Groundwater Management District 4

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1. Introduction

A. Groundwater Management

The Groundwater Management District Act as described in the K.S.A. 82a-1020 through 82a-1041 of December 2012 states that "it has been recognized that a need exists for the creation of special districts for the proper management of the groundwater resources in the state (K.S.A. 82a-1020)." This is to be for the "conservation of groundwater resources, the prevention of economic deterioration for associated endeavors within the state and the stabilization of agriculture(K.S.A. 82a-1020)." This research paper focuses mainly on the Groundwater Management District 4 (GMD 4), specifically the Sheridan 6 (SD-6) Local Enhanced Management Area (LEMA).

B. Background

The proposal for the Sheridan 6 Local Enhanced Management Area (LEMA) was first proposed in January of 2011. It was asked that a working draft be presented to the GMD 4 board at a hearing at this time. The draft was first declined, and after much revision, with help from the governor, the board approved the Revised Management Program and submitted it to the Chief Engineer of the Kansas Division of Water Resources in April of 2012. By May, the Chief Engineer, David Barfield, approved the revised program, and by December of 2012, the SD-6 LEMA was enacted. On April 17th, 2013, the final Order of Designation was signed into law, and the experiment began.

This is the first LEMA in the state of Kansas, so it is being monitored very closely. There are eight standard monitoring wells in the area, and four additional wells collect hourly data. The Kansas Geological Society is helping to compile, read, and interpret the data as it comes in.

In March of 2013, the GMD4 appointed the Advisory Committee, who met for the first time to organize and discuss alternative meter methods that could be pre-approved. The five methods are: periodic meter readings and recordings, power company records that can express operational hours, temperature sensors that can log when the well is in operation, Agriculture-sense or similar Agriculture data services, and a sturdy engine hour meter- remotely mounted. In April, the GMD4 sent out the first edition of the new SD-6 LEMA ledger that is just for the stakeholders of the SD-6. In this newsletter there were four issues covered: alternative meter procedures, Risk Management Agency limited irrigation program information, Kansas Governor Sam Brownback's Agriculture Efficiency Task Force and their demonstration approach, and the Multi-Year Flex Account (MYFA) option for all water rights.

In April the Chief Engineer, David Barfield, also signed the Order of Designation. This is the final order, which stipulates that GMD4 is to send out individual letters to all water rights owners in the LEMA within 30 days. Included in these letters are the designated LEMA period, water use limits, and other relevant information. Each water right

recipient is to receive a letter and the full order is to be posted on the Division of Water Resources (DWR) and GMD4 websites with hard copies provided to the Register of Deeds in both Sheridan and Thomas Counties and the DWR Field Office in Stockton and GMD4. If there is a request, they are to mail a full copy of the order to any interested person who is affected.

This LEMA will only be in effect for five years, and at the end of this time stakeholders will look at all the data and determine what is working and what needs to be re-evaluated. There is much hope that at the end of five years the LEMA will be extended for a longer period of time. With the SD-6 being the first of its kind in the state there many other Groundwater Management Districts are looking at what is happening and working on starting their own LEMA.

C. Our Goal

The purpose of this paper was to gather information on the legislative issues that took place before the SD-6 LEMA could go into effect, the economy, and management of the resource. The goal was to compile relevant materials on the aforementioned topics to help inform interested parties about the new LEMA process that will aid in their groundwater management planning. After contacting many key people to this area and doing much research on the topic we have produced a sound research paper for our capstone project for the Natural Resource and Environmental Sciences Secondary Major.

2. Legislative Aspects of Local Enhanced Management Areas and SD-6 Plan

A. Legislative Context for the Local Enhanced Management Area

I. Kansas Water Appropriation Act

In 1945, the State of Kansas moved from riparian water rights towards a new paradigm with the Water Appropriation Act (Peck, 2006). This act, known for establishing the doctrine of prior appropriation, removed the absolute ownership of groundwater by the landowner and instead entrusted all of the state's water resources to the DWR within the Kansas Department of Agriculture (Peck, 2006). As the leader of the DWR, the chief engineer was then entrusted with "controlling, conserving, regulating, allotting, and aiding in distribution of the water resources of the state for the benefits and beneficial uses of all of its inhabitants (K.S.A. 82a-706)."

This act established the doctrine of prior appropriation in Kansas, where all water users must file for a permit with the DWR. This permit helps the chief engineer regulate the water resources, but also protects water-dependent enterprises by ensuring a consistent amount of water most years (Barfield, 2012). As part of the Kansas Water Appropriation Act, all non-domestic water users must file for a "water right," specifying both the amount and locations of diversion and use with the state's chief engineer (K.S. A. 82a-711). Once approved by the chief engineer, these rights are considered real

property of their owner (K.S.A. 82a-701). The water to fill these rights is prioritized in times of shortage by their date of filing, where the older rights have precedence regardless of the purpose of use, giving rise to the phrase "prior appropriation." This priority helps the state orderly deal with the plethora of water users, especially during drought years. However, when the rights have the same priority, purpose of use is prioritized with domestic use first, followed by domestic, municipal, irrigation, industrial, recreation, and lastly, water power uses (K.S.A. 82a-707). As real property, these rights can be transferred to a new location or changed in their purpose of use with the approval of the chief engineer (K.S.A. 82a-708b). New rights established by the chief engineer cannot interfere with existing rights, nor can they negatively affect the public interest. When considering new groundwater appropriations, the chief engineer must consider the area of withdrawal, safe yield from the source, and aquifer recharge rates (K.S.A. 82a-711). If a water right is not put to "beneficial use" for five consecutive years, the right is considered abandoned, and is surrendered to the state (K.S.A. 82a-718). As part of this legislation, the chief engineer can mandate conservation plans when water sources could be rendered insufficient during times of drought (K.S.A. 82a-733). The entire Water Appropriation Act is enforceable by civil suit and considerable penalties (K.S.A. 82a-736).

A newer part of this legislation is the Multi-Year Flex Plan (MYFP), which is intended to allow greater flexibility in the use of water allocations so that drought-emergency term permits are not needed in the future (Barfield, 2012). These drought-emergency term permits were enacted by the chief engineer for 2011 and 2012 only, and simply doubled a water allotment for the current years while suspending the same right for the following two years (Barfield, 2012). The 2012 Multi-Year Flex Plan (MYFP) addition to the Kansas Water Appropriation Act allows groundwater use limits to be extended into a five year account, while neither increasing the total water diverted nor hurting the groundwater source. These accounts are limited to five times the annual average usage, five times the estimated annual irrigation requirement plus 110%, or five times the annual allotment of groundwater use set by a groundwater management district (K.S.A. 82a-736).

II. Groundwater Management District Act – K.S.A 82a-1020

In 1972, the Groundwater Management District Act was passed to address the rapid depletion of groundwater stores in Western Kansas with the increase in irrigated agriculture (Peck, 443). To do this, Groundwater Management Districts consisting of local stakeholders would create policy alongside the chief engineer to approach the unique groundwater concerns in their particular geographic area (DWR, 6). To form a Groundwater Management District, an initial steering committee must gather an initial proposal including the proposed area, purpose, and board structure to be approved by the Secretary of State, the chief engineer, and the eligible water users of the proposed area (K.S.A 82a-1023). The chief engineer must determine: 1) if the area proposed is a "hydrological community of interest;" 2) if it overlaps with another Groundwater Management District; 3) if the proposed purpose aligns with the Groundwater Management District Act's purpose; 4) if the included aquifers are subject to

management; 5) if the current and future uses of groundwater require a groundwater management program and; 6) if the public interest will be served by the proposed Groundwater Management District (K.S.A. 82a-1024). After receiving approval from the chief engineer, the water users of the district, and the Secretary of State, the Groundwater Management District is incorporated (K.S.A. 82a-1025).

Once incorporated, the Groundwater Management District is run by an elected board with significant powers to manage water in the district, including the power to recommend policies to the chief engineer and other government agencies concerning groundwater management in the area, the power to monitor and enforce groundwater rules in the district, and the power to recommend areas to be Intensive Groundwater Use Control Areas (IGUCA's) (K.S.A. 82a-1028). All management plans of the Groundwater Management District still must be approved by the chief engineer and be reviewed with a series of public hearings. However, the activities and staff of these Groundwater Management Districts must be funded by the taxes levied on groundwater users in the district, district bonds, or by external grants and loans.

A Groundwater Management District or a coalition of residents in a specific area can recommend an Intensive Groundwater Use Control Area (IGUCA) to the chief engineer (K.S.A.82a-1036). These areas are intended to address significant groundwater use issues in a more narrow area than a Groundwater Management District, and also carry significant power and flexibility derived from the power of the chief engineer (Peck,443). These proposed areas must exhibit declining or low groundwater levels, a rate of recharge less than the rate of withdrawal, deteriorating groundwater quality, preventable waste of water, or another cause for more regulation (K.S.A. 82a-1036). After several hearings on the issue, the chief engineer designates the boundaries of the area along with the corrective control provisions, to be in force until their repeal. Some of the proposed corrective control measures include closing the area to further appropriation of groundwater, limiting the groundwater use over a period of time through the priority system, reducing withdrawal of particular users, rotating groundwater use through users, or any other measure the chief engineer believes will benefit the public (K.S.A. 82a-1038).

B. K.S.A. 82a-1041 Local Enhanced Management Areas

The Local Enhanced Management Area (LEMA) is the final and most recent addition to the Groundwater Management District Act. These areas may be designated for the same reasons as an IGUCA, which are declining or low groundwater levels, a rate of recharge less than the rate of withdrawal, deteriorating groundwater quality, preventable waste of water, or another cause for more regulation (K.S.A. 82a-1036). The initial LEMA plan must also include a geographic area entirely within a groundwater management district, clear goals and corrective provisions, compliance monitoring and enforcement plans in accordance with established state law (K.S.A. 82a-1041a). To proceed, a public hearing is called for all water rights holders, where it is established that one of the five criteria for the establishment of either an IGUCA or a LEMA exists, that there is sufficient public interest in the preliminary plan, and that the boundaries are

acceptable and manageable to achieve the stated goal (K.S.A. 82a-1041b). The chief engineer then issues an Order of Decision, where he either accepts the LEMA plan, rejects it, allows the plan to be resubmitted with revisions, or proposes modifications in administration of the plan for the Groundwater Management District and stakeholders within to consider (K.S.A. 82a-1041d). If the LEMA plan is accepted by the chief engineer, an Order of Designation then follows this where boundaries are finalized and circumstances set (K.S.A. 82a-1041f). These circumstances may include closing the area to new groundwater users, re-appropriating from a new water total, reducing withdrawals, or rotating groundwater rights (K.S.A. 82a-1041f). The Groundwater Management District then oversees the enforcement of the LEMA provisions, which is in effect until it is repealed or expired. Hearings for the LEMA plan must occur at least every seven years, and a complete review must be made at least every ten years or whenever the chief engineer or 10% of the public are concerned (but no more often than every 4 years) (K.S.A. 82a-1041j). While the Groundwater Management District is crucial to the development and implementation of this plan, the authority for the Local Enhanced Management Area ultimately comes from the chief engineer (K.S. A. 82a-1041).

This statute began as a bill in the Kansas senate (SB 310) as developed by the Northwest Kansas Groundwater Management District 4 in cooperation with the other GMD's, the DWR, the Kansas Farm Bureau, the Kansas Livestock Association, and the Kansas Grain and Feed Association (NWKS GMD 4, 1). The GMD 4 Sheridan-6 High Priority Area (HPA) illustrated the need for this type of law, as the residents of this area found the IGUCA protocol to be too risky, as they would have to surrender control of permanent decisions of the chief engineer, for better or worse. In the Local Enhanced Management Area bill, the residents of Sheridan 6 felt comfortable enough in deciding their own fate, but also agreed that the level of state control would allow the plans developed to still be effective in reaching their goals. As stated in the Northwest Kansas Groundwater Management District 4 testimony to the Kansas Senate, "SB 310 [the LEMA bill] does not guarantee the locals will get everything or anything they might propose as an enhanced management proposal, *but it does insure they will not get anything they don't want."* Overall, the LEMA procedure allows local residents to proactively get a handle on severe groundwater concerns in a short amount of time, while the IGUCA's, with their drawbacks, still remain an option for further management if necessary (NWKS GMD4, 2).

