III. No Water Right shall be allowed to exceed its Annual Authorized Quantity (AAQ) unless authorized by a DWR Term Permit. WHCL Allocations for each Water Right will be included in an official Order of Designation issued by the Chief Engineer. Upon approval of the WHCL, WHCL Allocations are subject to review pursuant to Section IV (a) (5). WHCL Allocations will be established based on the following:

##### **a. Irrigation Water Rights**

- 1. The Historical Usage shall be reduced by the Conservation Factor. The result shall be multiplied by five (5) to establish the total WHCL Allocation for each point of diversion during the LEMA Period as follows:
  - A. If the Historical Usage is 20% or less of the AAQ for a point of diversion, the WHCL Allocation shall be:
 

$\text{Historical Usage} \times 5$
  - B. If the Historical Usage is more than 20% of the AAQ for a point of diversion, the WHCL Allocation shall be the greater of:
    - (i)  $\text{AAQ} \times 20\% \times 5$ , or
    - (ii)  $\text{Historical Usage} \times 75\% \times 5$
- 2. If an Appropriation Water Right is authorized for the same point of diversion as a Vested Water Right that has not voluntarily enrolled in the WHCL, a WHCL Allocation shall be established for the portion, if any, of the Historical Usage authorized by the Appropriation Water Right, as follows:
  - A. If the Annual Authorized Quantity for the overlapped Vested Water Right is greater than the Historical Usage, then no WHCL

Allocation will be established for that point of diversion and the Vested Water Right will be unaffected by the WHCL.

- B. If the Historical Usage from the point of diversion is greater than the Annual Authorized Quantity of an overlapped Vested Water Right, the WHCL Allocation will be established by subtracting the Vested Water Right's Annual Authorized Quantity from the Historic Usage, multiplying the remaining quantity, which is authorized by the overlapping Appropriation Water Right, by 75% then multiplying that product by five as described in Section IV (a) (1).
3. Each point of diversion within the WHCL boundaries will be assigned a WHCL Allocation pursuant to Section IV(a) (1) and are subject to review pursuant to Section IV (a) (5), (6).
4. If a point of diversion is authorized by more than one Water Right, it will be subject to any DWR limitations for the point of diversion.
5. Due consideration will be given for past conservation. If Water Rights are enrolled or have been enrolled in conservation programs, have implemented past conservation measures affecting their Historical Usage record, establishment of the WHCL Allocation will follow the guidelines set forth in Section XIII.
6. For Water Rights operating under the authority of a Term Permit, including a MYFA, or enrolled in a K.A.R. 5-5-11 change, WCA, or other flexible water plan, the most water restrictive plan shall apply. Water Rights within the WHCL boundaries that are withdrawn from an existing WCA during the LEMA Period shall be subject to the WHCL and provided a WHCL Allocation based on the years remaining in the LEMA Period.
7. Irrigation Use applications for MYFA Term Permits must be filed in the first year of the LEMA Period. If a subsequent LEMA is designated pursuant to Section III(e), then any carryover shall be limited by the provisions of this Management Plan and if no LEMA is subsequently designated then pursuant to K.S.A. 82a-736.

**b. Vested Water Rights (See Attachment B).**

1. Pursuant to K.S.A. 82a-703, Vested Water Rights shall not be subjected to the Management Plan.
2. Vested Water Rights once voluntarily enrolled in the WHCL may access the flexibilities of the Management Plan. If voluntarily enrolled, the Vested Water Right shall be subject to the terms and conditions of the Management Plan including the assignment of a WHCL Allocation as described in Section IV (a) (1). Enrollment must occur in the first year of the LEMA Period; prior to the first irrigation application and will require all owners of the Water Right(s), to sign a notarized document provided by GMD1.

c. **Non-Irrigation Uses** - The water use reports of all non-irrigation Water Rights will be reviewed annually by the Board. Additionally each type of use is encouraged to implement the following recommendations:

**1. Stock Water Rights**

- A. Increase efficiency by implementing scheduled infrastructure inspections, repairing leaks in a timely manner, upgrading old equipment, and applying water reuse technology.
- B. Use less than the recommended maximum water authorized by K.A.R. 5-3-22.

**2. Municipal Water Rights**

- A. Reduce the gallons per capita per day.
- B. Implement scheduled infrastructure inspections, conduct system repairs in a timely manner, implement systems to account for all water usage.
- C. Consider implementing water reuse technology for precipitation runoff and effluent.
- D. Require all new and remodel construction projects to use water efficient plumbing fixtures and recommend that all consumers meet the new standard by updating their existing fixtures.
- E. Request all consumers, especially administrators of large capacity facilities and outdoor sport and recreation areas, maintain infrastructures and repair leaks in a timely manner.
- F. Request all consumers use less water intensive plants and lawns, water in the early morning and late evening, and be aware of the amount of water applied per year.

**3. Industrial and Recreational Water Rights** are asked to voluntarily conserve water whenever possible for the betterment of their water community.

**4. Domestic Water Rights**

- A. Reduce their gallons per capita per day.
- B. Install water efficient plumbing fixtures in new and remodel construction and update their existing fixtures.
- C. Identify and repair leaks.

D. Use less water intensive plants and lawns, and water in the early morning or late evening.

#### **V. Combined Well Unit (See Attachment C)**

Wells within a Combined Well Unit will be allowed to share the combined quantity of their individual WHCL Allocations. No individual well shall be allowed to exceed its Annual Authorized Quantity unless authorized by a DWR Term Permit. Enrollment in a CWU must occur in the first year of the LEMA Period; prior to the first irrigation application and will require all owners of the Water Right(s), to sign a notarized document provided by GMD1. This document will contain the water right numbers and locations of the wells that are physically tied together along with a map showing the location of the pipeline. If Water right changes are required to implement a CWU, the owners are responsible for completing all necessary applications and gaining approval of such by the Chief Engineer. All Combined Well Units must be approved by the Board and the Chief Engineer prior to implementation.

#### **VI. Violations**

The WHCL Order of Designation shall serve as initial notice to all Water Right owners within the WHCL boundary on its effective date. A copy of the Order of Designation and the Management Plan shall be available on DWR's website and GMD1's website. DWR shall mail a notification that the Order of Designation is effective to all Water Right owners and WUC, if different from the owner, with instructions on how to request a copy of the Order of Designation. Violations shall be addressed as follows:

- a. Exceeding the five-year WHCL Allocation and all other Water Right violations shall be subject to applicable Kansas statutes and regulations, specifically but not limited to K.A.R. 5-14-10 and K.A.R. 5-14-12.
- b. The combined authorized pumping rate of all wells in a CWU shall be used to calculate the number of days pumping occurred in excess of the CWU's WHCL Allocation.

#### **VII. Metering and Monitoring**

- a. All Water Right owners shall be responsible for ensuring their water flowmeters are in compliance with state statutes and regulations prior to the diversion of water at each point of diversion.
- b. In addition to being in compliance with DWR requirements and reporting annually the quantity of water diverted from each point of diversion, all Water Right owners within the WHCL boundaries are encouraged to implement at least one additional well or meter monitoring procedure.
- c. Should the water flowmeter reported readings be in question and determined insufficient and no other records are provided upon request of GMD1, the well shall be assumed to have pumped its full Annual Authorized Quantity for the year in question.
- d. Whenever a meter is repaired or replaced, the Water Right owner or authorized designee

shall submit form DWR 1-560 Water Flowmeter Repair/Replacement Form to GMD1 or DWR within seven days of the completed repair.

- e. This metering protocol shall be a specific annual review issue and if discovered to be ineffective, specific adjustments shall be recommended to the Chief Engineer by GMD1.

### **VIII. Accounting**

- a. DWR, in cooperation with GMD1, shall keep records of the annual diversion amounts for each Water Right within the WHCL boundary and the total five-year quantity balances. Upon written request, this information will be available to the Water Right owner or GMD1.
- b. GMD1 and DWR shall cooperate on reconciliation and correction of any annual water use report found to be in error.
- c. GMD1 will provide DWR with copies of all completed Combined Well Unit Forms and any other documentation or information concerning the WHCL in a timely manner.

### **IX. LEMA Reviews**

- a. The Board and a member of DWR staff appointed by the Chief Engineer shall comprise the "Review Board" and shall conduct an annual review of the items in subsection (b). The review data shall also be presented at the Annual Meeting of GMD1.
- b. Annual Review Items
  - 1. Water use data.
  - 2. Water table information.
  - 3. Economic data as is available.
  - 4. Compliance and enforcement issues.
  - 5. Any new and preferable enhanced management authorities that become available.
  - 6. Other items deemed pertinent by the Review Board.

- c. **WHCL Order of Designation Reviews**

In addition to the annual review of the WHCL, the Review Board shall conduct a more formal review of WHCL Order of Designation in the fourth year of the LEMA Period. The review will encompass the annual review items with a focus on the economic impacts, as data is available, to the WHCL area and the local public interest while pursuing the LEMA goals.

The Review Board shall produce a report to the Chief Engineer following this review that contains specific recommendations regarding future WHCL actions. This report shall be presented at Stakeholder meetings for the purpose of considering any future LEMA plans. All recommendations shall be supported by reports, data, testimonials, affidavits or other information of record.

#### **X. Impairment Complaints**

The Stakeholders request that any impairment complaint submitted to the Chief Engineer during the LEMA Period be investigated with consideration to Water Right priority and the Management Plan.

#### **XI. Water Level Monitoring**

Prior to this WHCL proposal there were 43 recognized observation wells, two with continuous water level sensors and one continuously monitored index well, all within or near the WHCL area that have been measured annually by either DWR or KGS personnel. For each of these wells, there is a long history of annual water level measurements. Pumping influences and recovery trends can be analyzed to evaluate results of the corrective controls implemented by this Management Plan.

#### **XII. Coordination**

The Stakeholders expect reasonable coordination between DWR and GMD1 on at least the following efforts:

- a. Development of the WHCL Order of Designation resulting from the LEMA process.
- b. Compliance and enforcement of the WHCL Order of Designation.
- c. Annual accounting of the WHCL Allocation quantities used and available balance to Water Right owners and WUC if different from the owner.

