

**BEFORE THE STATE CORPORATION COMMISSION
OF THE STATE OF KANSAS**

In the matter of the application of Shakespeare Oil) Docket No. 25-CONS-3411-CUIC
Company, Inc. for a permit to authorize injection)
into the Whitehorse and Cedar Hills formations at) CONSERVATION DIVISION
the Wells #2-27 well in Section 27, Township 16)
South, Range 35 West, Wichita County, Kansas.) License No. 7311

PRE-FILED TESTIMONY OF

KENNY SULLIVAN

ON BEHALF OF COMMISSION STAFF

OCTOBER 24, 2025

1 **Q. What is your name and business address?**

2 A. Kenny Sullivan, 210 E. Frontview, Suite A, Dodge City, Kansas, 67801.

3 **Q. By whom are you employed and in what capacity?**

4 A. I am employed by the Conservation Division of the Kansas Corporation Commission
5 (Commission), District #1 Office, as the District #1 Professional Geologist Supervisor.

6 **Q. Would you please briefly describe your background and work experience?**

7 A. I received my Bachelor's degree in Geology from Fort Hays State University in 2011.
8 Additionally, I received a professional geology license from the State of Kansas in 2021. I
9 have worked at the Commission for over 14 years. I was an Environmental Compliance and
10 Regulatory Specialist (ECRS) for three years, a Geology Specialist for six years, and
11 Supervisor since January 2021.

12 **Q. What duties does your position with the Conservation Division entail?**

13 A. I oversee the daily operations of the District #1 Office as they relate to oil and gas activities.
14 I currently supervise one Professional Geologist, nine ECRSs, and one Administrative
15 Specialist.

16 **Q. Have you previously testified before this Commission?**

17 A. Yes.

18 **Q. What is the purpose of your testimony in this matter?**

19 A. The purpose of my testimony is to discuss the application for injection filed by Shakespeare
20 Oil Company, Inc. (Operator) for the Wells #2-27 well (Subject Well), API #15-203-20394.
21 My testimony will also address certain statements made in the testimony submitted by Mr.
22 Don Williams, Mr. Andrew Eck, and Mr. Jeff Scarbrough on behalf of Operator. My

1 testimony supports Mr. Todd Bryant's testimony and recommendation that Operator's
2 injection application should be denied.

3 **Q. What is Operator requesting in this docket?**

4 A. Operator has applied for authorization to inject into the Subject Well in what is alleged to be
5 the Whitehorse and the Cedar Hills formations at a maximum rate of 500 barrels of water
6 per day and maximum surface pressure of 0 pounds per square inch. However, Operator's
7 testimony conflicts with its application by alleging that the Subject Well is perforated in the
8 Day Creek formation, Whitehorse formation, and the Cedar Hills formation.

9 **Q. Why should Operator's application be denied?**

10 A. Operator's application should be denied because the Subject Well is a present threat to
11 usable water. Based on the information available and evidence collected by Staff, I believe
12 that the formations Operator proposes to inject into are largely inaccurate, that the Subject
13 Well is perforated and would inject into formations above the minimum depth established
14 by Table II, and that the application for the Subject Well as it currently stands should be
15 denied for the reasons described in more detail below. The uppermost perforations in the
16 Subject Well appear to be in the Jurassic System Morrison Formation and are clearly above
17 the minimum injection depth allowed by Table II. Mr. Bryant discusses the requirements of
18 Table II in greater detail in his testimony. Since the Subject Well is perforated above the
19 Permian formation it is clearly not perforated in the formations alleged in Operator's
20 application. On top of that, there are no formations that effectively act as confining layers
21 between Operator's proposed injection and usable water zones.