C. Sheridan 6 High Priority Area

I. Original Proposal from Steering Committee

a. Development Hearings

The groundwater stakeholders of the Sheridan 6 High Priority Area of the GMD 4 developed a LEMA proposal to "reduce decline rates and extend the life of the aquifer (SD-6 Stakeholders, 1)." Eleven public hearings were conducted to develop the proposal over almost four years while the LEMA legislation was being created and

passed at the state level. The initial Sheridan-6 hearing covered concerns of the stakeholders regarding a proper timeframe to address the issue locally, and also a general need of models for different total pumpage amounts in the area (SD-6 Stakeholders, 9-10). The second meeting focused on the alternatives to broad percentage reductions, including different irrigation techniques and alternate supplies of water, and concluded with a decision to compare 20%, 40%, and 60% reductions in pumpage in the future (SD-6 Stakeholders, 12). For the third meeting, participants discussed different legal options to enact a reduction in pumpage, but neither the MYFP nor the IGUCA provided the flexibility and the power necessary to reach their stated goals (SD-6 Stakeholders, 14). At the conclusion of this third meeting, a steering committee was finally formed (SD-6 Stakeholders, 15). The fourth meeting, the first under the formal steering committee, began with a discussion of a voluntary conservation measure (Agriculture Water Enhancement Program) to achieve pumpage reduction in the area, but it was mentioned that a mandatory 20% reduction in a five-year allocation could be a workable solution (SD-6 Stakeholders, 17). Again in the fifth meeting, the Agriculture Water Enhancement Program was discussed along with the IGUCA as alternatives, ending with some frustration with the myriad of options available. At the sixth meeting, some key elements were discussed, with the affirmed ideas including: 1) mandated usage restriction; 2) penalties for violations; 3) automatic expiration of restrictions; 4) disregarding of priority of right in reduction measures; 5) no penalization for already reduced or conserved rights; and 6) that IGUCA procedures were inappropriate (SD-6 Stakeholders, 25). At this meeting, the exemption of non-irrigation rights was discarded from consideration. Many intervening meetings were not recorded, leading to the thirteenth meeting, where concerns with the geographic boundaries and the priority of reduction were discussed but these concerns did not change the steering committee's position (SD-6 Stakeholders, 31).

b. Initial Proposal

The stakeholders of Sheridan-6 HPA submitted a five year LEMA plan to "reduce decline rates and extend the life of the aquifer" in June of 2012. Their proposed limit was set at 114,000 acre feet total to be withdrawn over the whole Sheridan-6 HPA between January of 2013 and December 2017 (SD-6 Stakeholders, 1). This initial proposal called for an irrigation water use reduction of one inch on every annual acre foot historically used by water rights holders, totaled over a five year period (about an 18% reduction). It also prohibits holding more than the maximum set number of cattle, and rations stock water use to 12 gallons per head per day, again totaled over a five year period or potentially left as an annual value. Lastly, the LEMA proposal also called for a 10% reduction in recreational water use, totaled over five years or left as an annual allocation (SD-6 Stakeholders, 1). Irrigation is set to a hard limit of 55 acre inches over 5 years per each previous acre foot. Water was also allocated to be used within an irrigator's total system rather than dedicated to specific acres of the irrigators total land. Water pumped must still fall under annual allocations, though water rights can be transferred within the HPA if total water is still under the five year allocation (SD-6 Stakeholders, 2-3). MYFP accounts can be entered before October 2013, so long as they are not greater than the maximum allocations in the LEMA. All water rights in the

LEMA are converted to five-year water rights, regardless of their participation in the MYFP; though MYFP participation allows these users to exceed their annual allocation. Water rights that were entered into the Agriculture Water Enhancement Program or the Environmental Quality Incentive Program are allowed to join the plan without penalty at the expiration of their conservation term (SD-6 Stakeholders, 3). Harsh penalties were proposed, including a $1,000 per day fine for overuse less than four acre feet, and exceeding the right by more than four acre feet calls for a two year suspension of water right. Users are responsible for metering their water use every two weeks, and if water use data was unavailable, it is assumed that the right-holder used his annual allocation in full. Meter failure and repair should be explicitly reported to the GMD office within 48 hours (SD-6 Stakeholders, 3-4). Northwest Kansas GMD 4 was set to maintain records and send five year account balances to water right holders on an annual basis. The District would also manage all temporary transfers of water allocations. New hourly monitoring wells were installed by the GMD Office in addition to the nine observation wells already in place (one for each section) (SD-6 Stakeholders, 4-5). An advisory committee primarily composed of Sheridan-6 stakeholders (with at least one non-irrigating water user), but also a GMD Representative and a DWR representative would meet annually to monitor water use, the water table, economic data, violations, and new management techniques. An additional review 1.5 years before expiration would determine the new level of public interest and the economic impact of the water use reduction on the area (SD-6 Stakeholders, 5).

c. Order Finding Satisfaction of the Initial Requirements

The chief engineer found that the initial requirements of a LEMA were satisfied by this proposal in September of 2012 (Barfield Sept. 2012,1). All water right holders within the HPA were then summoned to a hearing to discuss whether the basic requirements of management need, public interest, and appropriate boundaries were met (Barfield Sept. 2012, 1). A concern was raised about the data underlying the plan and the geographic boundaries, but most comments were in favor of the proposed plan. Many well owners in favor of the plan commented on their concern about the significant declines they have seen at their wells. Scott Foote, a livestock producer, acknowledged the economic basis of the plan in saying that it would "bring economic benefit over the long term, although it would cause economic harm in the short term. Several supporters also mentioned their long tradition of farming in the region, and want that opportunity to be available for their grandchildren as well (Barfield Dec. 2012, 5-10). The chief engineer found that the first requirement of management need was satisfied by the decline in groundwater level, the lack of adequate recharge, preventable waste occurring in the area, and a deterioration of water quality. This was ascertained from the GMD's almost 50 years of data, along with the Republican River Compact data and public comments (Barfield Dec. 2012, 11). The chief engineer also found sufficient public interest under the Groundwater Management District Act definition, evident in the many preliminary hearings and additional public comments (Barfield Sept. 2012, 1). The geographic boundary for the LEMA was originally set under the Kansas Water Authority's recommendation of aquifer subunit management. Under this directive, GMD 4 selected areas with a high rates of decline (greater than 9% over 6 years), or a high water-use

density (over 275 acre feet per section) as found in data from Kansas Geological Survey (KGS) data (Bossert, 2008). The Sheridan-6 area represents a cluster of these indicators and also has sufficient public interest in improving groundwater levels to deserve immediate and specific management. The chief engineer found that this HPA protocol, along with the public support of the boundaries, was sufficient to accept the proposed boundaries (Barfield Sept. 2012, 1).

II. Order of Decision

The final hearing of the Sheridan-6 LEMA took place in November of 2012, and considered whether the plan should be accepted, rejected, or modified (Barfield Dec. 2012, 1). The Order of Decision indicates that an Order of Designation is to follow with final findings, conclusions, and all other elements necessary to enact the plan. Public testimony began with some technical issues, with representatives of the Northwest Kansas GMD 4, the DWR, and the KGS presenting evidence in support of the proposal. Mitchell Baalman, a farmer in the proposed area, stated that he would still "make money" even with the restriction on water. Another farmer, Roch Meier, said that on a field with 10.5 acre inches of water he yielded 193 bushels, which was only about 23% less corn than a fully irrigated field would yield with 38% more water. One non-water using energy firm expressed concern with the declines in groundwater, as a loss of crop productivity in the area ultimately means a loss of business for his firm. Several people mentioned concerns with transfers of water allocations, as it might lead to inequity amongst users and disparity in the level of pumpage in different areas (Barfield Dec. 2012, 5-10). For the Order of Decision, the chief engineer limited the area of the LEMA to the Sheridan 6 HPA, affirmed that the groundwater is declining in this region, accepted the corrective control provisions, and found all provisions to be in accordance with state law (Barfield Dec. 2012, 10-13). According to the proposed plan, the total diversion from the aquifer is to be no more than 114,000 acre-feet over the next five years which is intended to extent the future of the aquifer with irrigators still sustaining their farming operations today (Barfield Dec. 2012, 13-14). This Order of Decision then restricts the regulation to the specified area, to go into effect immediately setting each irrigator to a limit of 55 inches per irrigated acre over the five year period starting January 1, 2013. This order allows users to combine multiple wells into a single account, to transfer allocations to other users (but up to the five year and annual limits), to use MYFA, to enter conservation rights into use without penalty, to use up to 12 gallons per head per day up to lot capacity in stockwater, to use up to 90% of recreational water rights, and to combine all non-domestic rights to a five year account (Barfield Dec. 2012, 16-19).

III. Order of Designation

The final Order of Designation, released on April 17th, 2013, reviews the entire process of the LEMA for the Sheridan-6 HPA (Barfield 2013, 1). This Order reviews the process local stakeholders took in developing the proposal to reduce groundwater decline, and how the need for a locally-designed plan with specific goals and corrective control provision having the force of law led state legislators to adopt the LEMA provision to the

Groundwater Management District Act (Barfield 2013, 2-5). Soon after the legislative adoption of the LEMA, the Northwest Kansas GMD 4 submitted the proposal to the chief engineer, who found that the criteria for the LEMA were met, and proceeded with two public hearings leading up to the issuance of an Order of Decision accepting the plan (Barfield 2013, 4-5). In the Order of Designation, the chief engineer affirms that the boundaries of the area are hydrologically appropriate, enclose a small enough area to effectively manage, and that the benefits from groundwater reduction will stay in the area (as water in the area moves laterally only one mile in 15-20 years) (Barfield 14-17). Groundwater level data and models of the proposed reduction were also found to be sound. The chief engineer also finds that the proposed plan does not violate the "first in time, first in right" doctrine of the Water Appropriations Act, as there is sufficient water for every user's needs under this plan. Anyone who feels a senior right is impaired by the plan is entitled to an investigation through the DWR, either during the term of the plan, or after the plan's conclusion. Also, the chief engineer concedes that there is some conflict with the priority rule when regulating by purpose of use, but again finds that this clause only engages when there is insufficient water to meet all right holders' needs (Barfield 2013, 17-19). Lastly, he does have some concerns with the flexibility of appropriations in the long-term, but finds that the short-term range of the current plan, as restricted to the narrow area of the HPA, will not be hindered by such concerns (Barfield 2013,19). Economically, this plan is intended to extend the viable life of the aquifer through an intentional loss in productivity today. With the current conditions of extremely low groundwater levels and very limited recharge, this problem will likely persist for up to 50-60 years. An economic study of reduced groundwater use in Northwest Kansas has found that unregulated use severely reduces the future viability of the aquifer by reducing profits from $5.3 million to $4.0 million in 60 years. A more moderate reduction (in this model, 30%) results in a more delicate loss in economic activity, moving from $4.7 million to $4.3 million in 60 years. These models show that the water left unused today is proportional to future profits. Over five years, the economic impacts of a moderate reduction are nearly imperceptible (Barfield 2013, 20-23). The chief engineer finds that this limited time threatens to undermine the entire purpose of the plan (to make a meaningful decrease in the rate of aquifer decline), but finds that the LEMA regulations do not require a certain amount of time, and that the five year proposal is still sound. However, he states that if the plan is not renewed, these efforts will have been wasted (Barfield 2013, 24). Most of the specific directives of the Order of Designation match those found in the Order of Decision, except for some additional details in determining water use from past years' data, attached forms for transfers and combinations of allocations, specifics about metering protocols as outlined in the initial proposal, cooperation in accounting for water use among the Northwest Kansas GMD and the DWR, fines for violations as proposed initially, specific criteria on which the annual advisory committee will evaluate progress of the plan, and how the Order of Designation is to be distributed to the public (Barfield 2013, 28-60).

D. Conclusions about Legal/Management Aspects

I. Why was Sheridan-6 the birthplace of the LEMA?

1) The area was seeing extreme enough declines in groundwater to deserve a High Priority Area designation.

After the Kansas Water Organization's Management Advisory Committee's recommendation to manage groundwater more proactively at smaller units, GMD 4 set out to create HPA's that were worthy of more intensive management (Bossert, 2008). Barfield explains that the HPA's in GMD4 are the areas of the aquifer with the least life left, and are reasonably where management resources should be focused (Barfield). HPA's within GMD 4 must include two or more sections with either a 9% decline between 1996 and 2002 or a density of use greater than 275 acre feet in a 2 mile area (Bossert, 2008). Sheridan-6 meets this definition, and in total represents 99 sections with a total pumpage of 30,164 acre feet, irrigating 24,803 acres in 2007 (GMD 4, page 1). The average saturated thickness in the area has declined by 20-30 feet since 1980, and is currently at about 70 feet (GMD 4, page 5). This prompted GMD 4 under Wayne Bossert to move forward in proactively managing these groundwater stores with the local users.