#### **XIII. Allocation Appeal Process**

- a. The following process will govern appeals for the possible modification of WHCL Allocations.
  1. Only the amount of the WHCL Allocation may be appealed. Appeals regarding any other issues shall not be allowed and will not be considered through this process.
  2. The Board will serve as the appeals board. Information generated by DWR, KGS, any agency of the United States, and GMD1 will be the Board's official source of information for appeals.
- b. Water Right owners must submit a written request for an appeal to GMD1 before March 1, 2022. Failure to file an appeal before March 1, 2022 will cause the WHCL Allocation to become final during the LEMA Period. The request shall specify the point(s) of diversion, relevant year(s) of the Comparison Years, and the basis for the appeal. During the appeal period, each point of diversion is limited to one appeal for each of the three reasons listed below. Water Right owners may withdraw their

appeal by providing written notice prior to the Board issuing a final determination pursuant to subsection (e). New WHCL Allocations authorized by the Board will become effective the year the appeal is approved. Appeals may be based on any of the following reasons:

1. Verification of reported water use history used for the WHCL Allocations provided in Attachment A.
  2. Due consideration of previous voluntary conservation measures resulting in an incomplete or diminished Historical Usage record.
  3. Water Rights on land not owned, leased, rented or otherwise previously controlled or pumped for any of the Comparison Years by the Farm Services Agency producer of record as of January 1, 2020 shall be allowed a flow rate test, pursuant to subsection (f). Appeals for this reason shall be reviewed by the Board for approval.
- c. Appeals based solely on reported water use history will be referred to DWR for verification. Written notification will be provided to the Water Right owner when the process is completed.
- d. Appeals based on previous voluntary conservation measures must be accompanied by supporting documentation before the appeal will be scheduled for consideration by the Board. Information that will be required includes:
1. For water rights enrolled in government sponsored conservation programs, documentation must include an approved enrollment contract indicating the years of participation.
  2. Any other documentation supporting past voluntary conservation that may have influenced the water use record during the Comparison Years.
- e. The Board will review the submitted information at the next scheduled board meeting or special meeting scheduled for the purpose of appeal reviews. The Board shall issue one of the following determinations:
1. Denial of appeal.
  2. Grant an extension for the Water Right owner to provide additional information.
  3. New WHCL Allocation based on the information presented.
  4. Authorize a flow rate test. For points of diversion enrolled in government sponsored conservation programs the test may be postponed until the current contract expires.
  5. Authorize a WHCL Allocation equal to 20% of a point of diversion's AAQ x 5.
- f. Flow Rate Test Procedure



1. All flow rate tests shall be conducted by GMD1 or DWR between June 15 and September 15.
2. All wells shall have adequate spacing to allow proper installation of test equipment. If spacing is insufficient the Water Right owner will have the opportunity to make the required adjustments to facilitate an accurate test.
3. Each well within a Combined Well Unit shall be tested independently.
4. The resulting flow rate will be multiplied by 150 days to determine an annual acre-foot quantity, not to exceed the Annual Authorized Quantity. The annual quantity may be used to replace the year(s) of the Comparison Years under appeal. The new Historical Use record shall be reduced by the Conservation Factor to establish the new WHCL Allocation pursuant to Section IV (a) (1).

#### **XIV. Attachments**

Attachments A, B, & C will be available at the GMD1 office and on the GMD1 website ([www.gmd1.org](http://www.gmd1.org)).

Attachment A: Listing of WHCL Water Rights and WHCL Allocations/17 page spreadsheet

Attachment B: Voluntarily Enrolled Vested Right WHCL Consent Form

Attachment C: Combined Well Unit Form

Attachment D: GMD1 Map

Attachment E: Wichita County LEMA Boundary Map

Attachment F: KGS Estimated Useable Life Projection Map

Attachment G: KGS Observation Well Map

Attachment H: KGS Water Level Change Map

**Attachment A: Listing of WHCL Water Rights and WHCL Allocations**

**Proposed Allocations available on the LEMA page at [www.gmd1.org](http://www.gmd1.org)  
Access the allocation table linked to “View Proposed Allocations Here - 11/20/2019”**

**Linked Document Titled  
“Wichita County Local Enhanced Management Area (LEMA): Historical Use & Allocations”  
Revised 11/15/2019**

**ATTACHMENT B  
VOLUNTARILY ENROLLED VESTED RIGHT WHCL CONSENT FORM**

**By signing this Voluntary Vested Right Enrollment Consent Form, I am voluntarily choosing to enroll my Vested Right into the WHCL and I understand that by enrolling my Vested Right into the WHCL that my Vested Right will be subject to all of the WHCL's conditions, restrictions and benefits.**

Owner Name: \_\_\_\_\_

Owner Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_ Phone: \_\_\_\_\_

Water Right File No(s) (Use Additional Sheets if Needed)	Well ID	Section	Township	Range	Annual Authorized Quantity	LEMA Allocated Quantity
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
Totals					=====	=====

I am voluntarily entering the Vested Water Right No(s) listed above into the WHCL. I understand that once this voluntary consent form has been approved, these Vested Rights will have to remain in the WHCL until December 31, 20\_\_.

**ALL VESTED WATER RIGHT OWNERS AND THEIR SPOUSE MUST SIGN BEFORE A NOTARY IF THEIR VESTED RIGHT AND/OR THEIR LAND IS INCLUDED IN THIS VOLUNTARY VESTED RIGHT WHCL ENROLLMENT.**

**MUST BE ACCOMPANIED BY THE CONSENT FORM.**

**VESTED RIGHT CONSENT FORM**

**MUST BE SIGNED IN PRESENCE OF A NOTARY by ALL WATER RIGHT OWNERS, AND WATER USE CORRESPONDENTS (WUC).**

I, \_\_\_\_\_ and \_\_\_\_\_, understand and agree with the terms of this  
(Printed Name) (Printed Spouse Name)  
Voluntary Vested Right enrollment form.

\_\_\_\_\_  
Signature Date Spouse Signature Date  
Owner WUC  
(Circle one)

State of Kansas )  
) SS  
County of \_\_\_\_\_ )

I hereby certify that the foregoing form was signed in my presence and sworn to before me this \_\_\_\_\_  
day of \_\_\_\_\_, 20 \_\_\_\_\_.

\_\_\_\_\_  
Notary Public  
My Commission Expires \_\_\_\_\_

I, \_\_\_\_\_ and \_\_\_\_\_, understand and agree with the terms of this  
(Printed Name) (Printed Spouse Name)  
Voluntary Vested Right enrollment form.

\_\_\_\_\_  
Signature Date Spouse Signature Date  
Owner WUC  
(Circle one)

State of Kansas )  
) SS  
County of \_\_\_\_\_ )

I hereby certify that the foregoing form was signed in my presence and sworn to before me this \_\_\_\_\_  
day of \_\_\_\_\_, 20 \_\_\_\_\_.

\_\_\_\_\_  
Notary Public  
My Commission Expires \_\_\_\_\_

**ATTACHMENT C  
COMBINED WELL UNIT FORM**

By signing this Combined Well Unit Form, I understand that all of the wells included in this Combined Well Unit must be physically tied together prior to the starting date of the WHCL (January 1, 20\_\_ ) and that in order to be approved, water right changes may be required by the Kansas Department of Agriculture, Division of Water Resources.

Owner Name: \_\_\_\_\_

Owner Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_ Phone: \_\_\_\_\_

Water Right File No(s) (Use Additional Sheets if Needed)	Well ID	Section	Township	Range	Annual Authorized Quantity	LEMA Allocated Quantity
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
				<b>Totals</b>	=====	=====

\_\_\_\_\_ A map is attached showing the locations of the pipeline for this Combined Well Unit.

**ALL WATER RIGHT OWNERS AND WATER USE CORRESPONDENTS APPLICABLE TO THIS COMBINED WELL UNIT MUST SIGN IN THE PRESENCE OF A NOTARY.**

**MUST BE ACCOMPANIED BY THE CONSENT FORM.**

**COMBINED WELL UNIT CONSENT FORM**

**MUST BE SIGNED IN PRESENCE OF A NOTARY by ALL WATER RIGHT OWNERS AND WATER USE CORRESPONDENTS (WUC).**

I, \_\_\_\_\_ and \_\_\_\_\_, understand and agree with the terms of this  
(Printed Name) (Printed Spouse Name)  
Combined Well Unit.

\_\_\_\_\_  
Signature Date Spouse Signature Date  
Owner WUC  
(Circle one)

State of Kansas )  
) SS  
County of \_\_\_\_\_ )

I hereby certify that the foregoing form was signed in my presence and sworn to before me this \_\_\_\_\_  
day of \_\_\_\_\_, 20 \_\_\_\_\_.

\_\_\_\_\_  
Notary Public  
My Commission Expires \_\_\_\_\_

I, \_\_\_\_\_ and \_\_\_\_\_, understand and agree with the terms of this  
(Printed Name) (Printed Spouse Name)  
Combined Well Unit.

\_\_\_\_\_  
Signature Date Spouse Signature Date  
Owner WUC  
(Circle one)

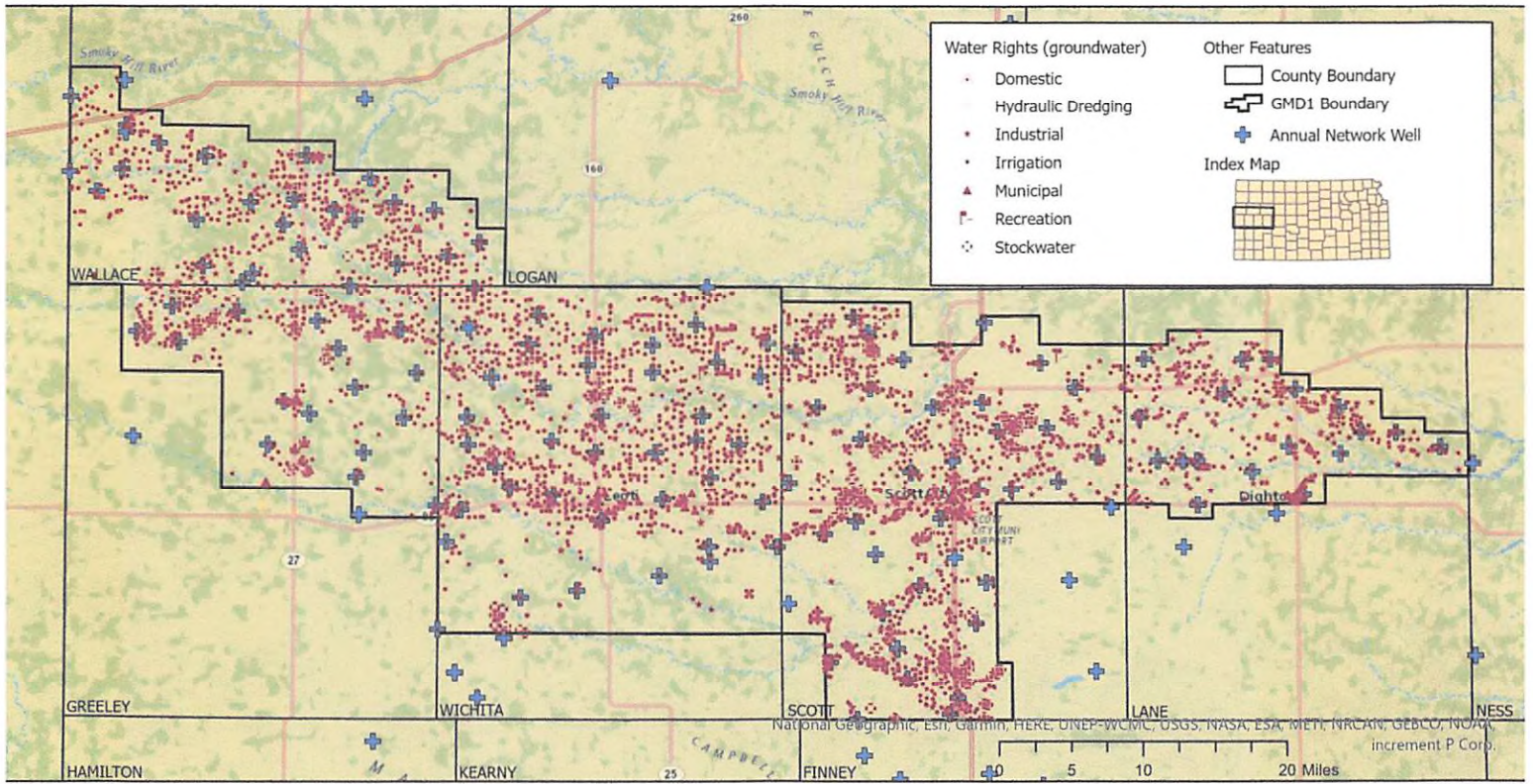
State of Kansas )  
) SS  
County of \_\_\_\_\_ )

I hereby certify that the foregoing form was signed in my presence and sworn to before me this \_\_\_\_\_  
day of \_\_\_\_\_, 20 \_\_\_\_\_.