1 **Q. When did you first become aware that the Subject Well may be perforated above the**
2 **minimum injection depth provided by Table II?**

3 A. The first indication that I had was when one of my ECRSs, Mr. Ken Jehlik, sent me a
4 picture of the subsurface material that was coming out of the Subject Well. I have attached a
5 copy of the picture that was sent to me as *Exhibit KS-1*. These formation samples were
6 taken from the Subject Well while Operator was swabbing the well. When an operator
7 swabs a well, it brings fluids to surface. In this instance, the zones Operator perforated in the
8 Subject Well had sand that was so fine it was coming to surface along with the fluid. The
9 sample on the left is formation solids removed from the upper perforations in the Subject
10 Well at 1452 to 1476 feet. The sample on the right is formation solids from the upper
11 perforations and middle perforations in the Subject Well at 1522 to 1582 feet. As you can
12 see in that photo, the sample on the left is much different than the sample on the right. The
13 left sample is almost grey/white in color and is not consistent with anything that I have ever
14 seen come from the Permian formation. The sample on the right is reddish in color and
15 much more consistent with material found in the Permian Red Beds.

16 **Q. What was the purpose of the swab test conducted on the Subject Well by Operator?**

17 A. In April 2025, the Operator conducted swab tests on the well to pull water samples from
18 perforated zones and test for chlorides and total dissolved solids. They swabbed 300 barrels
19 of fluid along with formation solids to the workover pit from both sets of the upper
20 perforations and then isolated them from each other and swabbed another 300 barrels of
21 fluid and formation solids to the workover pit. I believe the Operator wished to show that
22 the water was already above usable water standards set forth under K.A.R. 82-3-101(78).

1 However, the results of these tests are inconclusive due to the Subject Well's perforations
2 being open to each other since December 2024.

3 Generally, an operator will detail its findings from these types of tests in a report or log. I
4 have attached a copy of the Daily Report for the Subject Well that was sent to me by
5 Operator to my testimony as ***Exhibit KS-2***. As you can see, the daily report also details the
6 work Operator conducted on the Subject Well in April 2025. Operator's report indicates that
7 when the top two formations were swabbed together, they were bringing up mostly red
8 sands. However, when Operator only swabbed the top zone, they were only bringing up
9 white sands. This leads me to believe that the lower zone gives up a lot more material than
10 the upper zone from which the white/grey sand comes. It was also an indication to me that
11 the Subject Well may have been perforated above the Permian formation.

12 **Q. Did you request that your Staff collect and document samples from the Subject Well?**

13 A. Yes. We requested that Operator provide samples from its swab tests, so that we could
14 review and test the samples. However, Operator indicated that it no longer had any material
15 from their perforations. Out of an abundance of caution I directed Mr. Jehlik to perform a
16 lease inspection at the Subject Well to see if any formation solids from Operator's
17 perforations were still available. On August 18, 2025, Staff performed a lease inspection at
18 the Subject Well. I have attached a copy of Staff's inspection report to my testimony as
19 ***Exhibit KS-3***. When Staff arrived on site the working pits next to the Subject Well were still
20 open and had formation solids from the swab tests within them. Based on the pictures
21 attached to the field report you can see how both white and red sands were found within the
22 pits. Mr. Jehlik collected a sample of the grey/white sand and brought the sample he had
23 collected to me. I later transported part of the sample to the KCC Central Office and gave

1 the sample to Mr. Todd Bryant, so that he could run additional tests on the collected
2 material. I believe he discusses his findings in greater detail in his testimony.

3 **Q. How would you describe the sample collected from the Subject Well?**

4 A. The sample is a very fine white to grey quartz sandstone which is consistent with formations
5 found above the top of the Permian formation.

6 **Q. Has a well been permitted for injection into the Whitehorse formation since you
7 became the District #1 Supervisor?**

8 A. No. However, I would like to mention that an application for injection into the Whitehorse
9 formation has been denied by Staff since I became the District #1 Supervisor. In September
10 2023, Hartman Oil applied for disposal into the Whitehorse formation at a well located in
11 Scott County. After Staff reviewed the application, Staff determined the application should
12 be denied due to the Whitehorse formation's proximity to usable water. Hartman Oil did not
13 contest the denial of its application and instead completed the well deeper into the Cedar
14 Hills formation. I would also note that nearly all applications for the Whitehorse in District
15 #1 were permitted prior to extensive studies being conducted on these deeper usable water
16 aquifers. Additionally, no well has been permitted for injection into the Day Creek
17 formation since 1982.