2) The leadership of Wayne Bossert and other local proactive young farmers.

Wayne Bossert has been the manager of the Northwest Kansas GMD for 36 years, and in that time has accumulated much knowledge about his constituency and of the aquifer in the area. David Barfield believes that Sheridan-6 was the birthplace of the LEMA because of the leadership of Wayne Bossert and of the local stakeholders (Barfield). About Wayne Bossert, Barfield says that he is a very experienced and knowledgeable manager for the GMD, and is also a greater personal leader who helped to create the innovative HPA's and then lead locals in those areas to consider their groundwater management options. As for the local leadership, Barfield notices that there are many younger farmers that want to irrigate into the future (Barfield). Mitchell Baalman is one example of this, who is a fourth-generation farmer in the area that is interested in passing the tradition onto his four children (Peters, 2012).

II. Strengths

a. Strength of the LEMA law

1) Allows great flexibility in the voluntary local control of groundwater, but still carries the force of law.-

Wayne Bossert also says the LEMA law has "nothing that says what you have to do," and allows locals to identify a problem and work together to approach it (Bossert). The strength that sets a LEMA apart from an IGUCA is that every stipulation of a plan must be approved by the local stakeholders (Bossert). While conservation programs can also

work this way, they are completely voluntary, but a LEMA plan has the force of law once passed by the chief engineer, requiring compliance by all water users in the area (Barfield). Bossert reiterates that the LEMA process is flexible enough to do anything a local area wants, so long as the plan developed is hydrologically sound, legal, and agreeable to the people of the area. According to David Barfield, the major benefit of the LEMA law is that it allows stakeholders to "initiate action without fear" in managing their groundwater stores.

b. Strengths of the Sheridan-6 LEMA plan

1) Allowing the Risk Management Agency(RMA) to develop a unique level of crop insurance for an intermediate level of irrigation between full irrigation and dryland farming.

Insuring crops under intermediate irrigation levels is quite new, as it is a more common practice to fully irrigate wherever possible. With reduced water application, yield is expected to be lower than full-irrigation, therefore insurance coverage must adapt to stay cost-effective for all parties involved. To adapt, the Risk Management Administration of the USDA is working alongside the Office of the chief engineer in piloting a limited-irrigation insurance program case-by-case in the Sheridan-6 HPA (Barfield). Sheridan-6 and the LEMA law are helping to test limited-irrigation insurance that will be in high demand as groundwater levels continue to decline across the nation.

2) Allows junior rights to continue using water while still reducing the overall pumpage.

Invoking the Kansas Water Appropriation Act's clause of "prior appropriation" would mean restricting or revoking junior rights to meet the water needs of senior users (Barfield). This would punish only more junior users for a problem that all users created. Especially in Sheridan-6, this was not a practical solution. Many irrigators sell their corn to the feedlot, which has one of the junior rights that could be revoked if prior appropriation were to be followed (Barfield). In the face of losing their biggest customer, irrigators were motivated to find a different solution, namely the LEMA. Using a LEMA, the Sheridan-6 area was able to spread the water reduction over all users, inflicting a manageable hardship on everyone rather than debilitating pain on the junior rights (Barfield).

3) Extends the life of the aquifer.

The Sheridan-6 LEMA plan is "cutting off the least important water economically in order to have more high value water later," effectively extending the economic life of the aquifer (Barfield). This plan is buying water users in the area up to an additional 20 years of if the 20% reduction is followed indefinitely (Rogers). Since the saturated thickness is currently about 70 feet, under status quo water use the aquifer would be nearing depletion around 2060, but with a permanent 20% reduction it would be until around 2080 until it is depleted (Rogers). Because the first inches of irrigation have the most economic value, and the last inches have the least, saving water to be the first

inches in the future allows the limited amount of water available to be used most efficiently (Barfield). As cited in the Order of Designation, an economic study found that unregulated groundwater use severely reduces the future viability of the aquifer by reducing profits from $5.3 million to $4.0 million in 60 years (Barfield, page 21). A moderate reduction (in this model, 30%) results in a more delicate loss in economic activity, moving from $4.7 million to $4.3 million in 60 years. All across the Ogallala, Barfield sees ratcheting down use to extend the life of the aquifer as the best management option available today in light of the near 80% reduction necessary to reach safe yield (Barfield).

III. Weaknesses

a. Weaknesses of the LEMA law

1) It is difficult to find areas that have both the political will and are homogeneous enough to support meaningful management.

This "pilot" LEMA is only in one place of GMD 4, and is it a concern of Barfield whether there is going to be same type of leadership to cause a LEMA plan to successfully elsewhere. He states that it is "not easy to get people to ask for regulation" and that people don't often "trust each other voluntarily." He says that irrigators "know they have a problem" when they see their gallons per minute drop during the same irrigation season. Another barrier to more LEMAs is that most GMDs still have to find what areas could support a LEMA, and are homogeneous enough to support management that could have a meaningful impact on the aquifer. Barfield says that the GMDs have great diversity in saturated thickness and development, and it is very difficult to identify suitable areas and come up with consensus about what to do. Another difficulty in finding a location for a LEMA is drawing boundaries that make sense to the water and to the water users. Throughout the development of the Sheridan-6 LEMA the exact boundaries were questioned (Barfield, page 10). As Barfield states, geographical boundaries are often "lines of dispute," but groundwater modeling is helping to solidify the reasoning behind where the line is drawn (Barfield).

2) The LEMA law is new, and has some areas where legal challenge is possible.

As mentioned in the Order of Designation, all water right holders in Kansas are entitled to an impairment investigation if they feel that they are experiencing an "unreasonable raising or lowering of the static water level…or the unreasonable deterioration of the water quality at the water user's point of diversion beyond a reasonable economic limit (K.S.A. 82a-711c). Even under a LEMA plan, this provision of the Kansas Water Appropriation Act holds, and each water right holder can petition if they cannot meet their water needs "beyond a reasonable economic limit." As a "real property right," regulations must be careful not to infringe upon the right of the holder, and this is why a LEMA requires several hearings and public approval to assure that extreme harm is not done to the users affected (K.S.A. 82a-701g). The LEMA plan in Sheridan-6, and presumably all other LEMA's to be formed as well, violate the Kansas Water

Appropriation Act's doctrine of prior appropriation, in that water is not regulated by seniority, and is even regulated by use (K.S.A. 82a-707b). However, with only four stockwater rights, one recreational right, and around 130 irrigation rights (representing 97.7% of water use in SD-6), relatively few users are being regulated differently than the majority (Bossert). According to Wayne Bossert, the LEMA as a state law could still be challenged, either through an internal appeal to the DWR, or the chief engineer/GMD could be sued (Bossert).

b. Weaknesses of the Sheridan-6 LEMA plan

1) The Sheridan-6 plan does not solve the issues of groundwater decline, only extends the life of the aquifer.

One of the greatest strengths of the Sheridan-6 LEMA plan is also a weakness due to the fact that the solution the Sheridan-6 stakeholders reached is not a perfect solution. A perfect solution for groundwater management would be stabilization of the aquifer so that it could be used indefinitely. When asked about the feasibility of safe yield over the Ogallala, Barfield mentions that "we're going to get there," implying that ultimately the groundwater will in fact run out at some point and recharge will exceed use when the aquifer is completely depleted (Barfield). According to Rogers, the water in the Sheridan-6 area could still be nearing depletion around 2080 with the 20% reduction imposed (Rogers). Barfield estimated that an 80% reduction in use would be necessary to stabilize the Ogallala, which is infeasible (Barfield). Bossert optimistically says that stabilization of the aquifer could be a future goal of the Sheridan-6, or any, LEMA (Bossert).

2) The Sheridan-6 plan is only temporary, and is not assured to continue after the five year period.

The Sheridan-6 LEMA is a "pilot" LEMA and was always intended as a "five-year experiment" (Barfield). He does believe the LEMA plan will continue into the future though with more hearings. At 3.5 years, a comprehensive evaluation of the plan will be conducted, after which, the Sheridan-6 stakeholders will decide whether the plan should be allowed to lapse, whether another plan should be created, or whether the current plan should be extended into the future (Bossert). In his opinion, continuing the LEMA indefinitely does have the potential to extend the life of the aquifer by at least 20%. However, little would be accomplished if the LEMA is not continued after the five year term. Bossert is somewhat concerned that the 20% reduction for only five years will be worthless if old practices are adopted after the plan's expiration, but believes that the odds are in favor of residents being more comfortable with the restriction after three years, and that they will continue the plan in some form into the future. In the Sheridan-6 LEMA plan, Barfield would have preferred to see a long term LEMA plan with adjustment at five years rather than an automatic expiration.

IV. Future Legal/Management Considerations

1) The LEMA process is spreading to different areas.

GMD 1 is exploring the LEMA, but interest and recognition of the problem is not yet translating to "this amount of pumping in this area (Barfield)." Barfield says that the entire district is exploring a LEMA, but there are large differences in saturated thickness, and he is urging them to break it down in pieces of higher water use and lower saturated thickness. The district does have some HPA's related to municipal water supplies, but they operate with incentive based management to reduce water use, not as regulation (Barfield). Another district Barfield highlights is GMD 3, which represents half of the water use in the state. This District is approaching major problems with low groundwater levels, but Barfield has yet to see significant leadership steps toward consensus (Barfield).

2) The future outlook is positive.

According to Wayne Bossert, producers in the Sheridan-6 LEMA area are in a "good mood" for the five year term of the reduction, partially due to efficiency returns and new management strategies. A 20% reduction should result in a seeable lessening of decline, but the variability in recharge (and precipitation) could distort the change in groundwater level (Bossert). Wayne Bossert also says he will not be surprised if a change in the water level decline rate is not seeable after the five year term due to these confounding factors. Bossert asserts that addressing the groundwater decline is necessary to retain land value in the area, and will be especially important if the value of water goes up in the coming years. He has no worries about changes in cropping patterns however, as growers in the area are smart and can make a new situation work. Statewide, Barfield sees many factors that could force the use of LEMAs, IGUCAs, or other more restrictive regulations. Many areas in the state are seeing extreme declines in groundwater levels, which will force the chief engineer to act when all water users' needs can no longer be met (Barfield). According to Barfield, the new focus for Kansas groundwater management must be "the long term value rather than the annual value" of the water resource (Barfield).

3. Sheridan-6 Local Enhanced Management Area and the Economy

It is obvious that the goal of the Sheridan-6 LEMA plan is to manage water more sustainably so as not to squander this vital resource and ultimately ruin it for future generations. Economically speaking, it can be difficult to encourage responsible practices because less responsible practices tend to produce more immediate and sometimes larger payoffs. Local economies must change entirely to encourage responsible practices. While that change is happening, it is unavoidable that some producers will have to face losses in the short term with the hope that it will pay off in the long term. This fact was affirmed by many of our interviewees, although some also felt that the losses would actually be minimal or even nonexistent.

Danny Rogers states that the farmers would absolutely be losing some money at the start (or at least that is how it will appear). Over the course of a few years their incomes would not be negatively affected (Rogers). There will be more water maintained in the aquifer and plenty of income is as well. This is extremely important because this represents the livelihood of almost all residents of the area. Everyone needs to make money in order to have food on the table and a roof over their heads. If a plan does not make sense economically (that is, if there is no financial incentive), then the plan will fail in modern society. People have to feel secure, and money ensures security. Economist Bill Golden expressed that the key to avoiding financial strain for many growers will be to switch from growing corn to sorghum (also referred to as "milo"), which requires less water overall. At the same time though, with the corn industry being so dominant, there is a great deal of funding going toward improvement of corn production, which could possibly result in the reduction of water needs for the crop (Golden).