\_\_\_\_\_  
Notary Public  
My Commission Expires \_\_\_\_\_

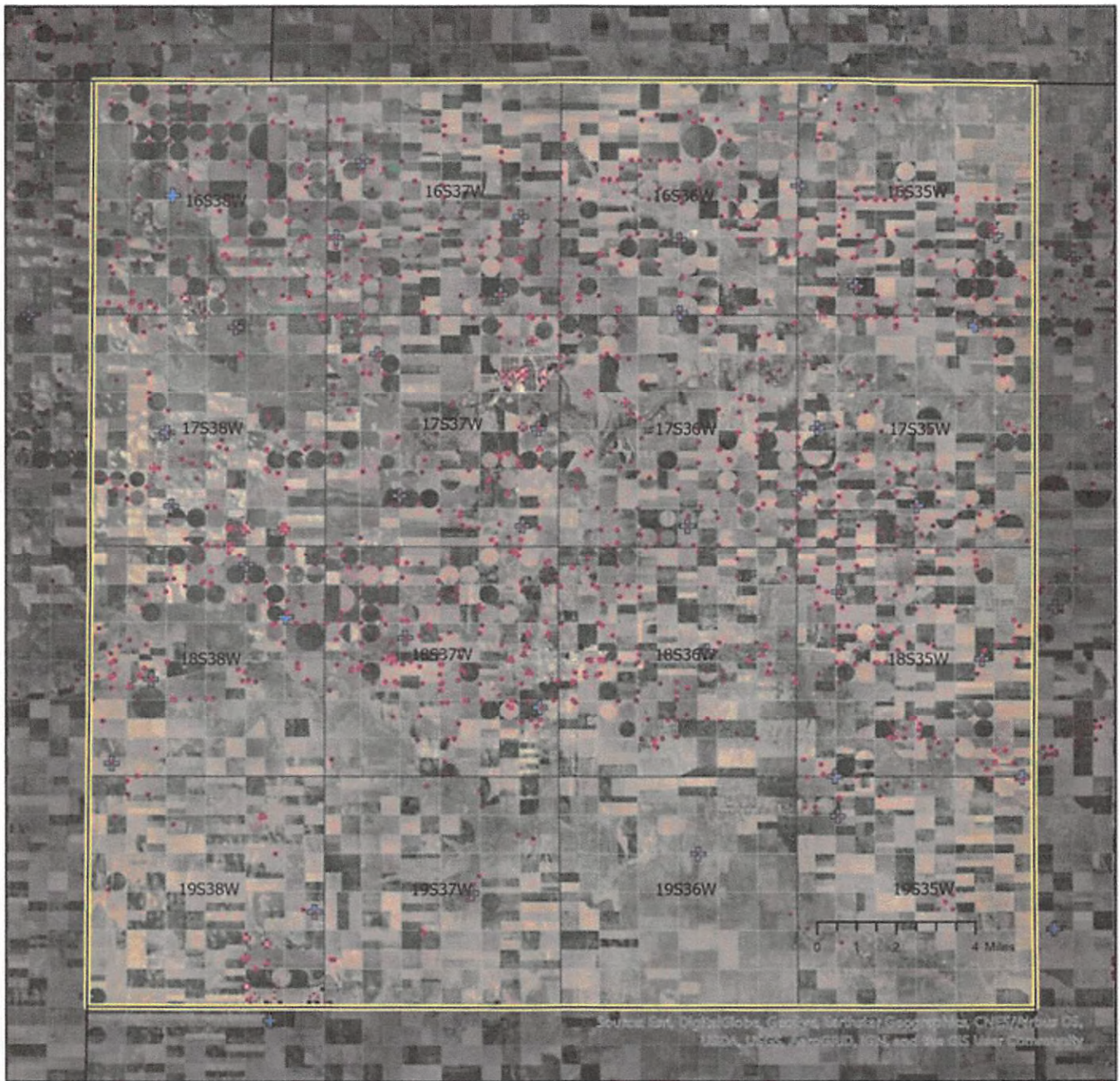
**Attach Map showing the Combined Well Unit:**

# Attachment D: GMD1 Map





Attachment E: Wichita County LEMA Boundary Map



Water Rights (groundwater)

- Domestic
- Hydraulic Dredging
- Industrial
- Irrigation
- ▲ Municipal
- Recreation
- ◇ Stockwater

Other Features

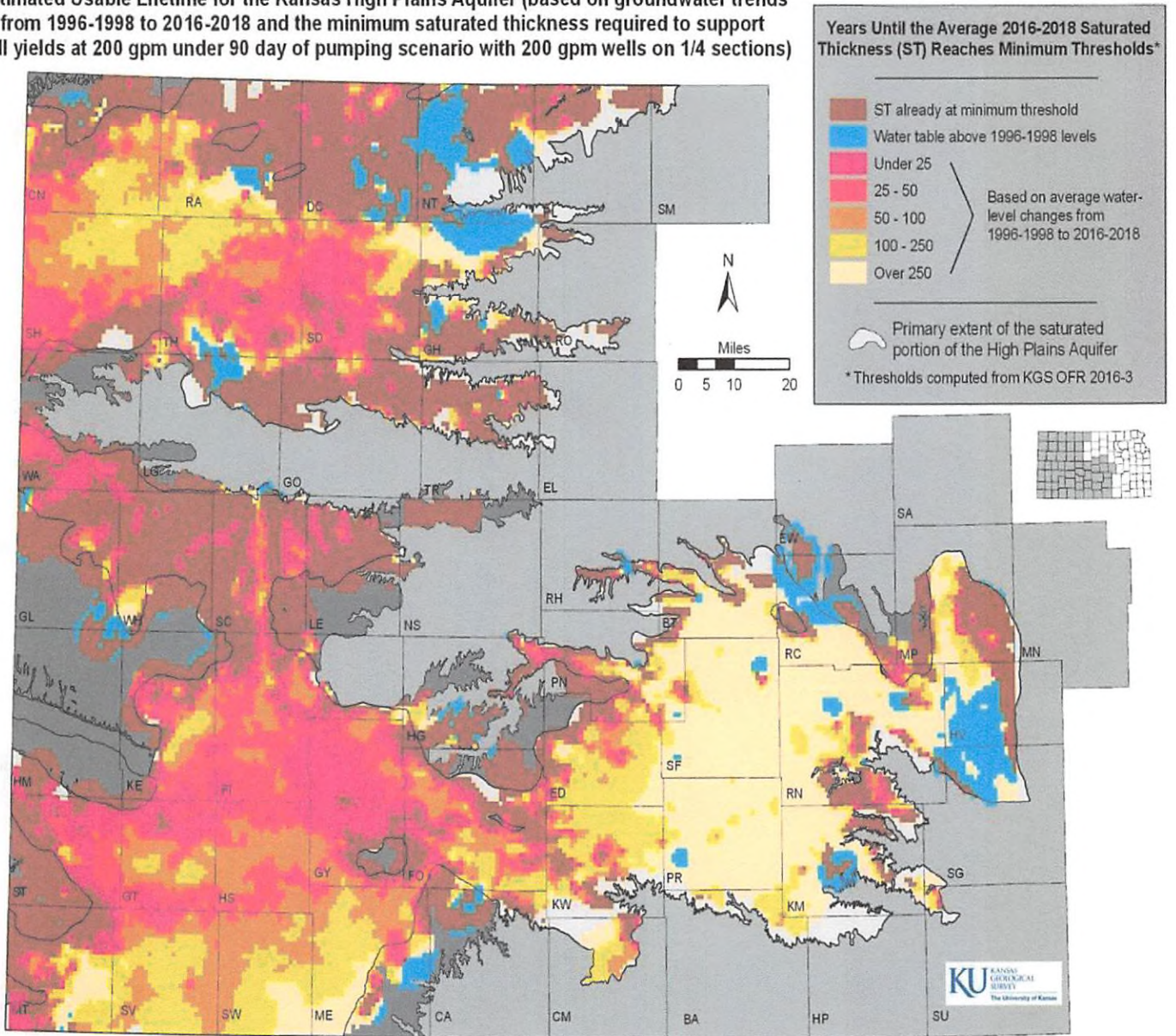
- County Boundary
- ▭ LEMA Boundary
- + Annual Network Well

Index Map

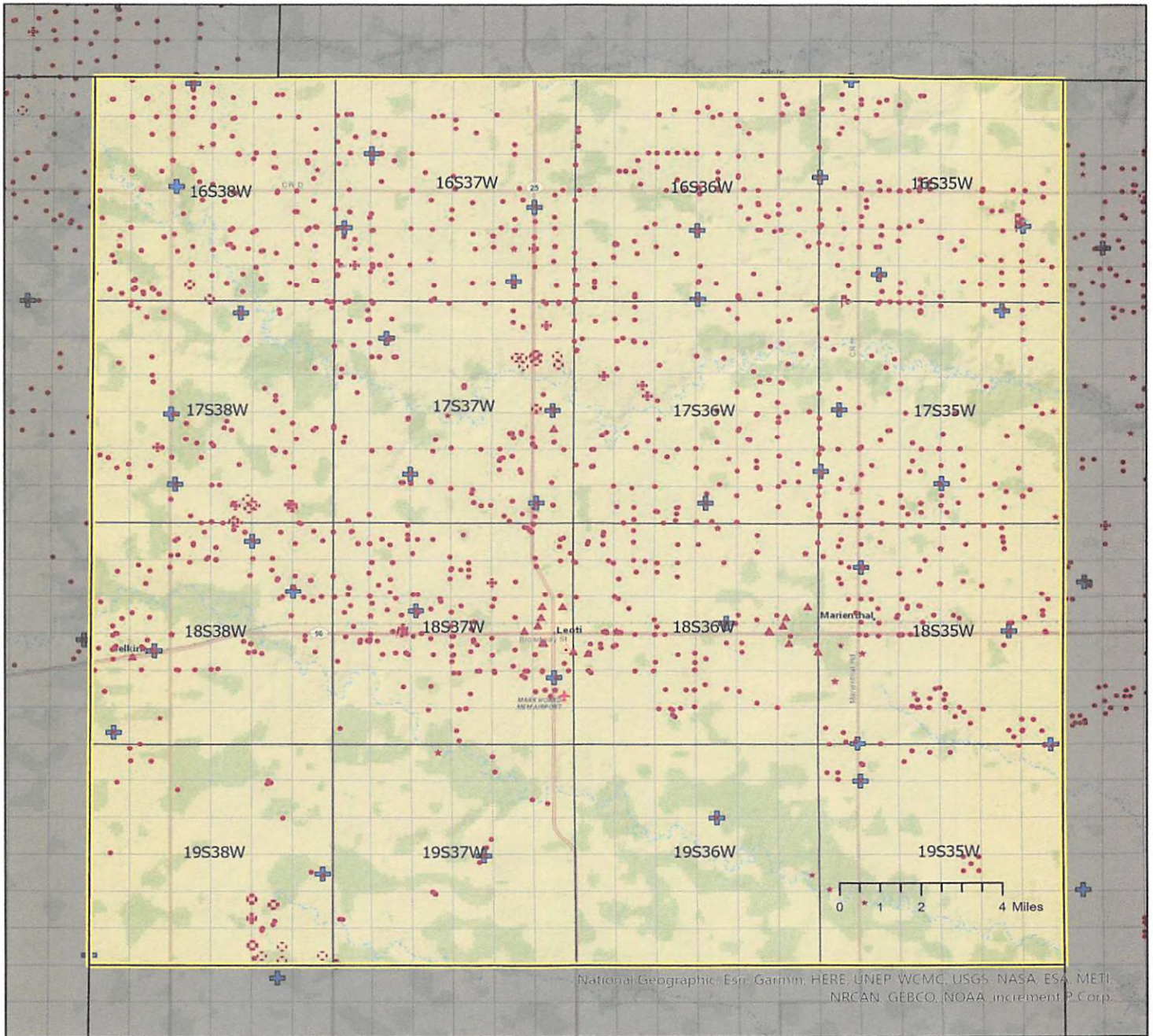


# Attachment F: Estimated Useable Life Projection Map

Estimated Usable Lifetime for the Kansas High Plains Aquifer (based on groundwater trends from 1996-1998 to 2016-2018 and the minimum saturated thickness required to support well yields at 200 gpm under 90 day of pumping scenario with 200 gpm wells on 1/4 sections)