18 **Q. Have you read and reviewed the testimony filed on behalf of Operator in this docket?**

19 A. Yes. I have read through and reviewed the testimony filed by Mr. Andrew Eck, Mr. Don
20 Williams, and Mr. Jeff Scarbrough.

1 **Q. I would like to begin by discussing Mr. Williams' testimony. On page 2, lines 8 through**
2 **12 of Mr. Williams' testimony, he states that the Subject Well was initially drilled as a**
3 **producing well. How deep was the Subject Well drilled?**

4 A. The well was initially drilled to 4,898 feet below the surface into the Mississippian
5 Formation. A copy of the ACO-1 that was submitted by Operator which contains that
6 information is included in Mr. Bryant's testimony as Exhibit TB-2.

7 **Q. On page 2, line 18 of his testimony, Mr. Williams states that Operator has spent a total**
8 **of \$485,923 on the Subject Well. Is there a cost that justifies creating a threat to usable**
9 **water?**

10 A. No. Different agencies have conducted studies to determine the extent of usable water in
11 southwest Kansas. One that stood out to me was an abstract from a study of the depth and
12 thickness of selected units in the Upper Permian, Upper Jurassic, and Lower Cretaceous
13 Rocks in southwestern Kansas. I have attached a copy of the abstract to my testimony as
14 *Exhibit KS-4*. The abstract states, "As ground-water reserves decline in the Ogallala aquifer
15 in the area of about 17,400 square miles in 26 counties in southwestern Kansas, sandstone
16 aquifers in underlying Upper Jurassic and Lower and Upper Cretaceous rocks may be
17 developed to supplement or replace the Ogallala as a source of water for some uses." I
18 reference this abstract because it illustrates the need to be proactive in protecting usable
19 water, especially in southwestern Kansas where it is such a valuable resource. I don't
20 believe that a price can be put on that need. Additionally, Mr. Williams also discusses
21 potentially shortening the economic life of a nearby well in his testimony. While that would
22 be an unfortunate result, I would say that potentially extending the life of a nearby well is
23 also not a sufficient excuse to impact usable water. Especially when considering that this all

1 could have been avoided if Operator had contacted Staff to discuss its options prior to
2 conducting work on the Subject Well.

3 **Q. On page 4, lines 13 and 14 of his testimony, Mr. Williams states that Operator**
4 **perforated the Subject Well in Cedar Hills formation. Do you believe that statement is**
5 **accurate?**

6 A. No. I do not believe that information is accurate. I will discuss this in more detail below, but
7 it appears that the lowest perforations in the Subject Well are in the Blaine formation based
8 on the logs available. Even if the Subject Well was perforated in the Cedar Hills, I am
9 unsure why Operator targeted that formation. In this area it is well known that the Cedar
10 Hills formation is salt cemented and does not take water very well if at all. Mr. Williams
11 acknowledges that Operator had knowledge that it is a poor injection zone on page 5 of his
12 testimony, so it makes no sense to me why Operator would attempt to inject into a formation
13 that they knew was not viable.

14 **Q. On page 4, lines 21 through 23 of his testimony, Mr. Williams states that there are not**
15 **any other potentially viable injection zones below the Cedar Hills formation. Is that**
16 **statement correct?**

17 A. No, it is not. In Wichita County, there are around a dozen other formations in the area that
18 are currently permitted and utilized for injection and would be better suited for this
19 application. This includes the Altamont, Council Grove, Lansing, Lecompton, Kansas City,
20 Marmaton, Mississippian, Oread, Shawnee, Tecumseh, Topeka, and Toronto formations, all
21 of which are at or above the original total depth of the well. The UIC Department has the
22 ultimate say, but Staff would likely approve the application if Operator sought to inject into
23 any of these formations instead of what is currently listed on the application.