Another interviewee, Mitchell Baalman, a fourth-generation farmer from Sheridan County and also a GMD4 board member, is optimistic about the overall economic effects of the LEMA. This is because of the fact that water is valuable, *extremely* valuable, monetarily. Water brings more tax dollars into the state and local economy. "(In) irrigated ground we use more fertilizer, seed, energy to power the pumps. In turn, more money is spent locally. Not saying dry land is the same. Just not as much money is spent," (Baalman). Although he does also admit that through the past ten years more net income was probably made in dry-land crops compared to irrigated ground. So, whether it be presently or in the recent past, water has been and remains to be very important (Baalman). Dry land farming is profitable too, but it simply is not feasible for the whole area to be dry land farming so the water will always be necessary (Baalman). On the other hand, Bill Golden states that although absolute value of water may be increasing, the relative value of water is declining. So, people can come to different conclusions depending on how they look at this picture.

Most of the officials involved with the LEMA also have surprisingly positive feelings about the feedlots in this area. Mitchell Baalman said that his group of farmers chose to impact the feedlots as little as possible. "They buy most of the crops in our area, and also employ forty members [of] our community. This puts kids in the schools, wives or husbands to work other jobs in the communities," says Mitchell. The feedlots appear to play a very important role in the economy of the area(Baalman).

He is not the only one though. David Barfield, chief engineer of the DWR, stated that the immediate economic benefits of protecting the junior water right of the Hoxie Feeders feedlot also provoked the use of the LEMA. This is because when following the Kansas Water Appropriations Act in a water shortage, the chief engineer must cut the junior right to provide water for the senior rights, which in Sheridan-6 are irrigators (Barfield, 2013). If groundwater became scarce in the area, the feedlot would have its water right suspended and many irrigators would no longer be able sell their corn to the feedlot, possibly collapsing much of the economy in the Sheridan-6 area. So, contrary to what

some may believe, the feedlot is a good thing, at least as where the economy of Sheridan County is concerned (Barfield).

As is to be expected with any issue where money is involved, fraud becomes a concern. There are people in this world who are dishonest, and farmers are not immune. There could be cases where a farmer could take advantage of their insurance by letting one crop fail by neglecting it while using all of their water, fertilizer, herbicides, etc. on another crop (Barfield). This way they can collect insurance on the crop they neglected and also bring in the most money possible on the other crop. Fortunately, monitoring is both relatively strict and reliable so this does not seem to be an issue of high concern among officials. They are aware of these possibilities but for the most part remain positive, hopeful, and trusting (Bossert).

One issue of considerable concern is the impact of drought on the LEMA. Here in Kansas, we have been experiencing water shortages. If this continues, farmers will be more frugal where water is concerned, and the 20% reduction in water withdrawals in the LEMA plan of Sheridan-6 may just seem like too much (Golden). Therefore, drought would have a significant negative effect on the LEMA. Another small concern with respect to the success of the LEMA is the adoption of new technology and change amongst farmers of the area (Golden). We, as people tend to think that we are very efficient at what we do. We are guilty of not always being as open to the idea of improvement as we perhaps should be. We might not be as economically efficient as we think we are (Golden). Basically, many farmers will tend to be more inclined to continue business as usual, rather than actively seeking betterment. Despite these issues it is better to try than not to try (Golden).

Jeff Peterson, agricultural economics professor at Kansas State University says that the LEMA in Sheridan-6 may offer many unique economic advantages to producers. The flexibility for farmers to adjust how much water they use in one year to meet the five-year total of 55 inches presents these producers with the opportunity to rotate crops based on how much water they want to apply in a given year (Peterson). This gives irrigators the opportunity to rotate from water-intensive crops, such as corn, to crops that have lower water requirements, such as milo or beans. This can help increase the economic benefit per unit of water (Peterson).

Peterson says that the way the LEMA is set up is possibly imitating the way Nebraska water rights are allocated just to the north of the Sheridan-6 HPA. In Nebraska, water rights are set up on a five year limit, as is similar to Sheridan-6 LEMA where producers must average 11 acre-inches annually for the five year period (Peterson).
According to an article by Jim Suber in the Topeka Capitol Journal, zero depletion of the aquifer could be more harmful than helpful economically. Because of the limitations on water use placed by the Sheridan-6 LEMA plan, producers might not to be able generate the yields that were once profitable for them and were able to sustain the beef industry (Suber). Those who are like Suber, believe that genetic improvements in crops will be the ultimate solution for the overconsumption of water in the aquifer. This would negate any efforts, such as the LEMA, from being effective (Suber).

Overall, it seems as though the LEMA is forecasted to be a success in the financial sense. The more appropriately the water is being managed, the more water will stay in the aquifer for longer. This means that the potential for money to be made from irrigating to raise and harvest profitable crops for the market remains present. Without water, namely the Ogallala Aquifer, the economy in the area would have to change entirely. Farming would still be possible, but with crops that demand less water and will be most likely less profitable. It has been found that the same amount of corn can be produced with less water and the same is probably true of other crops as well. The farmer just has to manage it a little differently by making a few adjustments. As Mitchell Baalman says, "Nobody thinks they want to pump all the water out. Just enough to make a living and get the crop to make it to harvest, and raise the best crop while making money on the least amount of water pumped." In the end, we are all just trying to make a living.

4. Measurement and Environmental Effects of Groundwater Depletion

The reason water is the lifeblood of the Sheridan-6 economy is because water is the lifeblood of the plants on which the economy is based. Perhaps Wayne Bossert, who helped to identify high priority groundwater management areas like the Sheridan-6, puts it best when he says, "Out here, the water is the economy." In this region, the major industries all rely on the availability of water within the local environment. Though potable water availability may not be at risk, according to Advisory Board member Stuart Beckman, the economy cannot function without sufficient groundwater supplies. (Beckman)

Unfortunately, the water supply in this region is simply insufficient. David Barfield, Chief Engineer of the Division of Water Resources within the Kansas Department of Agriculture, suggests that safe yield practices would require an 80% reduction in water usage, which is not feasible if anything comparable to today's output is to be maintained (Barfield). As groundwater is mined, the economy in the region declines.

With this in mind, the Sheridan-6 LEMA was implemented on January 1, 2013. This self-imposed limitation of water rights to 11 acre-inches per user is designed to prolong the life of the aquifer. Previously, consumption of up to 14 acre-inches had been permitted. This is certainly a controversial decision; some feel limited, whereas others, Beckman included, wish the cuts were more drastic and had started a decade earlier. Nevertheless, if water preservation is the goal, the LEMA is a step in the right direction. Local producers are more favorable to localized regulations of their own doing than they are to statewide governmental regulations such as an Intensive Groundwater Usage Control Area (IGUCA).

Moreover, improved irrigation techniques and crop varieties have helped to decrease water consumption, according to Beckman. For instance, farmers may transition to breeds that are more drought resistant or that grow more quickly. These could help to

offset the 3 acre-inch reduction imposed by the LEMA. Beckman estimates that the LEMA will extend the area's ability to irrigate by twenty-five to thirty years; providing economic security for an entire generation that otherwise would have been left high and dry.

Perhaps the greatest impact from the LEMA could come from the inspiration provided by the producers in Sheridan-6. If producers in other water-mining regions are compelled to implement similar policies, the LEMA experiment in Sheridan-6 could lead the way in conserving groundwater throughout the entire region for a longer time period. "That's what we would hope to see happen," commented Beckman when asked about the Sheridan-6 LEMA's influence on other regions. Beckman has already heard of meetings being held nearby, in other HPA's of GMD 4. GMD 1 has also considered a district-wide implementation of LEMA policies (Barfield).

Arguably, the most important step in accurately assessing the effects of the LEMA in Sheridan County is actually determining the amount of recharge within the management area. Sophocleous (2005) notes several methods where this type of monitoring may be performed, such as tensiometers or heat dissipation sensors. According to Beckman, maintenance of the water usage meters in Sheridan-6 are the responsibilities of the producers on whose land they sit. If meters are shown not to be working, full usage will be assumed and charged to the producer.Observation wells monitor the overall groundwater level in the area as well.

Other monitoring options exist. According to Sophocleous' study, in an average year, only an equivalent of 10 millimeters of water naturally infiltrates into the Ogallala Aquifer; an amount that is insufficient given current groundwater usage rates. One option available for monitoring the overall aquifer health is the Gravity Recovery and Climate Experiment (GRACE), as noted by Strassberg, et. al. (2009). With a temporal resolution of roughly one month, GRACE utilizes two satellites, one training behind the other, to measure the earth's gravity field. As one satellite reaches an area of the orbital path where earth's gravitational field changes, its orbital velocity changes, causing the distance between the two satellites to change, as well. This difference can be used to map changes in the earth's gravitational field, as one would expect from aquifer depletion. Strassberg, et. al. utilized this technique for their analysis of the High Plains Aquifer with some success. McGuire (2007) found that, on average, the entirety of the Ogallala Aquifer has dropped 14 feet since pre-development (beginning in roughly 1950). GRACE's spatial resolution is not particularly detailed (Becker 2005), but subsequent gravity mapping satellites should improve upon this unfortunate shortcoming.

Becker (2005) also notes several other methods that may be used to detect the presence of groundwater or groundwater availability changes. For instance, interferometric synthetic aperature radar (InSAR) can be used to detect the minute changes in elevation caused by the infiltration of water into loose soils or the removal of water from these soils via excessive groundwater depletion. Large-scale remote sensing mechanisms like GRACE and InSAR may be used to monitor the level of the

Ogallala Aquifer as a whole.

As Beckman puts it, the LEMA in Sheridan-6 will work, but its impact will not be as beneficial as some would hope. These predictions, of course, will need to be checked with actual water levels in the next few years, especially at the 3.5 year evaluation. (Bossert) If beneficial results are measured, it will likely encourage local producers to continue, or perhaps even enhance, the LEMA regulations into the future.

5. Conclusion

Overall depletion of the Aquifer will continue to decrease. By enacting High Priority Areas like the Sheridan-6, the users are recognizing that there is a problem, and the only solution is to slow down the amount of water used for crop irrigation in order to sustain their lively hood for future generations. We find that the LEMA is a great idea and applaud the users of Sheridan County for stepping forward and taking the initiative to work with each other in order to come to an agreement on how to better use the resource that will soon be gone.

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7. Appendix

A. Northwest Kansas Groundwater Management District 4

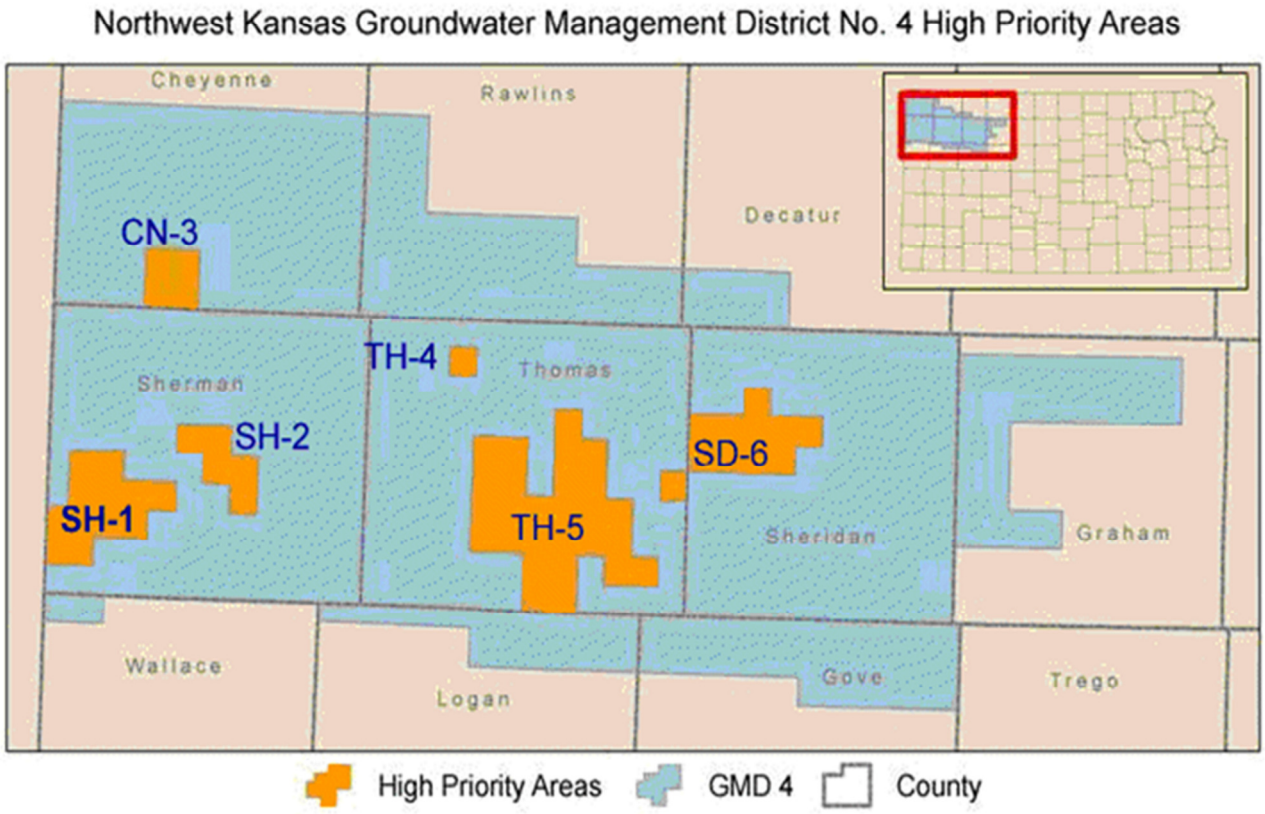

Figure 1. This map is of the Northwest Kansas Groundwater Management District 4 with the High Priority Areas defined.