# Attachment G: KGS Observation Well Map



### Water Rights (groundwater)

- Domestic
- Hydraulic Dredging
- Industrial
- Irrigation
- Municipal
- Recreation
- Stockwater

### Other Features

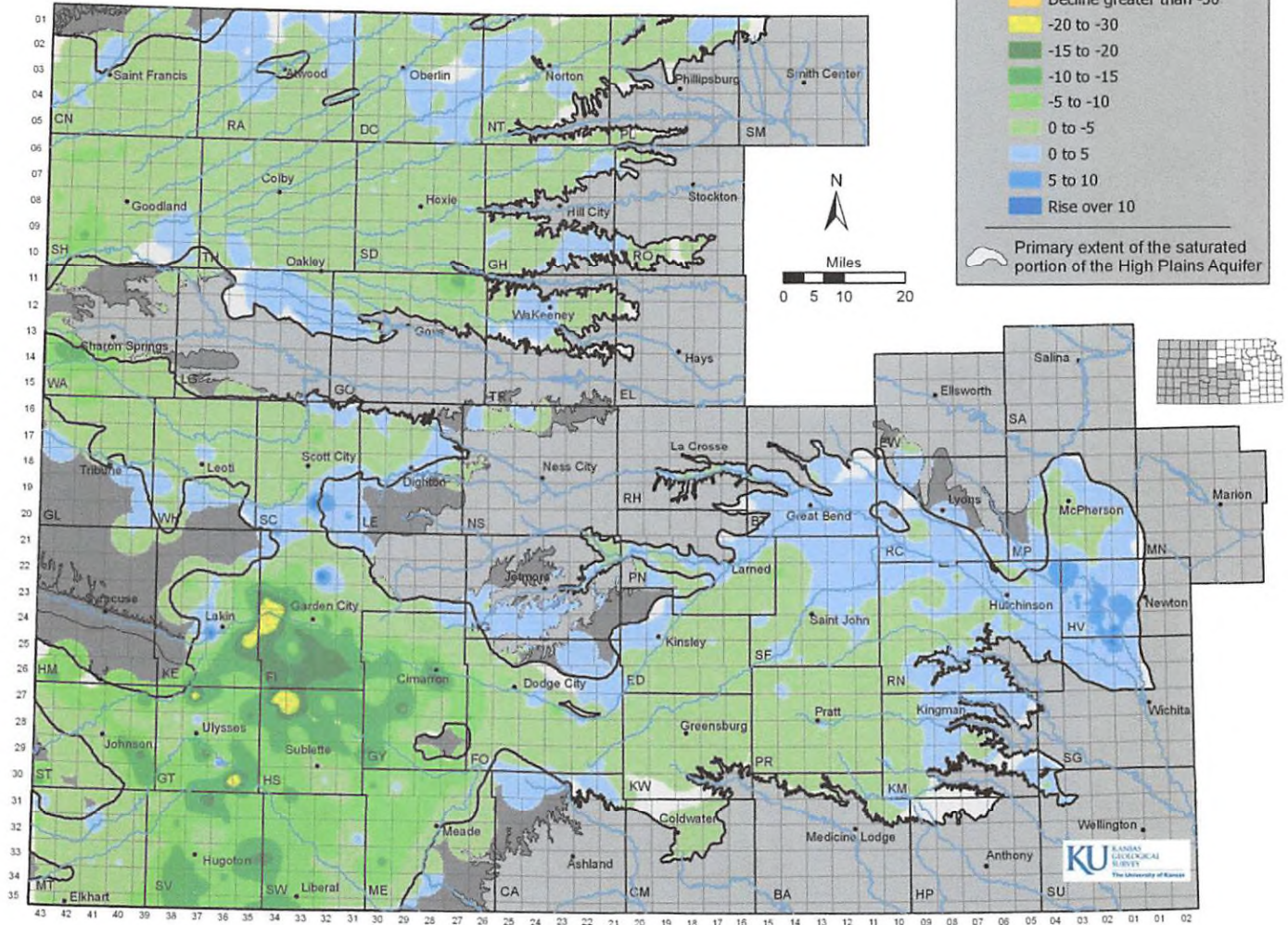
- County Boundary
- LEMA Boundary
- ⊕ Annual Network Well

### Index Map



Attachment H: KGS Water Level Change Map

Interpolated Water Level Change, Kansas High Plains Aquifer, Average 2012-2014 to Average 2016-2018



**Wichita County Local Enhanced Management Area (LEMA): Historical Use & Allocations**

DATE: 11/07/2020  
 Review: 11/07/2020  
 Worksheet: LEMA Data  
 - All historical and current water rights are shown for all water rights in the LEMA. Historical data is shown for all water rights in the LEMA.  
 - All historical and current water rights are shown for all water rights in the LEMA.  
 - All historical and current water rights are shown for all water rights in the LEMA.  
 - All historical and current water rights are shown for all water rights in the LEMA.  
 - All historical and current water rights are shown for all water rights in the LEMA.  
 - All historical and current water rights are shown for all water rights in the LEMA.

WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City			
WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City			
WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City	WDR#	City	City			
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EXHIBIT B











Order No	CDP No	Folio	2014 Area City (A/C)	CITY Limitation/Unit (A/C, if applicable)	Order/Item Number: (A/C, if applicable)	Incremental Use														Average Use (A/C, U.S. Floor)					U.S. Floor				S-Ty Allocation (A/C)					S-Ty Allocation (A/C)					UNIT Allocation Limitation (A/C, if applicable)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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Unit No.	Unit Name	CH	POPP	2018 Auth City (A)	CITY Limitation/Use (A/C, if applicable)	2018-2021	Average Use % (15-Month)						Legal Average Capacity (A)	Legal Average Use (A)	15-Month	Legal Rate	5-7% Allocation (A)	25% Contribution (A/7Y)	CITY Limitation/Use (A/C, if applicable)	Unit Allocation (A/7Y)	
							2018	2019	2020	2021	2022	2023									2024
11	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101	1101















Ward	Ward AL	Ward Pct	2010 South City (PT)				CITY University (1st, 4th, 6th, 8th, 10th, 12th, 14th, 16th, 18th, 20th, 22nd, 24th, 26th, 28th, 30th, 32nd, 34th, 36th, 38th, 40th, 42nd, 44th, 46th, 48th, 50th)	CITY (A/C, if applicable)	15% Contribution (M/PT)	5-Yr Allocation (PT)	15% Allocation (M/PT)	15% Allocation (PT)	CITY University (M, if applicable)	Line Allocation (M/PT)	Line Allocation (M/PT)
			Legal	Legal	Legal	Legal									
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13	1381	1381	1381	1381	1381	1381	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
14	1382	1382	1382	1382	1382	1382	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
15	1383	1383	1383	1383	1383	1383	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
16	1384	1384	1384	1384	1384	1384	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
17	1385	1385	1385	1385	1385	1385	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
18	1386	1386	1386	1386	1386	1386	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
19	1387	1387	1387	1387	1387	1387	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
20	1388	1388	1388	1388	1388	1388	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
21	1389	1389	1389	1389	1389	1389	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
22	1390	1390	1390	1390	1390	1390	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
23	1391	1391	1391	1391	1391	1391	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
24	1392	1392	1392	1392	1392	1392	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
25	1393	1393	1393	1393	1393	1393	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
26	1394	1394	1394	1394	1394	1394	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
27	1395	1395	1395	1395	1395	1395	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
28	1396	1396	1396	1396	1396	1396	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
29	1397	1397	1397	1397	1397	1397	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
30	1398	1398	1398	1398	1398	1398	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
31	1399	1399	1399	1399	1399	1399	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	
32	1400	1400	1400	1400	1400	1400	N/A	N/A	20.00	20.00	20.00	N/A	20.00	N/A	



WSP No.		WSP No.		WSP No.		WSP No.		WSP No.		WSP No.		WSP No.		WSP No.		WSP No.		WSP No.		WSP No.		
WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	WSP No.	
2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423
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932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954
955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977
978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000

\* Items 1-100 are not in the 2013 database.  
 \* Items 1-100 are not in the 2014 database.  
 \* Items 1-100 are not in the 2015 database.



**Written testimony from Brownie Wilson, Kansas Geological Survey.**

**Submitted to Rhonda Hutton, Kansas Department of Agriculture, on July 21, 2020.**

**RE: Written testimony, proposed GMD1 Wichita County LEMA Hearing, August, 14, 2020**

My name is Brownie Wilson. I am the Geographic Information Systems (GIS) and Support Services Manager for the Geohydrology Section at the Kansas Geological Survey (KGS). The KGS is a research and service division under the University of Kansas and has been directed by the Kansas Water Plan to provide technical assistance to the three western Groundwater Management Districts, the Kansas Water Office, and the Kansas Department of Agriculture-Division of Water Resources (KDA-DWR) in the assessment, planning, and management of the groundwater resources of western Kansas.

At the request of Western Kansas GMD #1 in November of 2019, the KGS compared the relationship between observed water-level change and groundwater use in the Ogallala/High Plains aquifer (HPA) from 2009 to 2015 within Wichita County, KS. The comparison uses the water-balance approach described in Butler et al. (2016), to calculate the reduction in the average annual amount of water use needed to produce, on average, stable water levels over a given. The approach is data-driven, utilizing only annually collected water-level measurements and annually reported water use estimates.

The focus of this study is on Wichita County in west-central Kansas. The HPA is the source of water supply for over 99% of the wells, most of which are along and north of highway 96 (fig. 1). The aquifer here generally has greater vertical thicknesses and greater amounts of water in storage relative to southern portions of the county where, because of bedrock highs that are close to the land surface, the aquifer thins and large-scale groundwater development is limited (Wilson et al., 2015)

Groundwater declines in Wichita County have been significant. The aquifer thickness has declined, on average, by 68% from predevelopment conditions to a 3-year 2018-2020 average of 24 feet across the county (Fross et al., 2012). The largest of these declines, 75 to 100 feet, have occurred in the northern portions of the county, generally in the same areas that have the highest concentration of groundwater pumping each year. However, annual groundwater use, 95% of which is typically for irrigation use, has shown declining trends in both Wichita County and GMD1. This is caused by a combination of reduced well yields from the reduction in aquifer thickness and an improvement in the accuracy of reporting water usage with the increasing adoptions of totalizing flow meters (Whittemore et al., 2018).