B. Sheridan County 6 High Priority Area

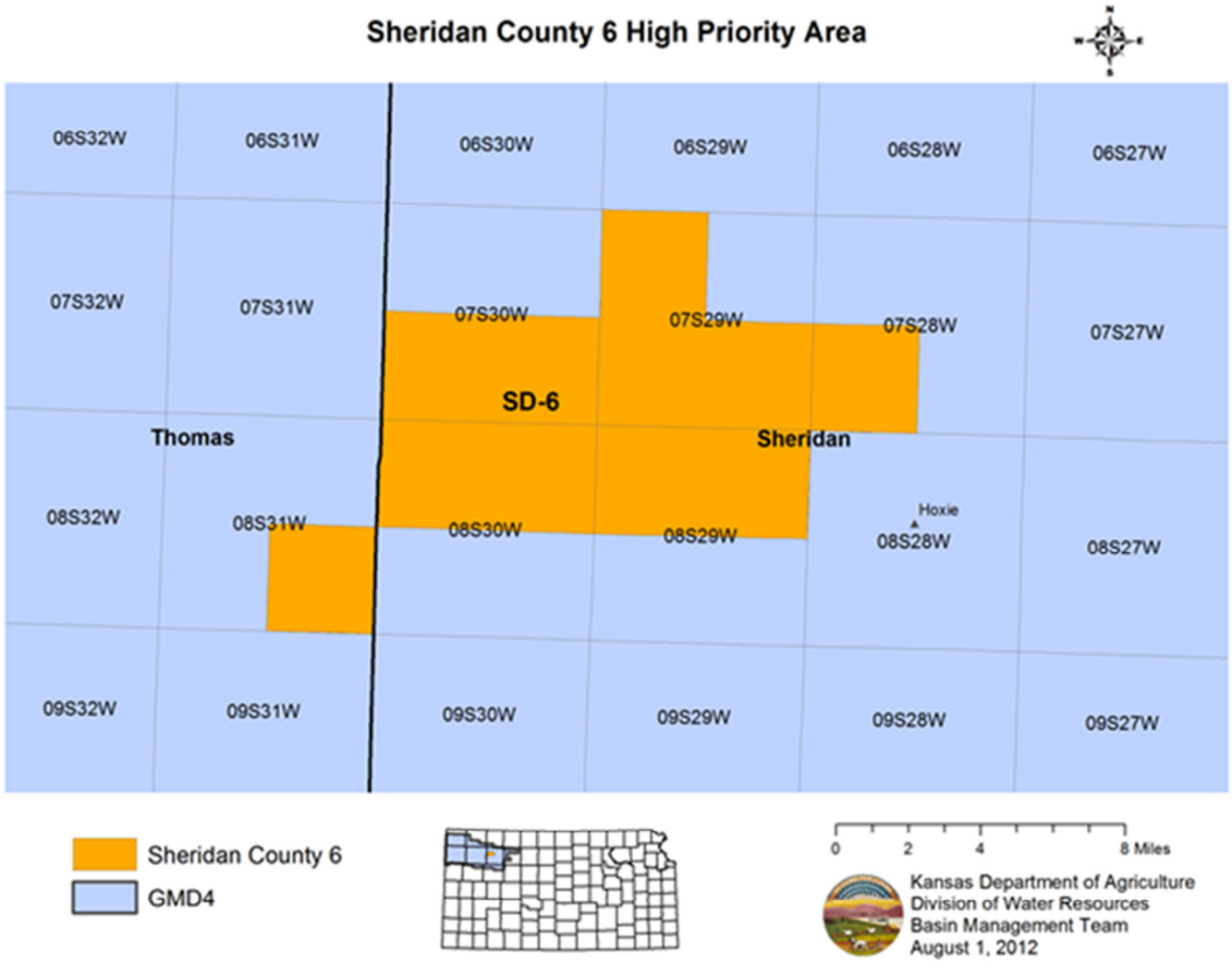

Figure 2. An up close map showing what townships are in our focus area. The High Priority area covers a total of 99 square miles, mainly in Sheridan County.

C. Sheridan County Observation Wells

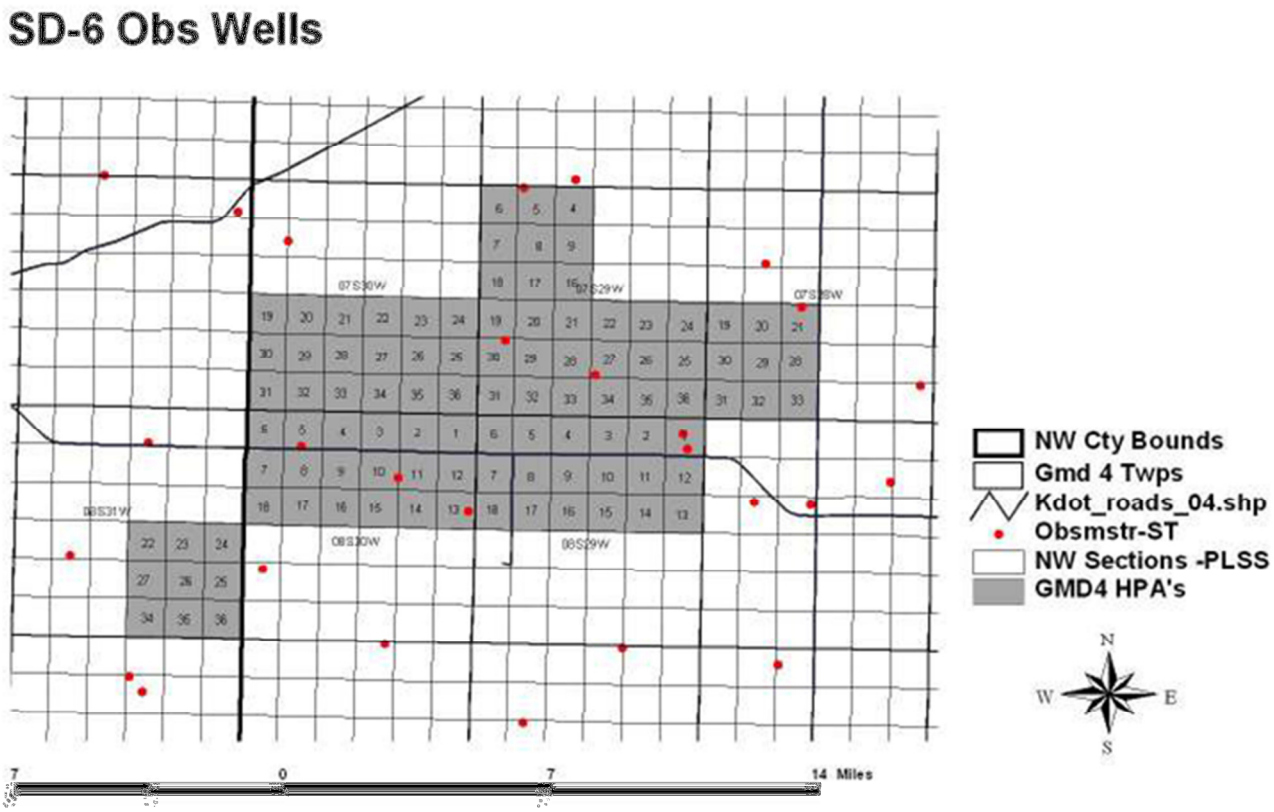

Figure 3. This chart shows the SD-6 area, with the 99 sections highlighted in gray. This totals 63,360 acres with 9 observation wells shown with a red dot.

D. Sheridan County Wells

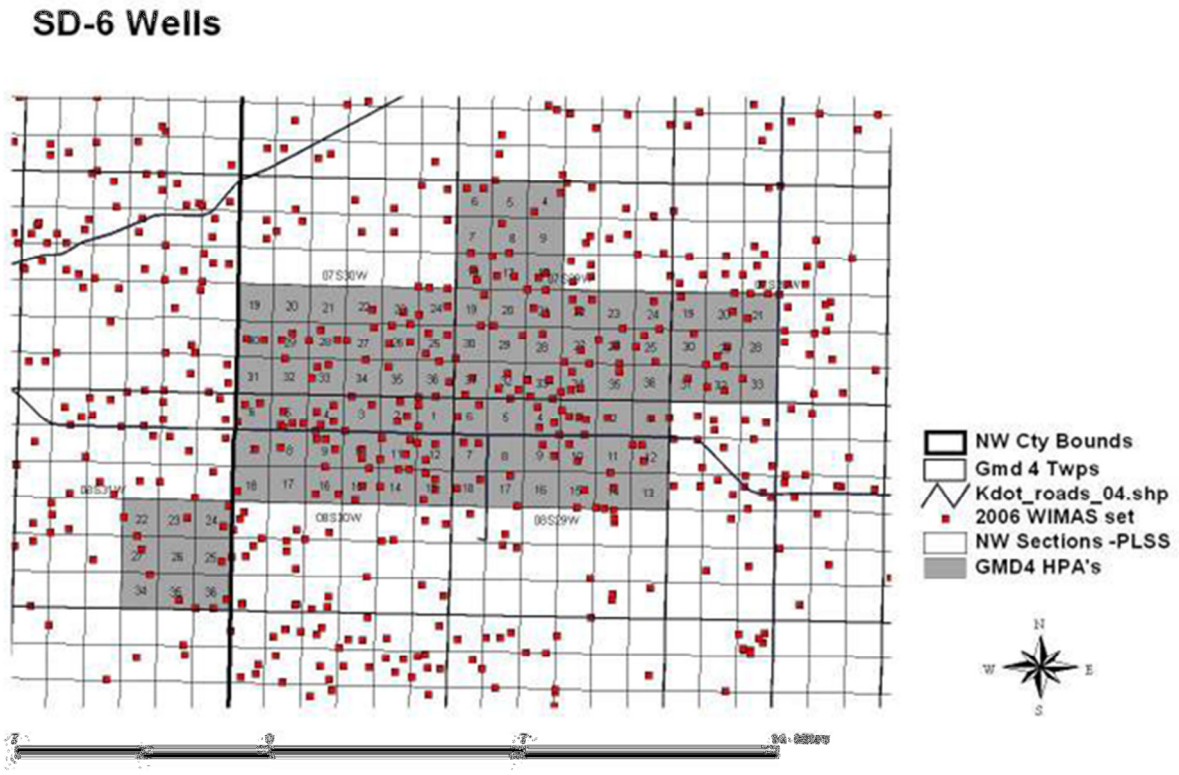

Figure 4. The SD-6 area is shown here with the 99 sections highlighted in gray. These totals 63,360 with the 9 observation wells shown by a red dot tan the other 195 permitted wills also shown by a red dot.

E. Ogalala Aquifer

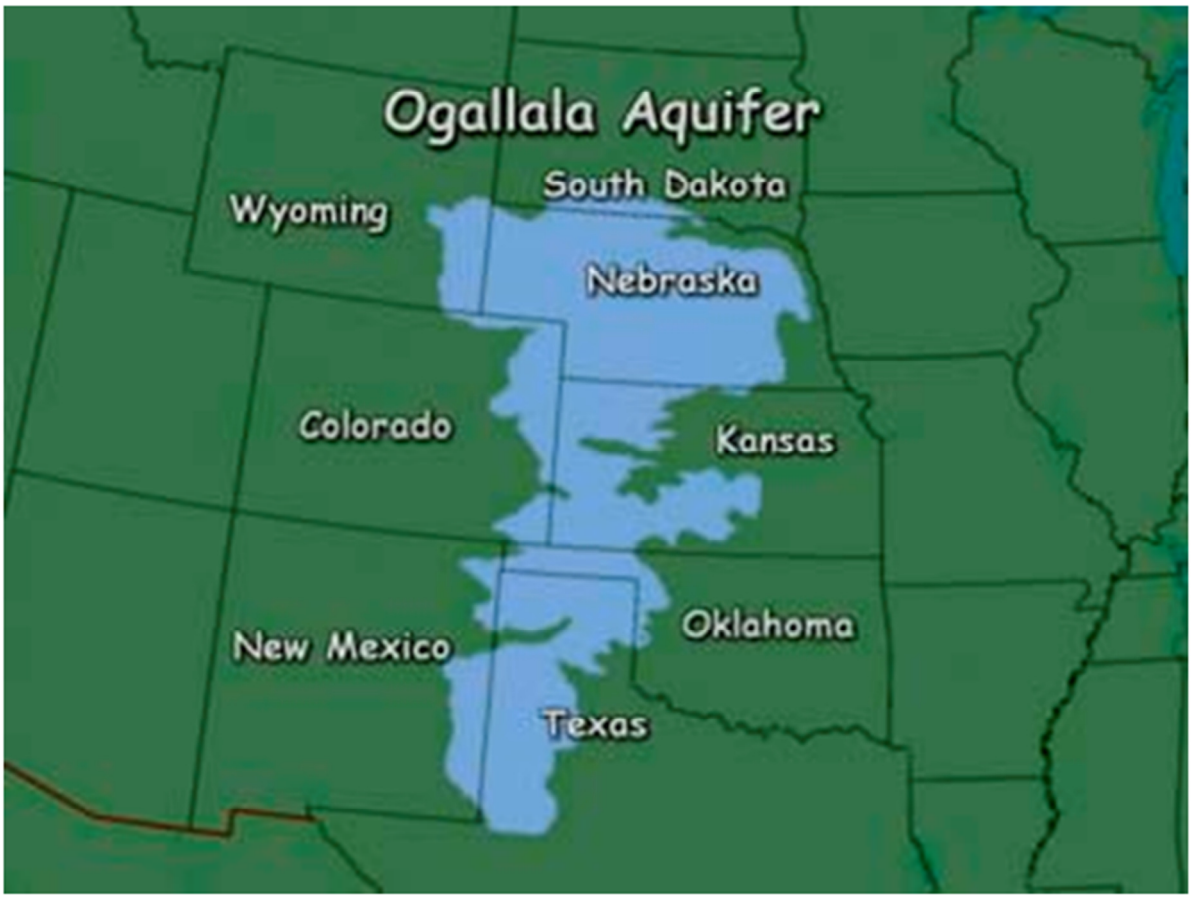

Figure 5. The blue marks where the Ogallala Aquifer covers parts of these eight states. All of these states have some sort of management for the groundwater.

F. Saturated Thickness

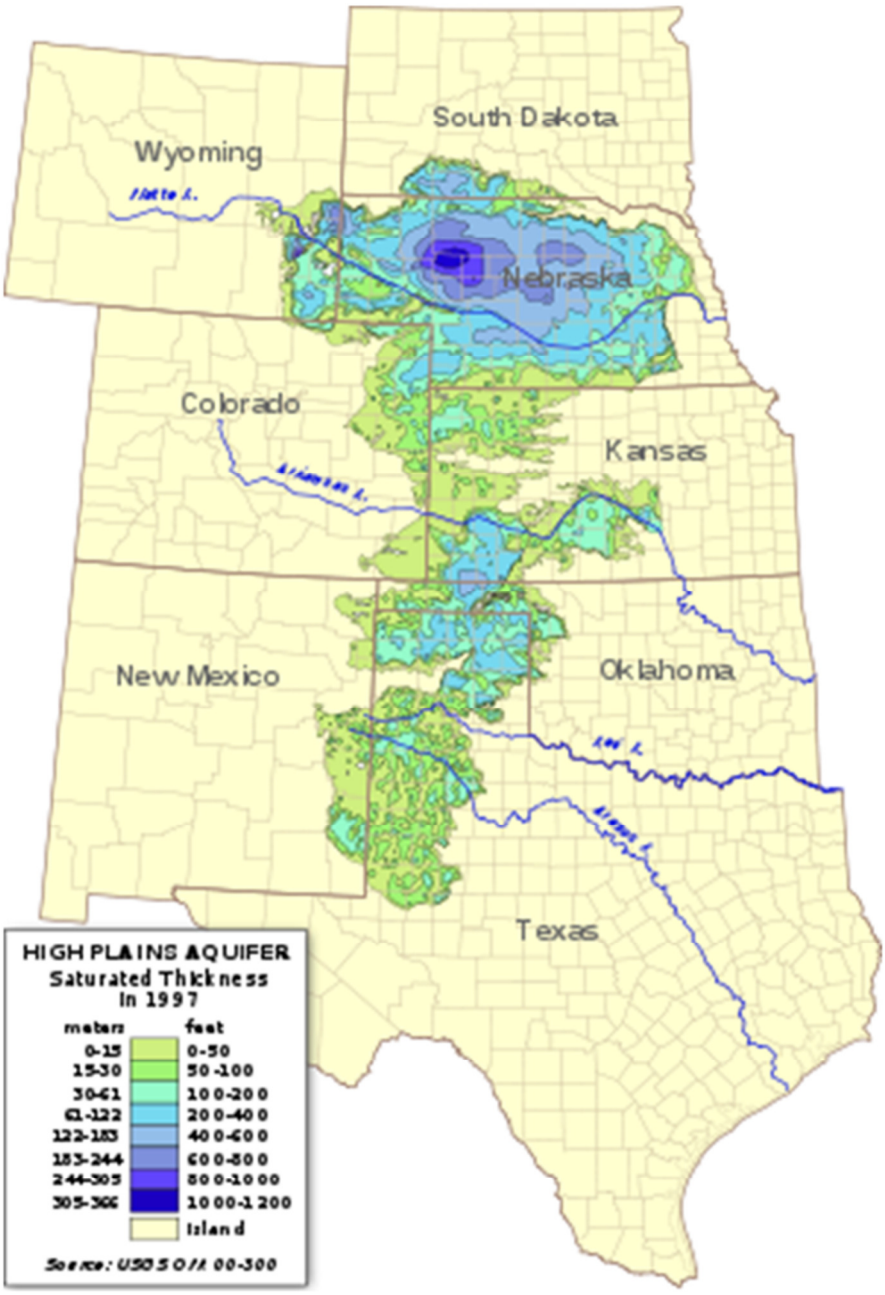

Figure 6. This map shows a current level of saturation thickness across the whole Aquifer.

G. Estimated Decrease in Saturated Thickness

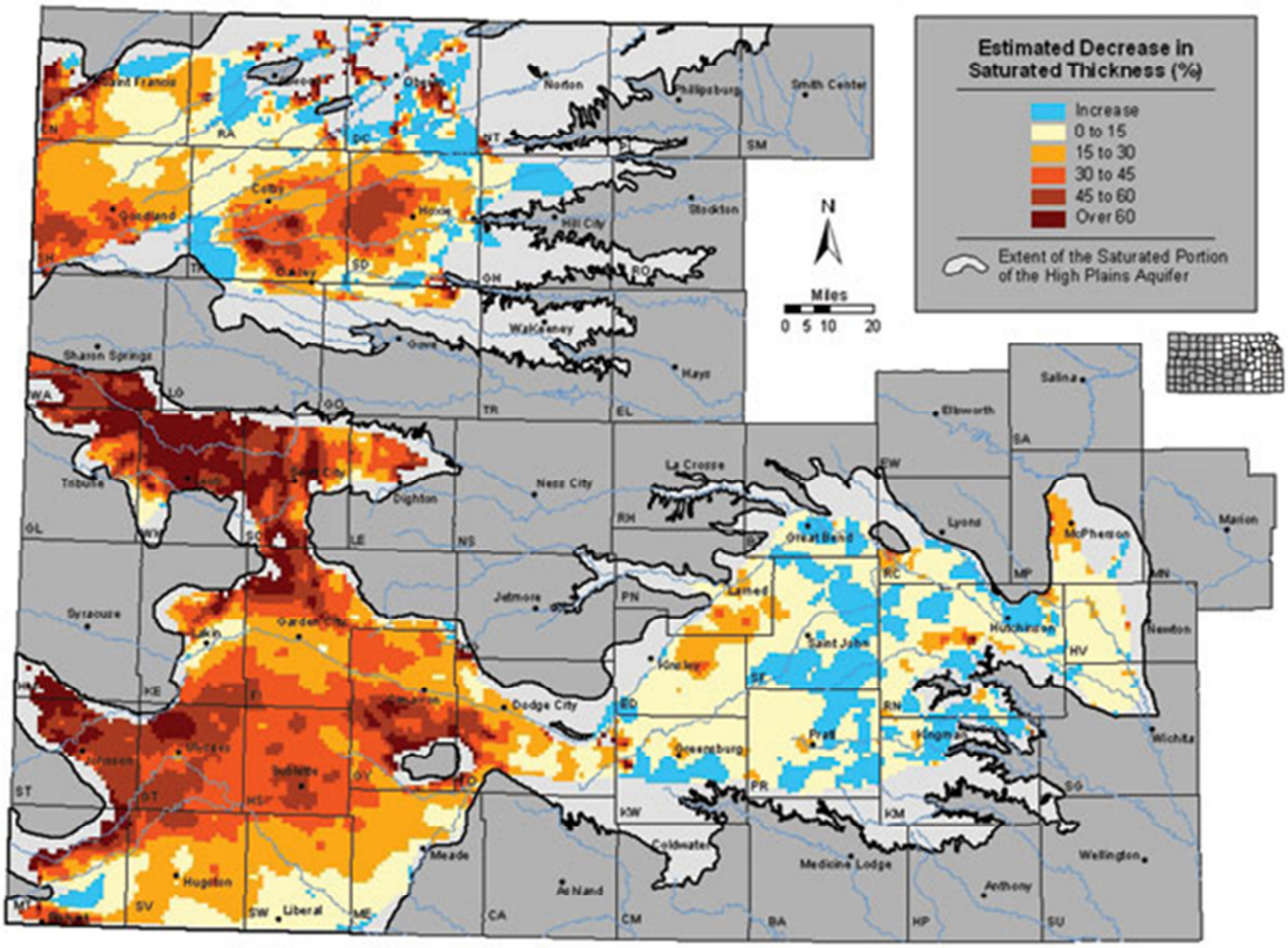

Figure 7. This is a map of the estimated decrease in saturated thickness for the current levels of water use. Our focus area is one of the major decreases, a reason for the LEMA.