#### Water Levels

Each year, the KGS and the KDA-DWR measure the depth-to-water in a network of approximately 1,400 water wells, across the HPA, as part of the state's Cooperative Water Level Program. The

network attempts to have a well every 16 square miles and is used to provide regional- to sub-county- scale characterizations of the aquifer.

Customized software developed by the KGS, coupled with Global Positioning System (GPS) data, is used to make sure the same wells are visited each year. The majority of water-level measurements are taken in late December and early January using steel or electric tapes with precisions down to the hundredths of a foot. Measurements are field checked on site at the time of the visit to ensure locational accuracy and that the current measurement is within the historical trend of past measurements. Additional statistical and GIS reviews are conducted later to identify abnormal or anomalous measurements. If deemed necessary, well sites will be re-measured the same day or within a month, depending on the circumstances.

Collected water levels from the Cooperative Water Level Program, along with additional measurements from other local, state, and federal sources, are stored and served online through the KGS' Water Information Storage and Retrieval Database (WIZARD). WIZARD evolved from the U.S. Geological Survey's Ground Water Site Inventory in the mid- 1990s, and today represents the largest repository of depth-to-water measurements in Kansas.

Well site locations in the HPA and their associated water-level measurements were downloaded from WIZARD to estimate the water-table elevations each year from calendar years 2009 to 2016. The well site locations, based on their listed geographic coordinates, were spatially mapped into the ArcGIS software platform, a GIS mapping software. Within GMD1, all of the measured well locations used in this project have been surveyed with hand-held GPS units, which typically have horizontal accuracy ranges of 12 to 40 feet (fig. 1).

The WIZARD database contains codes indicating the status of the site at the time the water level was measured. Most water level measurements across GMD1 are taken in the first week of January and contain blank or null status codes indicating static or near static water level conditions. Past water level measurements that were coded to be "anomalous" from previous statistical and geostatistical reviews were not included in this project along with measurements taken from locations where the well was obstructed, was pumping at the time of the measurement, had recently been pumped, or had nearby sites that were being pumped at the time of the measurements.

The water-level measurements were used to calculate 1-year average winter depth to water for each well site, centered on each calendar year from 2009 to 2016. For example, a well's 1-year average, winter depth to water for 2009 are based on measurements taken in the months of December 2008, January 2009, February 2009, and March, 2009. Given most of the wells are only measured once a year (over 90% of the time in the month of January), the winter averages are typically only composed of a single measurement. However, some wells could be measured 2 or 3 times in a single winter period.

For this project, only wells containing computed 1-year, winter average water levels centered on the calendar years of 2009, 2010, 2011, 2012, 2013, 2014, 2015, and 2016 were considered. If a well site was missing a winter average value for one of these target years, it was removed from the data set. Under these selection criteria, 33 well sites were identified within Wichita County with 31 of them located within the proposed LEMA boundaries of GMD1 (fig. 2). The annual change in the water table occurring each year from 2009 to 2015, was computed for each well site.

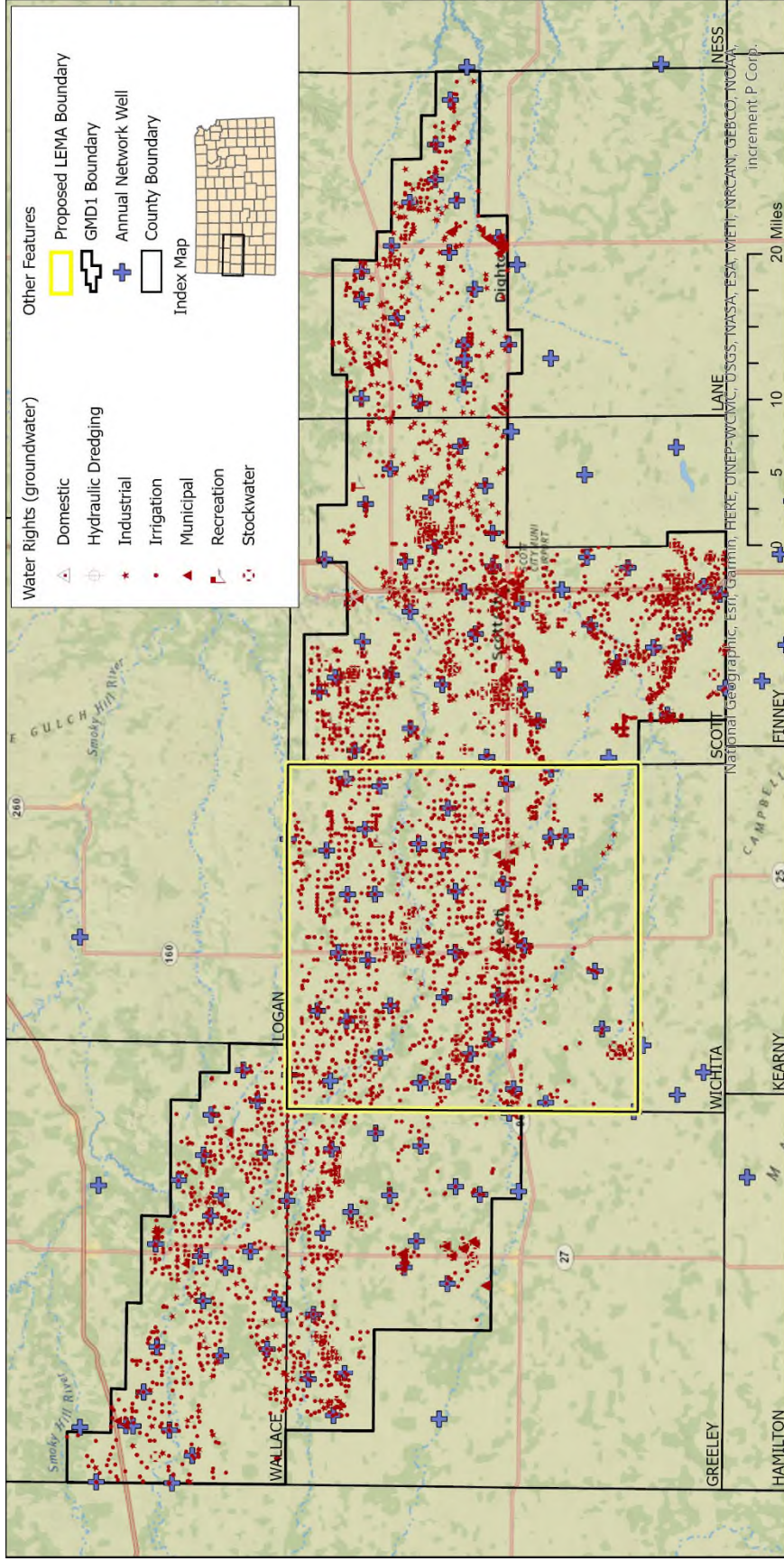
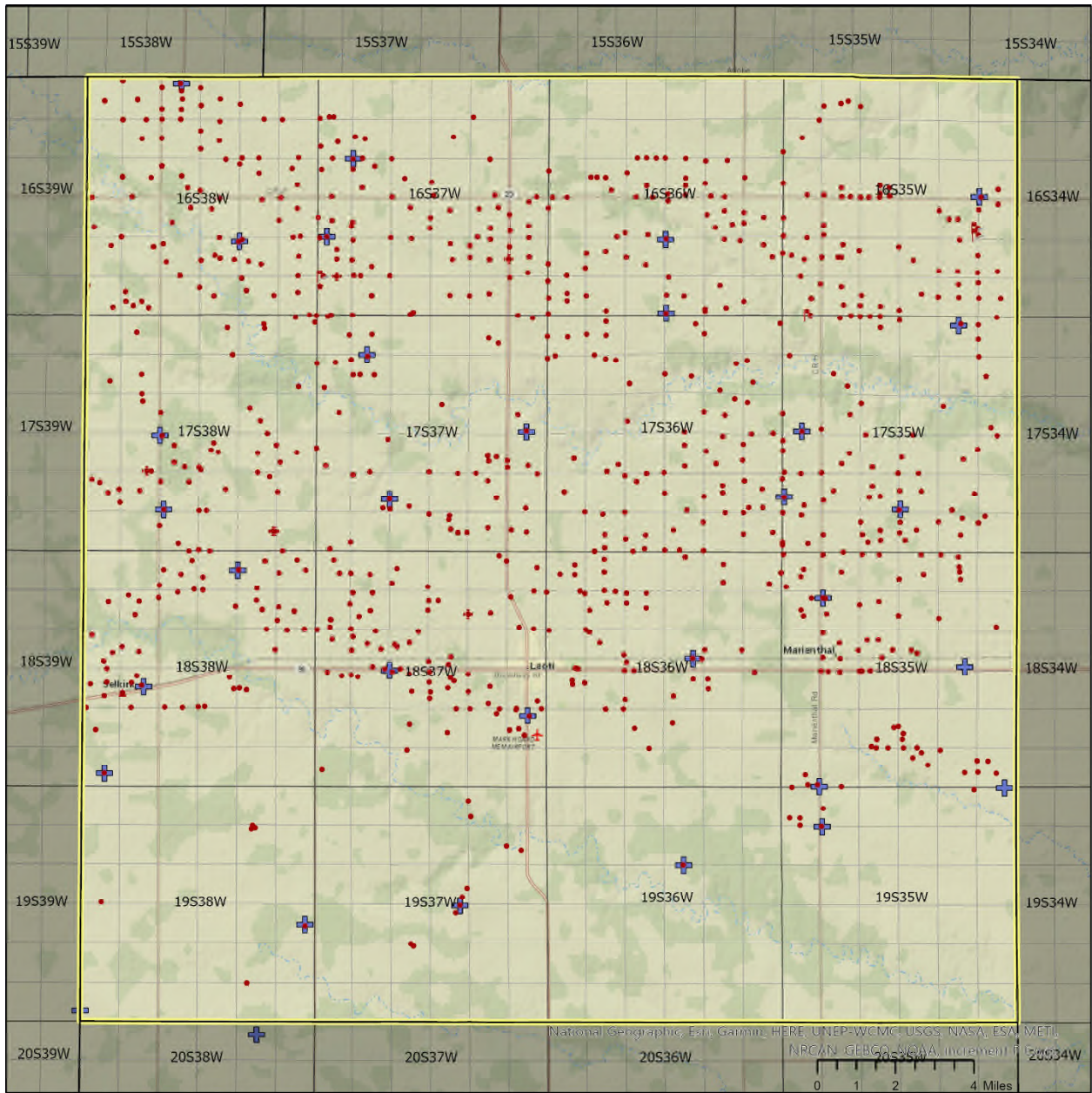


Figure 1. Western Kansas GMD 1, annual network wells, and groundwater-based water right wells.





KDA-DWR Water Use Point

- ★ Industrial
- Irrigation
- ▲ Municipal
- ▬ Recreation
- ◌ Stockwater

Other Features

- ⊕ Annual Network Well
- County Boundary
- ▭ LEMA Boundary

Index Map



**Figure 2.** Proposed GMD1 Wichita County LEMA Area. The red points represent the PDs used in the KDA-DWR water use assessment and the blue pluses are the wells in which annual water levels were measured every year from 2009 to 2016.

## Groundwater Use

Water use reports can be downloaded from the online Water Information Storage and Retrieval Database (WIMAS) database. These reports are required by law to be submitted annually by water right holders, or their designee, to the KDA-DWR and penalties exist for non-submission or knowingly falsifying them. A quality control program has been in place since 1990 to review the reports and follow up when necessary with the water right holders to correct missing or questionable information.

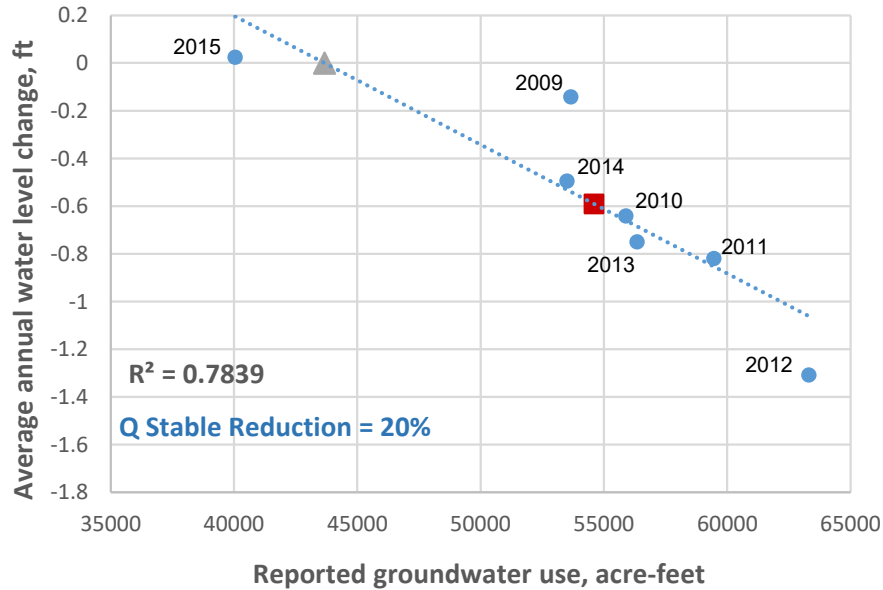
The KDA-DWR compared historical water use in relation to annual allocations for all water rights in Wichita County in order to determine new LEMA annual allocations based on the proposed 25% reduction in average use. This process consolidates or groups water rights into units based on overlapping point(s) of diversions and or place(s) of use. Reported water use for each point of diversion was based on active years of pumping from 2009 to 2015 and was adjusted where overpumping may have occurred. Water right information and the summarized water use from the KDA-DWR review was exported and spatially mapped into GIS, based on listed geographic coordinates for the points of diversion (fig. 2).

## Groundwater Use and Water-Level Relationships, Wichita County

In Butler et al. (2016), the authors demonstrates how to apply the fundamental concepts of a water balance approach to seasonally pumped aquifers extending over county-scale areas in order to produce linear relationships between annual water use and annual water-level change. From these relationships, the reduction in the average annual water use needed to stabilize areally averaged water levels, defined as Q stable, can be readily calculated.

Figure 3 shows this relationship for the proposed LEMA area in Wichita County. Each dot on the plot represents the total amount of groundwater reported used in relation to the average annual water-level change for each year from 2009 to 2015. Over this time period, total reported water use ranges from a low of 40,050 acre-feet in 2015 to a high of 63,300 acre-feet in 2012, with an average of 54,600 acre-feet. Likewise, average water-level change computed from the 33 observation wells show the same pattern. Water levels rose slightly (0.02 ft) in 2015 (change from 2015 to 2016), had the largest decline (-1.3 ft) in 2012 (change from 2012 to 2013), and had an average annual water level decline of -0.59 feet over the period.

The relationship between water use and water level change is statistically significant with an R-squared value of 0.78. This indicates 78 percent of the variation shown in the average water-level change can be explain statistically by variations in the total annual reported water use. Based on this correlation of conditions from 2009 to 2015, a 20.02% reduction in average annual reported use would allow for stabilized water levels, defined here as a zero change in water levels.



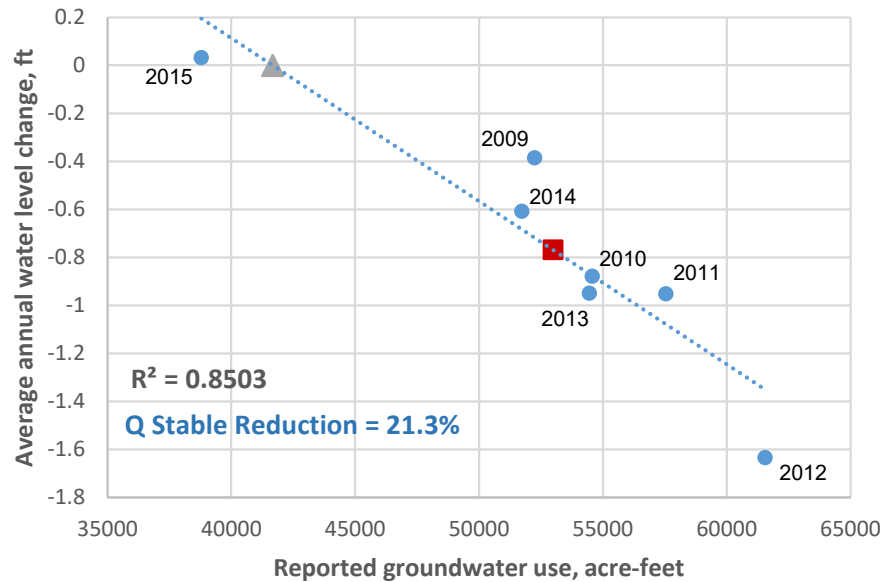
**Figure 3.** Average annual water-level change versus annual water use from 2009 to 2015 for the proposed Wichita County LEMA. Dashed line is the best-fit straight line to the plot. Overall average conditions for both water use and water-level change is represented by the maroon square. Water use, under stable water-level conditions, is shown by the olive-colored triangle.

Given the relative lack of water right development in the thinner portions of the HPA in the southern areas of Wichita County, the analysis was repeated using data only from townships along and north of highway 96- specifically, townships 16 to 18 south and ranges 35 to 38 west. During this review, it was found that the observation well in section 28 of Township 17S, Range 38W had an abnormally deep water level reading in 2009. This resulted in a computed 2009 to 2010 water level rise of 3.5 feet, a change that is out of trend relative to other wells in the area. The one change from 2009 to 2010 for this particular well was removed from consideration and the analysis for the northern portions of Wichita County repeated.

Figure 4 shows the relationship between water use and water-level change in the northern portions of Wichita County has an even stronger statically significant relationship (R-squared of 0.85) although the overall reduction in average use is relatively unchanged at 21.3 percent. The improved statistical relationship is a reflection of using data that is a better representation of the conditions of where water is actually used in the county.

Water-level trends from continuously recording observations wells across the Kansas HPA suggest these conditions and the computed Q stable values should hold for at least the next decade or two. However, the analysis should be repeated over time as the components that make up the water balance (aquifer inflows and outflows) slowly adjust to new pumping allocations determined by proposed management plans.

Thank you for your time today and I would be glad to answer questions or provide additional information.



**Figure 4.** Average annual water-level change versus annual water use from 2009 to 2015 for the proposed Wichita County LEMA and areas along and north of highway 96. Dashed line is the best-fit straight line to the plot. Overall average conditions for both water use and water-level change is represented by the maroon square. Water use, under stable water-level conditions, is shown by the olive-colored triangle.

References:

Butler, J.J., Jr., D.O. Whittemore, B.B. Wilson, and G.C. Bohling, 2016, A new approach for assessing the future of aquifers supporting irrigated agriculture, *Geophys. Res. Lett.*, v. 43, no. 5, pp. 2004-2010.

Fross, D., M. Sophocleous, B. B. Wilson, and J. J. Butler Jr., 2012, Kansas High Plains Aquifer Atlas, Kansas Geological Survey. [Available at [http://www.kgs.ku.edu/HighPlains/HPA\\_Atlas/index.html](http://www.kgs.ku.edu/HighPlains/HPA_Atlas/index.html), accessed May, 2020].

Whittemore, D. O., Butler, J.J., and Wilson, B. B., 2018, Status of the High Plains Aquifer in Kansas: Kansas Geological Survey, Technical Series 22, 14 p.

Wilson, B. B., Liu, G., Bohling, G. C., Whittemore, D. O., and Butler, J. J., Jr., 2015, West Central Kansas GMD1 Model: Kansas Geological Survey, Open-File Report 2015-33, 137 p.

### **Purpose**

The social and economic vitality of the Wichita County community is dependent upon our water supply. In order to reduce the rate of decline of water levels in our aquifer and extend the life of our water supply, we propose to establish a Water Conservation Area within the boundaries of Wichita County. The management plan for this Water Conservation Area is presented herein and shall form the basis of a Consent Agreement and Order Designating a Water Conservation Area as required by K.S.A. 82a-745. The participating water right owners have reached a consensus and agree to the terms and conditions contained in this proposed management plan.

### **Goal**

The water right owners participating in the Wichita County Water Conservation Area have joined together because of their collective desire to sustain their community by conserving their groundwater resources. The participants have concluded that this goal can be achieved by taking the following actions:

1. Implement substantial reductions in water use based upon a defined period of historical use.
2. Encourage participation by providing flexibility in beneficial use, place of use, and quantity of annual use so that participants can adjust to weather conditions, market conditions, and advancements in technology.
3. Participate for a period that is compatible with typical crop rotations and long enough to indicate measurable results.
4. Provide a process for ongoing enrollment and renewal of water conservation area agreements (i.e. consent agreements).
5. Establish a scheduled review process to revise the terms and conditions of this management plan based upon lessons learned through experience and to accommodate changes in technology.
6. Establish an enforcement process to obtain compensation from those participants that fail to fulfill the responsibilities contained in their respective consent agreements.
7. Establish a governing board to guide the management plan review process.

The structure of this management plan is focused on irrigation use because that accounts for the vast majority of water use within Wichita County. Water rights with other beneficial uses may participate in the Water Conservation Area if feasible. We support and encourage all livestock and municipal water users to implement conservation measures and we specifically support the stockwater and municipal water use goals adopted by the Upper Smoky Hill Regional Advisory Committee in 2015. These goals are contained in Appendix 1.

# **WICHITA COUNTY WATER CONSERVATION AREA MANAGEMENT PLAN**

## **Term**

The terms and conditions of the Wichita County Water Conservation Area shall be effective upon issuance of a Consent Agreement and Order Designating a Water Conservation Area (WCA Agreement) that is approved by all participating water right owners and the Chief Engineer of the Division of Water Resources. The proposed term of the WCA Agreement is seven (7) years. The WCA Agreement will be automatically renewed for the term specified in the current management plan unless the participant submits a request to terminate renewal.

The Wichita County Water Conservation Area management plan will be reviewed every three years. Revisions and amendments to the management plan will be implemented when WCA Agreements are established or renewed. WCA Agreements may be revised prior to expiration to incorporate revisions and amendments resulting from the triennial reviews if such revision is mutually acceptable to the participants and the Chief Engineer of the Division of Water Resources.

## **Geographical Boundaries**

All water rights and the associated points of diversion that are located within Wichita County, Kansas, shall be eligible to participate in the Wichita County Water Conservation Area. The boundaries of Wichita County represent the geographic boundary of the Wichita County Water Conservation Area. Each WCA Agreement shall list the participating water right file numbers and describe by legal description the area encompassing the point(s) of diversion and place(s) of use.

## **Findings Regarding Groundwater Conditions**

K.S.A. 82a-745 requires a finding that one of the following conditions be present within the area proposed as a Water Conservation Area:

1. Groundwater levels in the area in question are declining or have declined excessively;
2. The rate of withdrawal of groundwater in the area equals or exceeds the rate of recharge within such area;
3. Preventable waste of water is occurring or may occur within the area in question; or
4. Unreasonable deterioration of the quality of water is occurring or may occur within the area in question.