H. Percent Decrease in Saturated Thickness

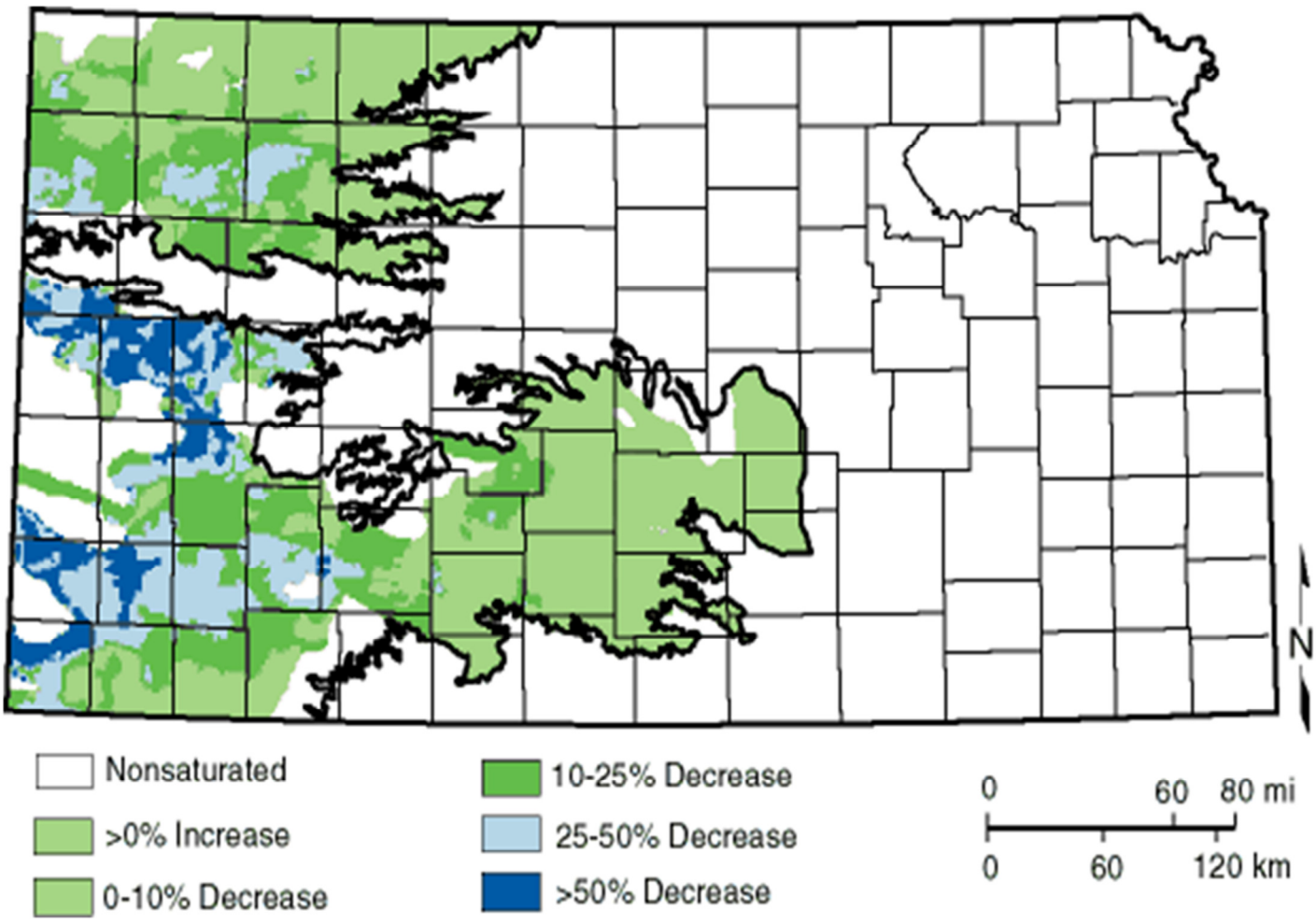

Figure 8. This shows the percent decrease in saturated thickness across the state in the Ogallala Aquifer. Our focus areas of Sheridan 6 HPA show a 25-50% decrease.

I. Groundwater Management Areas

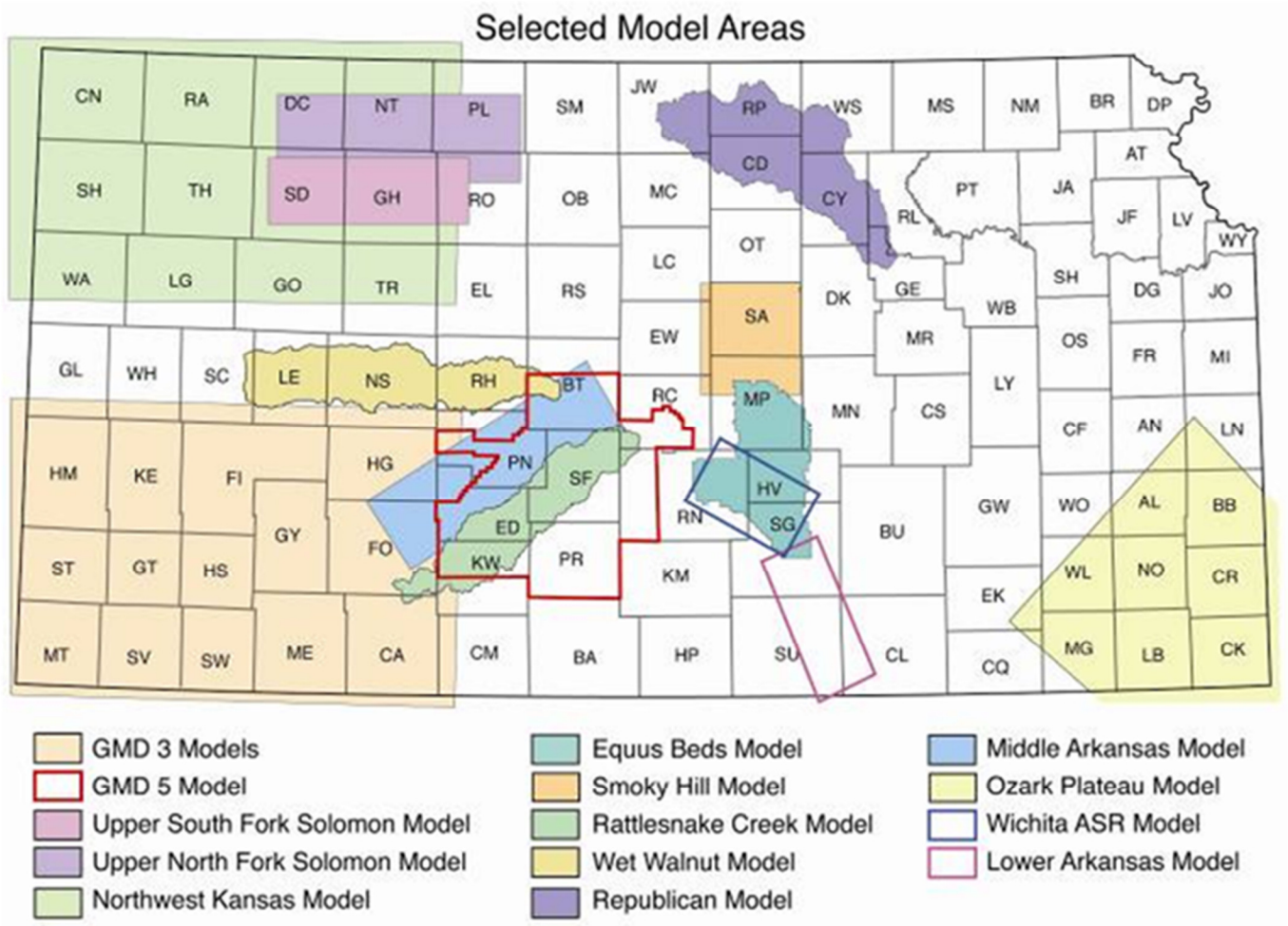

Figure 9. This map shows the Groundwater Management Districts and the potential area for High Priority Areas and IGUCA's.

J. 2011 Drought Monitor

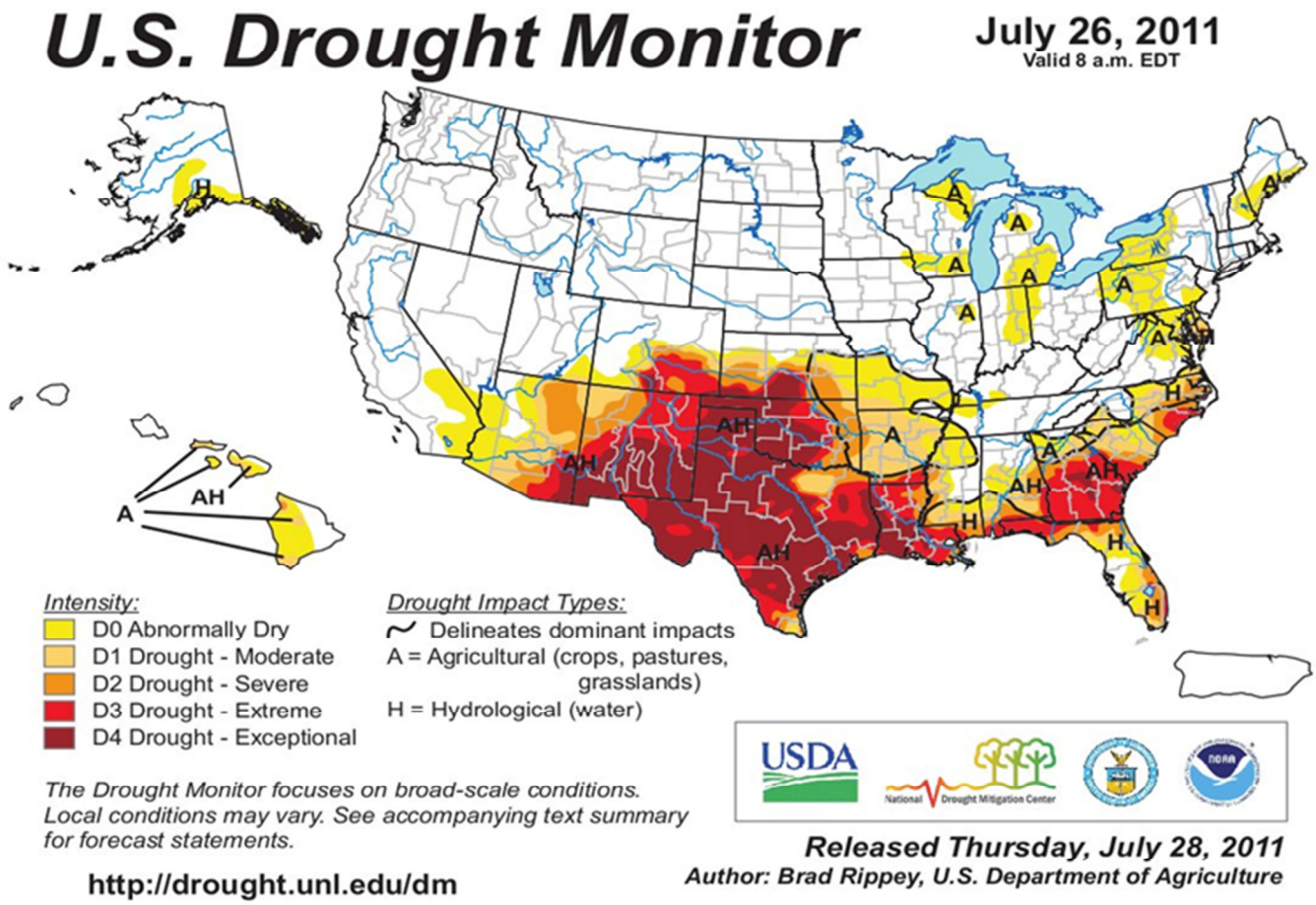

Figure 10. According to the USDA, this map shows where heavy drought occurred in 2011. Our priority area had a severe drought during this year.