The participating water right owners have determined that the following conditions exist:

- Groundwater levels within Wichita County have declined excessively and continue to decline under the current levels of water use. The amount of decline has been documented by the Kansas Geological Survey and the Kansas Department of Agriculture, Division of Water Resources. The Kansas Geological Survey estimates that approximately 65 percent of the original water in storage within this portion of the High Plains aquifer has been depleted.

## **WICHITA COUNTY WATER CONSERVATION AREA MANAGEMENT PLAN**

- The rate of withdrawal of groundwater within Wichita County substantially exceeds the rate of recharge within this area. Information provided by the Kansas Department of Agriculture, Division of Water Resources shows that the average county-wide irrigation use was approximately 11.2 inches per acre in 2014. Information provided by the Kansas Geological Survey indicates that the total rate of recharge in 2014 was approximately 0.4 inch.

### **Corrective Control Provisions and Plan for Conservation**

The following corrective control provisions within the Wichita County Water Conservation Area will be in effect during the term of the WCA Agreement:

1. The basis for determination of the quantity of permissible groundwater withdrawal during the term of the WCA Agreement shall be the reported use by point of diversion for the period defined by calendar years 2009 through 2015, inclusive.
2. The annual quantities for the basis period shall be the quantities reported on the water use reports submitted to and verified by the Division of Water Resources. If a reported annual quantity exceeds the authorized quantity, the reported value shall be reduced to the authorized quantity for the purpose of calculating average use during the basis period.
3. The total quantity of water use during the basis period shall be tabulated for each point of diversion included in the WCA Agreement. The average use for each point of diversion shall be determined by dividing the total quantity by 7.
4. The average use quantity of each point of diversion shall then be multiplied by the applicable reduction factor to determine the annual quantity of permissible groundwater withdrawal during the term of the WCA Agreement. The applicable reduction factor is related to the effective date of the WCA Agreement and is obtained from Table 1.

$$\text{Annual Quantity of Permissible Groundwater Withdrawal} = (\text{Average Use in acre-feet}) \times (\text{Reduction Factor})$$

The term of each WCA Agreement shall be a period of seven (7) calendar years. Table 1 indicates a four-step reduction process to reach target reductions in the years 2017, 2024, 2031, and 2038. The reduction factors shall be indexed so that the target reductions are achieved in each WCA Agreement regardless of enrollment date.

## WICHITA COUNTY WATER CONSERVATION AREA MANAGEMENT PLAN

Table 1 – Reduction Factors for Annual Quantity Determination

Effective Date of WCA Agreement	Time Remaining in Reduction Step	Reduction	Reduction Factor
January 1, 2017	7 Years	29%	0.71
January 1, 2018	6 Years	30%	0.70
January 1, 2019	5 Years	31%	0.69
January 1, 2020	4 Years	32%	0.68
January 1, 2021	3 Years	33%	0.67
January 1, 2022	2 Years	34%	0.66
January 1, 2023	1 Year	35%	0.65
January 1, 2024	7 Years	36%	0.64
January 1, 2025	6 Years	37%	0.63
January 1, 2026	5 Years	38%	0.62
January 1, 2027	4 Years	39%	0.61
January 1, 2028	3 Years	40%	0.60
January 1, 2029	2 Years	41%	0.59
January 1, 2030	1 Year	42%	0.58
January 1, 2031	7 Years	43%	0.57
January 1, 2032	6 Years	44%	0.56
January 1, 2033	5 Years	45%	0.55
January 1, 2034	4 Years	46%	0.54
January 1, 2035	3 Years	47%	0.53
January 1, 2036	2 Years	48%	0.52
January 1, 2037	1 Year	49%	0.51
January 1, 2038	7 Years	50%	0.50
January 1, 2039	6 Years	50%	0.50
January 1, 2040	5 Years	50%	0.50
January 1, 2041	4 Years	50%	0.50
January 1, 2042	3 Years	50%	0.50
January 1, 2043	2 Years	50%	0.50
January 1, 2044	1 Year	50%	0.50

5. Each WCA Agreement shall include a deposit schedule. The deposit schedule shall indicate how the annual quantity of permissible groundwater withdrawal shall be distributed during the term of the WCA Agreement. The purpose of the deposit schedule is to provide increased flexibility and to limit the adverse impacts of extreme drought during the initial years of the term. The deposit schedule is contained in Table 2.



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 Managing Kansas' Water Resources > Water Conservation Areas >  
 Wichita County WCA

# Wichita County WCA

Wichita County WCA Plan  
Order establishing the Wichita County WCA

Owner	WCA CA	Period	Acres Enrolled (Acres)	Water Surface Area (sq Acres)	Date Established
V. Baker	<u>WCA CA</u>	2019-2025	152	17	12/26/18
Simons	<u>WCA CA</u>	2018-2024	1,806	422	10/23/18
Brandt	<u>WCA CA</u>	2017-2023	131	15	05/08/18
Kiser Trust	<u>WCA CA</u>	2017-2023	267	74	05/08/18
Triple C Farms	<u>WCA CA</u>	2017-2023	320	103	05/02/18
Granville Koehn	<u>WCA CA</u>	2017-2023	496	96	05/02/18
Karlan Koehn	<u>WCA CA</u>	2017-2023	160	40	04/24/18
Heath	<u>WCA CA</u>	2018-2024	160	19	01/22/18
Wells	<u>WCA CA</u>	2018-2024	320	29	01/22/18
Arnes	<u>WCA CA</u>	2018-2024	320	57	01/22/18
J Two LLC	<u>WCA CA</u>	2017-2023	343	91	12/29/17
Zellner	<u>WCA CA</u>	2017-2023	480	84	12/21/17
Winter	<u>WCA CA</u>	2017-2023	220	55	12/11/17
Smith Trusts	<u>WCA CA</u>	2017-2023	640	57	11/07/17
Marshall Woodbury	<u>WCA CA</u>	2017-2023	2,427	801	10/11/17

Ted Woodbury	<u>WCA CA</u>	2017-2023	920	194	10/04/17
Hobson	<u>WCA CA</u>	2017-2023	160	124	10/02/17
Bar H Ranch, Inc	<u>WCA CA</u>	2017-2023	1,241	PC*	09/12/17
Bauck Trusts	<u>WCA CA</u>	2017-2023	282	52	08/25/17
Long Living Trust	<u>WCA CA</u>	2017-2023	160	43	07/05/17
Winter	<u>WCA CA</u>	2017-2023	320	68	05/01/17
Winter	<u>WCA CA</u>	2017-2023	377	67	05/01/17
Cutler	<u>WCA CA</u>	2017-2023	150	31	04/21/17
Watt	<u>WCA CA</u>	2017-2023	465	20	04/10/17
Watt	<u>WCA CA</u>	2017-2023	160	49	04/10/17
Long	<u>WCA CA</u>	2017-2023	155	41	03/31/17

\*WCA allocation held to historical average giving due consideration of past conservation per K.S.A. 82a-745.

Wichita County WCA webpage

Wichita County WCA Facebook

# Monitoring the Impacts of Sheridan County 6 Local Enhanced Management Area

Final Report for 2013 – 2017

11/15/2018

Dr. Bill Golden

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#### **IV. Economic Results**

As we move into the 21st century, goals for our water resources are gradually changing. Concerns over aquifer decline rates call into question the current allocation of water resources. With increasing frequency, producers and policy makers are asked to decide how to reduce groundwater consumption. Policy makers, producers, and other stakeholders are concerned about the likely negative economic impacts that the agricultural producers might incur as crop water use is reduced. Unfortunately, there is little economic literature and less empirical data that is capable of providing guidance on the likely impacts.

This section of the report reviews economic data collected from irrigated crop producers. These producers generally have irrigated cropland within the boundaries of the LEMA, as well as irrigated cropland outside the boundaries of the LEMA. Producer involvement was strictly voluntary; they reported data directly to GMD #4 who passed the data to the author for analysis. Due to the limited number of participants reporting economic data, the results cannot be considered statistically valid, never the less they are informative. Additionally, rainfall and soil type were not reported by the producers and these variables are important determinants of crop yield. In the following tables 'Cash Flow' was the economic metric reported. Cash Flow was defined as gross revenue (crop price x crop yield) less variable costs of production (fertilizer, seed, herbicide, hired labor etc.). While each producer reported their own crop price, for this analysis, the annual average crop price reported by all producers was used in the cash flow calculation. Land rent and fixed equipment costs were not included in the analysis.

Table 13 summarizes the producer reported data for the 2013 through 2017 crop year. Irrigated corn producers within the LEMA boundary reported using 23.1% less groundwater and yielding 1.2% less corn as compared to irrigated corn producers outside the LEMA boundary. These data are relatively consistent with irrigated crop production functions developed by Kansas State University Research and Extension which exhibit diminishing marginal returns, from the standpoint that using less groundwater typically generates less yield. However, if producers are efficiently using groundwater, outside the LEMA area we would expect a slightly larger yield loss. Somewhat surprisingly, irrigated corn producers within the LEMA boundary reported 4.3% more cash flow than their higher yielding counterparts outside the LEMA. Irrigated soybean producers within the LEMA boundary reported using 1.3% less groundwater and yielding 14.9% less soybeans as compared to irrigated soybean producers outside the LEMA boundary. These data are relatively consistent with irrigated crop production functions developed by Kansas State University Research and Extension. Soybean producers within the LEMA boundary reported 12.4% less cash flow than their higher yielding counterparts outside the LEMA. There was only one field of irrigated grain sorghum reported from outside the LEMA boundary. The producers that grew irrigated grain sorghum inside the LEMA boundary applied an average of 4.1 inches per acre, 60.5% less groundwater than their counterpart, yielded 13.8% less grain, but 59.9% more cash flow.

#### **V. Rainfall Data**

As previously mentioned, rainfall is a major determinant of groundwater use and crop yield. Figure 13 illustrates the historic annual rainfall for Sheridan County for the years 2000 through 2017. The average for this period was 20.3 inches per year. Both 2013 and 2014 were dryer than normal years, while 2015, 2016, and 2017 were wetter than normal years.

#### **VI. Hydrology Response**

The stated purpose of the LEMA legislation was to reduce groundwater consumption in order to conserve the state's water supply and extend the life of the Ogallala Aquifer. While the purpose of this research was to document the observed economic and agronomic changes, it is certainly relevant to comment on the hydrology response to the LEMA. After analyzing the data, Jim Butler, Kansas Geological Survey senior

scientist and geohydrology section chief stated that the results indicate that the decline rate within the LEMA has gone from about two feet per year to about 5 inches per year.<sup>3</sup>

## VII. Conclusions

The purpose of this report was to provide the methods, assumptions, and estimates of the agronomic and economic impacts associated with groundwater use reductions in the Sheridan #6 LEMA. The reader should note that this is the 'Final Report' and provides information from the five-year study

Relative to their neighbors outside the LEMA boundary, irrigated crop producers within the boundary of the LEMA: reduced total groundwater use by a statistically significant 23.1%, reduced average groundwater use per acre by a statistically significant 16.0%, reduced irrigated crop acreage by a statistically significant 10.9%, reduced irrigated corn acreage by a statistically significant 23.3%, increased irrigated grain sorghum acreage by a statistically significant 335.4%, and increased irrigated wheat acreage by a statistically significant 60.3%.

The economic results are consistent with Golden and Leatherman (2017) and suggests that, given the certainty of groundwater use reductions, producers are able to implement strategies to maintain returns and apply less groundwater. Additional research on the risk associated with reduced groundwater use is needed. The producer-supplied data suggests that producers within the LEMA boundary have been able to reduce groundwater use with minimal impact on cash flow. While we can observe the changes in crop mix and water use, we cannot discern, at this point, exact strategies producers are using to reduce variable expenses and/or adjust cultural practices.

On February 17, 2017, GMD 4, at the request of producers in the Sheridan #6 LEMA, submitted a request to the Division of Water Resources to extend the Sheridan #6 LEMA. On August 24, 2017, the Chief Engineer accepted the extension proposal for the period 2018-2022. This suggests that producers within the Sheridan #6 LEMA believe they can mitigate any negative economic consequences associated with reduced groundwater use and that the benefits of groundwater conservation outweigh the costs.

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<sup>3</sup> Source: <http://www.kgs.ku.edu/General/News/2017/stabilize.html>

# Impact Analysis of the Walnut Creek Intensive Groundwater Use Control Area

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**Abstract:** In 1992, an intensive groundwater-use control area (IGUCA) was established in the Walnut Creek Valley in central Kansas. Ex-post quasi-experimental control group analysis suggested that producers were able to mitigate the initial economic losses by maintaining/expanding the production of higher valued crops and by adopting efficient irrigation technologies and practices. It is hypothesized that the 'certainty' of water restrictions diminished the economic impacts. The foreknowledge that water use would be restricted into the foreseeable future allowed producers to develop long-run strategies to mitigate economic damages.

## 1. Introduction

For the majority of the 20th century, federal and state water policies in the western United States aimed to encourage settlement and develop surface water and groundwater natural resources for use by agriculture. Today, approximately 43 million acres of agricultural land are irrigated in the West. These lands produced 72 percent of crop sales on only 27 percent of the total harvested crop acreage. Irrigated agriculture currently consumes approximately 90 percent of the freshwater resources in the West (Gol-lehon and Quinby, 2000).

As we move into the 21st century, societal goals for our water resources are gradually changing. Public concerns over aquifer decline rates, diminishing streamflow, decreasing wildlife populations, the desire for more water-oriented recreational facilities, the water needs of an expanding industrial sector, and increased population concentration call into question the current allocation of water resources. With increasing frequency, policy makers are asked to decide how to equitably transfer water rights from the agricultural sector to competing sectors. When these situations occur, policy makers, agricultural producers, and other stakeholders are concerned

about the likely negative economic impacts that the agricultural community will incur as water resources are shifted away from the production of irrigated crops, the cost of the policy, and the benefits to the water resource. Unfortunately, there are few case studies capable of providing guidance on the likely impacts.

In 1992, an Intensive Groundwater-Use Control Area (IGUCA) was established in the Walnut Creek Valley in central Kansas. This IGUCA was instituted to address streamflow depletions resulting from excessive withdrawals of groundwater. The Walnut Creek IGUCA stopped the authorization of new water rights and cut back groundwater withdrawals by existing water right holders. The purpose of this project is to provide policy makers, producers, and other stakeholders with a quantitative analysis of the economic impacts associated with transferring water resources from agriculture to other uses or for conservation purposes. This will be accomplished by applying an ex-post case study technique to the Walnut Creek situation. The quasi-experimental control group analysis used in this study can be characterized as a long-run dynamic analysis.

cropland. As reflected in Figure 3 and Table 1, the IGUCA resulted in statistically significant short-run and long-run reductions in annual irrigated acreage. It is possible that idled irrigated acres generated non-irrigated crop revenues. Due to the uncertainty in crop rotation, as noted in Pope (1992), possible nonirrigated crop revenues generated from previously irrigated cropland were not included in this analysis. Had they been included, both the short-run and long-run estimated impacts to crop revenue would be reduced.

#### 4.3. Producer's reaction to water use restrictions

When water-use is restricted, producers of irrigated crops develop and implement strategies to mitigate potential revenue losses (Amossom et al., 2009). Buller (1988) and Wu et al. (1996) suggest that producers will change crop mix by shifting from high water-use crops, such as corn, into crops with lower consumptive use. Taylor and Young (1995) and BBC Research & Consulting et al. (1996) suggest that higher valued, possibly more water intensive crops will remain in production and lower valued crops on marginal land will be the first to be retired. Burness and Brill (2001) and Williams et al. (1996) suggest that in such cases producers will adopt more efficient irrigation technology. Harris and Mapp (1986) and Klocke et al. (2004) suggest that computer-aided technologies and improved irrigation scheduling might provide a solution. Schlegel et al. (2005) report significant water savings with the adoption of a limited irrigation management strategy.

Both alfalfa and corn are considered highly profitable and high water use crops. As a result, it was of interest to analyze how the acreage devoted to these crops varied over time. Data on irrigated crop acreage from WRIS were used to construct a time series for both the Target and Control areas. The econometric models for the difference in the indexed values of irrigated crop acreage,  $\Delta IA_t$ , follow the same general form as Equation (5), substituting the change in indexed values of irrigated crop acreage for total water use. The model results suggest that the IGUCA resulted in a statistically significant long-run increase in irrigated alfalfa acreage, but no statistically significant change was observed in irrigated corn acreage. While not reported, a reduction in the irrigated acreage devoted to wheat and grain sorghum was observed. These findings are consistent with those suggested by Taylor and Young (1995) and BBC Research & Consulting et al. (1996).

Data on the indexed time trends for acres irrigated with center pivot technology from WRIS were obtained. The econometric models for the difference in the indexed values of acres irrigated with center pivot technology,  $\Delta CPT_t$ , follows the same general form as Equation (5), substituting the change in indexed values of acres irrigated with center pivot technology for total water use. The model results suggest that the IGUCA resulted in a statistically significant long-run increase in acres irrigated with center pivot technology. While not reported, a similar analysis for acres irrigated with flood technology suggests that the majority of the short-run total irrigated acreage reduction (Figure 3) came from parcels of land irrigated with flood technology. These findings are consistent with those suggested by Burness and Brill (2001) and Williams et al. (1996). Referencing back to Figure 4 and Table 1, statistically significant short-run and long-run reductions in water use per acre were observed. This suggests that producers reduced water use on high water use crops such as corn and alfalfa without experiencing a comparable reduction in revenues. These findings are consistent with those suggested by Schlegel et al. (2005). It is unclear whether computer-aided technologies and improved irrigation scheduling, as suggested by Harris and Mapp (1986) and Klocke et al. (2004), enabled producers to reduce water consumption, as data on these practices are unavailable.

#### 4.4. Impacts on land values and property tax

When irrigated cropland is converted to nonirrigated cropland there may be a change in land values, which may in turn impact local property tax revenues. To determine the IGUCA's impact on land prices, this research relied on a model developed by on Tsoodle et al. (2006). This hedonic appraisal technique allows for the unbiased estimation of the value of irrigated cropland based on the conventional site-specific characteristics of the land as well as hydrological and related characteristics of the water right.

The linear hedonic model for irrigated cropland can be conceptualized as:

$$P = \beta_0 + \sum_{i=1}^n \beta_i EV_i + \sum_{i=n+1}^j \beta_i BV_i \quad (7)$$

where  $P$  is the logged per acre price for the land sale,  $EV$  is a vector of site-specific explanatory variables, and  $BV$  is a vector of binary variables representing the year of the sale. The vector of binary variables quantifies the yearly change in land price and will be used to compare the time path of land prices in the control and target areas.

The data in this analysis consists of all 'arms-length transaction' sales of irrigated agricultural land in Kansas between 1986 and 2000. The Property Valuation Division (PVD) of the Kansas Department of Revenue (KDR) collected this information and verified by personal contact the fair market nature of the sale. Kansas statutes require any land transaction to be reported to the KDR. The County Appraiser, using a standardized method, collects this data and provides it to KDR on an annual basis. The data contains information on sales location, sales date, the parcels' agriculture use types, soil mapping unit contained in the parcel, total acres in the parcel, the agricultural tax value, the tax value of all buildings, topographical codes, utility codes, and access codes.

Given Equation 4 and Equation 7, the econometric models for the difference in binary variables,  $\Delta BV_t$ , can be specified as in Equation (5), substituting the change in the binary variable for total water use. The model results (Table 1) suggest that the IGUCA resulted in no statistically significant short-run or long-run decrease in irrigated cropland values. However, it should be noted that only parcels that were sold as irrigated cropland were in the dataset. While on average there was no difference in observed irrigated land price, this does not imply that some unsold parcels may have experienced a reduction in value or that previously irrigated land that was sold as nonirrigated cropland did not experience a loss.

In 1985, concern over rapidly escalating land prices prompted a shift from fair-market appraisal of agricultural land to use-value appraisal for property tax appraisal purposes in the State of Kansas. These valuations were established for each parcel of land devoted to agricultural use upon the basis of the agricultural income or productivity attributable to the inherent capabilities of such land. In order to stabilize the appraisal process, multi-year averages for acreage, revenue, and costs are incorporated into the process. In 1989 and 1999, major changes were made to the appraisal process. In 1997, those irrigated parcels within the IGUCA boundaries that were classified as having either senior or junior water rights were assessed based on nonirrigated land use values.

County level data from PVD on total agricultural assessed valuations were collected for 1989 through 2005. The econometric models for the difference in the indexed values of total agricultural assessed valuations,  $\Delta TAAV_t$ , can be specified as:

$$\Delta TAAV_t = \lambda_0 + \lambda_1 D1_t. \quad (8)$$

This model specification includes only one binary

variable which takes the value of one for the period 1997 through 2005. The regression results suggest that the IGUCA may not have resulted in a statistically significant increase in total agricultural assessed valuations. The true impact of the reduction in senior and junior water rights assessments may be masked due to the fact that the target area PVD was aggregated at the county level, as opposed to the IGUCA boundaries, and also may have been impacted by the changes in appraisal process that were previously mentioned.

#### 4.5. Impacts on the natural resources

The goal of water conservation policy is obviously to conserve water. While the economic impacts of policy are important to all participants, one metric of success is whether or not the policy actually resulted in a reduction in the primary water usage. Since the implementation policy requires the expenditure of taxpayer dollars, the investment of other state resources, and the financial burdens placed on other stakeholders, it is imperative that research be expended to quantify the impacts on the water resources.

Concerns over the lack of continuous streamflow motivated the 1992 Walnut Creek IGUCA. Pope (1992) reported that the combination of declining streamflows and declining groundwater levels indicated that the hydrologic system was out of balance and that the balance needed to be restored to achieve the goal of sustainability. While this research primarily focuses on the economic impacts associated with the IGUCA, it is nevertheless appropriate to ask whether the IGUCA met its environmental objectives.

Recognizing the hydraulic connectivity between streamflow and the aquifer, the Walnut Creek IGUCA focused on aquifer recovery as the means to restore streamflow. Pope (1992) indicated that the aquifer should be allowed to recharge and be maintained in an essentially full state such that total average annual groundwater withdrawals are limited to the long-term sustainable yield. In order to monitor groundwater elevation changes, the Kansas Department of Agriculture's Division of Water Resources (DWR) began monitoring observation wells within the IGUCA's boundaries. From 1993 to 2008, on average, the groundwater elevation has increased during the observation period (conversely the depth to water has decreased).

The econometric model for depth to groundwater (DTG) can be specified as:

$$DTG_t = \lambda_0 + \lambda_1 P_t + \lambda_2 P_t^2 + \lambda_3 D1_t. \quad (9)$$