K. 2012 Drought Monitor

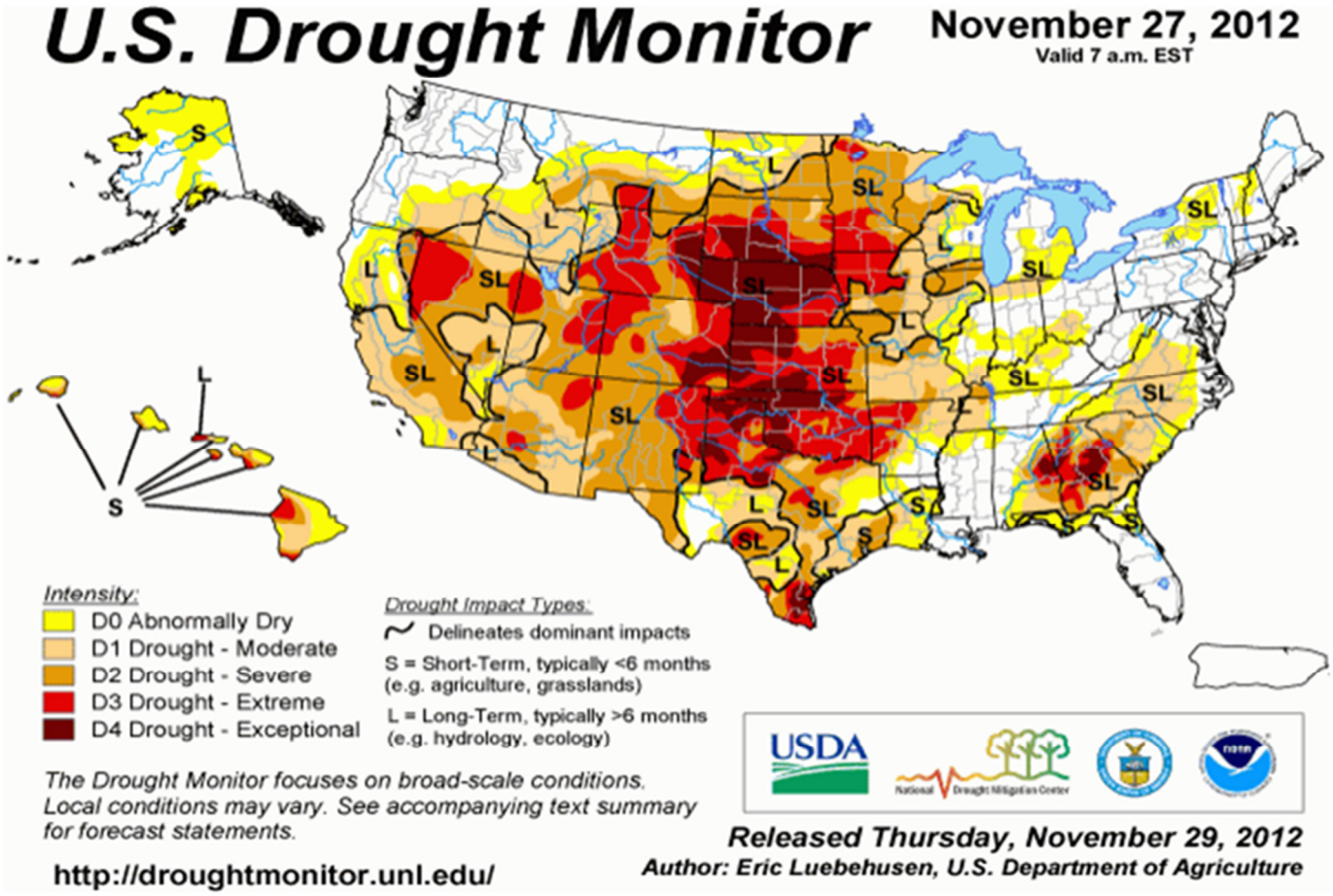

Figure 11. There was an increase in drought in 2012 as shown in the map from the USDA. Our priority area had an exceptional drought for the year of 2012.

L. Drought Outlook for 2013

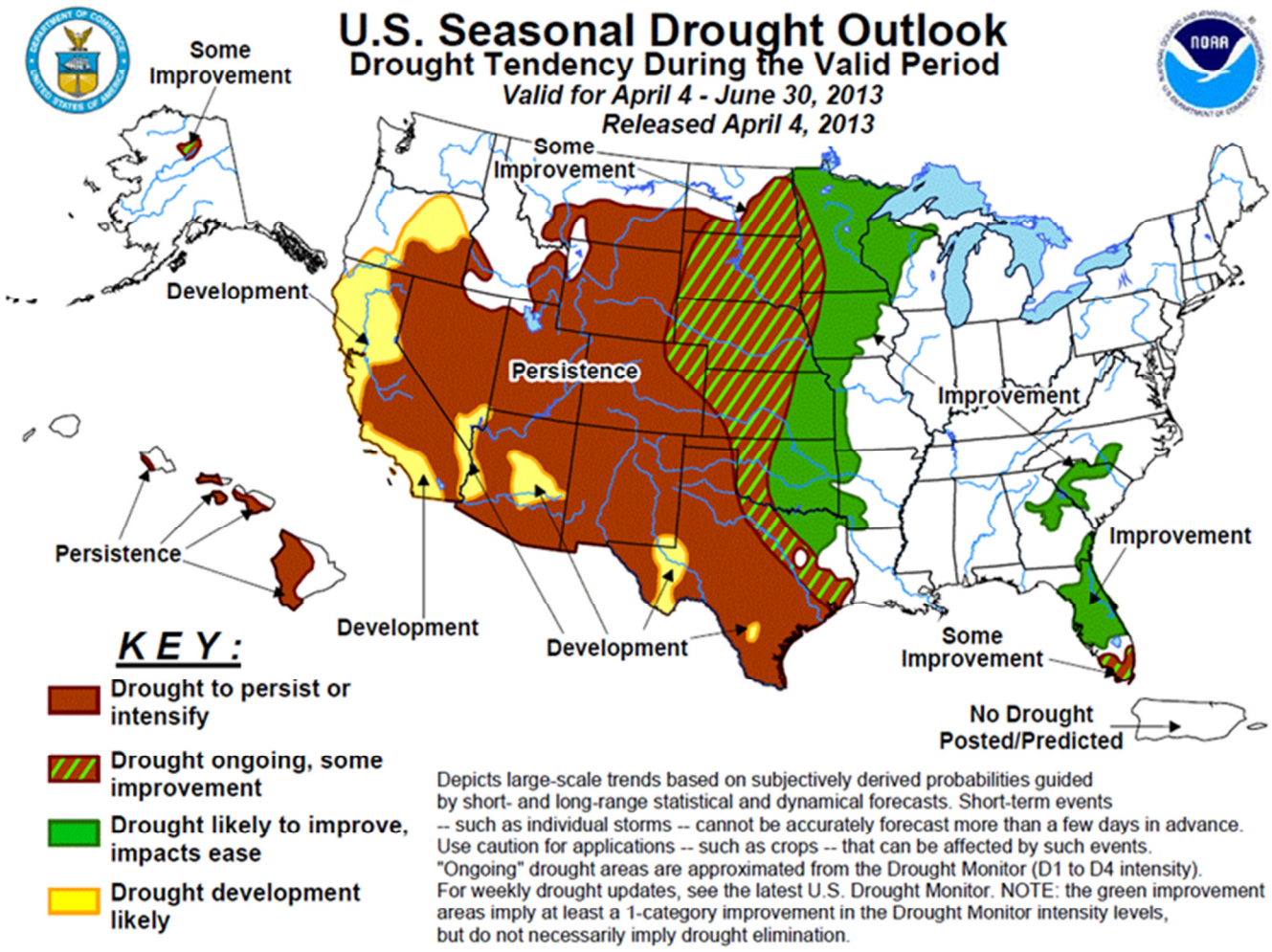

Figure 12. Just released from the USDA, this map shows where drought is predicted to either improve or continue to worsen. Our priority area is shown to improve slightly.

M. Water Well Pump

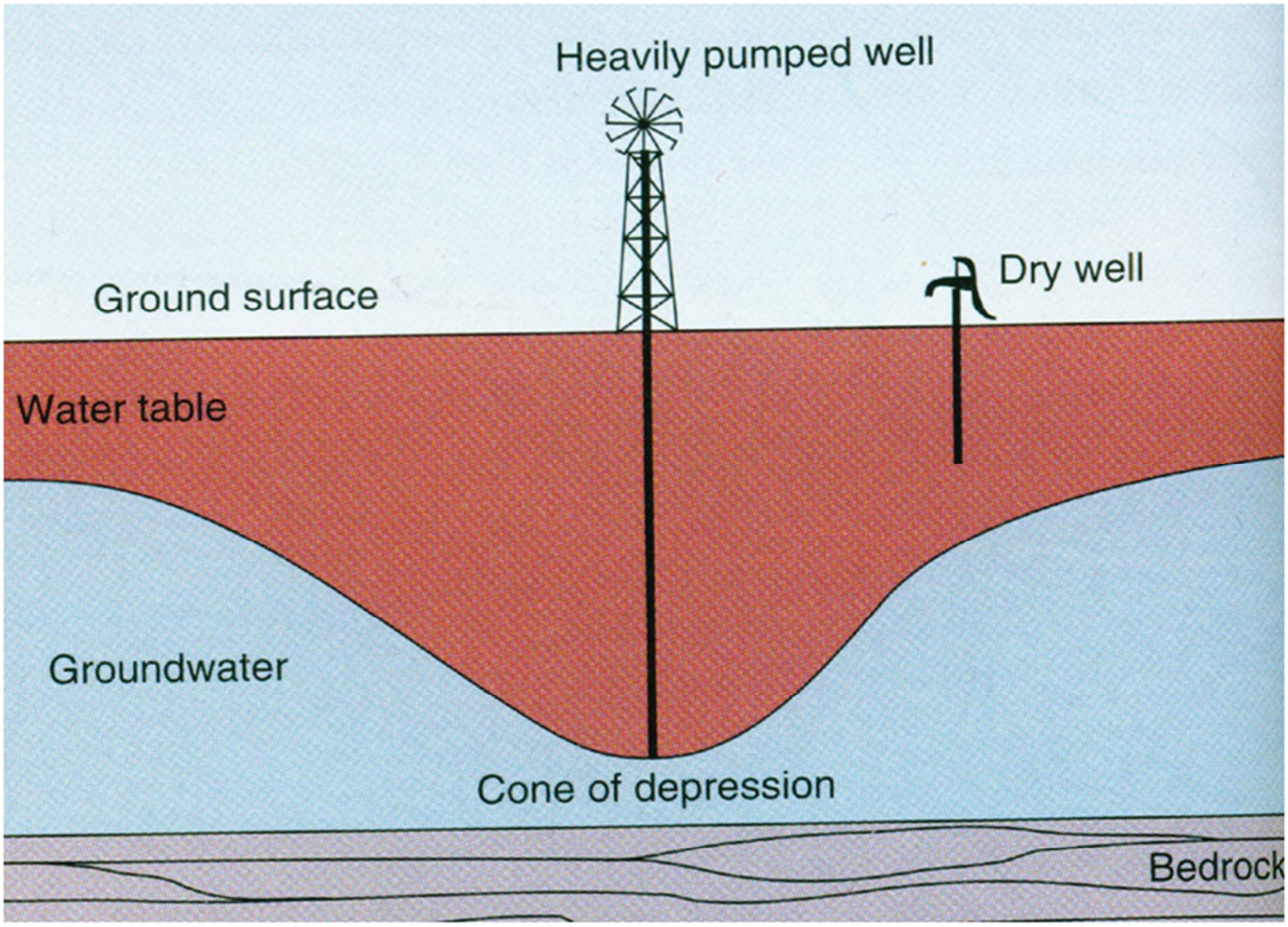

Figure 13. Here is a diagram of how the pumps in our focus area have been depleted and new deeper wells are needed to be drilled in order to reach the water.

8. Vocabulary

Vocabulary and Definitions provided from the Groundwater Management District Act, K.S.A. 82a-1020 through 82a-1041. This list of vocabulary is important to know in order to understand what is happening with the Local Enhanced Management Area in Sheridan County.

Aquifer- any geological formation capable of yielding water in sufficient quantities that it can be extracted for beneficial purposes.

Board- the board of directors constituting the governing body of a groundwater management district.

Chief Engineer- the chief engineer of the division of water resources of the Kansas Department of Agriculture

District- a contiguous area which overlies one or more aquifers, together with any area in between, which is organized for groundwater management purposes under this act and acts amendatory thereof or supplemental thereto.

DWR- Division of Water Resources

Eligible Voter- a natural person 18 years of age or older, or a public or private corporation, municipality or any other legal or commercial entity that: is a landowner that owns, of record, any land, or any interest in land, comprising 40 or more contiguous acres located within the boundaries of the district and not within the corporate limits of any municipality; or withdraws or uses groundwater from within the boundaries of the district in an amount of one acre-foot or more per year.

GMD- Groundwater Management District

Land- real property as that term is defined by the laws of the state of Kansas

Landowner- the person who is the record owner of any real estate within the boundaries of the district or who has an interest therein as contract purchaser of 40 or more contiguous acres in the district not within the corporate limits of any municipality. Owners of oil lease, gas lease, mineral rights, easements, or mortgages shall not be considered landowners by reason of such ownership.

LEMA- Local Enhanced Management Area

Management Program- a written report describing the characteristics of the district and the nature and methods of dealing with groundwater supply problems within the district. It shall include information as to the groundwater management program to the undertaken by the district and such maps, geological information and other data as may be necessary for the formulation of such a program.

Person- any natural person, public or Private Corporation, municipality or any other legal or commercial entity.

Water Right- the meaning ascribed to that term in K.S.A. 82a-701 and amendments thereto

Water User- any person who is withdrawing or using groundwater from within the boundaries of the district in an amount not less than one acre-foot per year. If a municipality is a water user within the district, it shall represent all persons within its corporate limits who are not water users as defined above.