1 **Q. Would a reasonable or prudent operator complete a well in proximity to usable water**
2 **without consulting with Staff first?**

3 A. No. The subsurface geology changes quickly in the area where the Subject Well is located,
4 and when you are looking to push the boundaries of regulations it is important for operators
5 to communicate with Staff prior to conducting the work, especially at such a shallow depth.
6 I believe that is the reason for the application process. As Mr. Bryant mentions in his
7 testimony, it is very common for operators to submit an application for design approval
8 prior to conducting work on a well in order to make sure that Staff is ok with their proposed
9 operation. It is important for operators to communicate with Staff prior to conducting work
10 in order to make sure both Staff and Operator are on the same page going into a project.
11 However, no such communication happened in this instance. I also do not think a reasonable
12 or prudent operator would rely on information that is a decade old especially when
13 attempting to complete a well right at usable water.

14 **Q. On page 5, lines 17 through 19 of his testimony, Mr. Williams discusses a conversation**
15 **with Rene Stucky. Did you ever have conversations with Mr. Stucky regarding the**
16 **Whitehorse formation?**

17 A. Yes. Prior to Mr. Stucky's retirement, I had multiple conversations with him about injection
18 into the Whitehorse formation. My recollection is that he was generally very hesitant for
19 injection to be permitted in such proximity to usable water. Further, on May 4, 2021, Mr.
20 Stucky sent an email to me, Mr. Bryant, Mr. Jake Eastes, and Conservation Division
21 Director Ryan A. Hoffman indicating that he was setting a limit on injection into the
22 Whitehorse formation and seriously contemplating a ban on any future injection into the
23 formation moving forward. I have attached a copy of that email to my testimony as *Exhibit*

1 **KS-5.** I believe that Mr. Stucky's letter shows that Staff has had concerns of injection into
2 the Whitehorse formation for an extended period of time. Applications for the Whitehorse
3 formation are subject to heightened scrutiny from Staff based on how close they are to
4 usable water, particularly in District #1 where the Ogallala formation is nearly depleted in
5 areas and formations right above the Permian have been found to be viable in the future.

6 **Q. Has industry ever expressed concern about injection into Permian formations?**

7 A. Yes. In August 2018, the late Mr. Cecil O'Brate, who was a well-known oil and gas
8 operator in western Kansas with American Warrior, sent a letter to the Commission
9 regarding his concerns of injection into the Cedar Hills in Hodgeman and Ness County areas
10 based on the threat injection in that formation presented to fresh and usable water. I have
11 attached a copy of Mr. O'Brate's letter to my testimony as **Exhibit KS-6**. While the Subject
12 Well is not in the same area, I do believe Mr. O'Brate's letter is relevant because it shows
13 that operators from Western Kansas acknowledge that shallow injection poses a threat to
14 usable water and that there is a need to protect usable water. I also believe the letter is
15 relevant because if Operator's Application is granted, Operator would be injecting into
16 formations that are at a much shallower depth than the Cedar Hills formation.

17 **Q. Next, I would like to move onto the testimony provided by Mr. Eck. On page 3, lines**
18 **10 through 15 of his testimony, Mr. Eck testifies that there are Permian Red Beds**
19 **above the uppermost perforations in the Subject Well. Is his testimony correct?**

20 A. No. Mr. Eck's testimony is incorrect. In Mr. Eck's testimony he discusses how the Permian
21 formations get the Red Bed name from the rust-red color that is prevalent in the section.
22 However, as I testified above, Operator's daily reports note that Operator was pulling white
23 sand from the Subject Well. If Operator had perforated the Subject Well in the Permian

1 formation, then it should not be pulling any white sands from the well. Additionally, I would
2 note a lack of any indication of dolomite being pulled from the Subject Well. Mr. Eck
3 testifies that he believes the Subject Well is perforated in the Day Creek Dolomite
4 formation, but that testimony appears to be refuted by Operator's own reports.

5 I have also conducted research that indicates the Subject Well is perforated above the
6 minimum depth established by Table II. Attached to my testimony as **Exhibit KS-7** are
7 maps from the Kansas Geological Survey (KGS) and United States Geological Survey
8 (USGS) websites. Based on Operator's intent, the surveyed ground elevation for the Subject
9 Well is 3197 feet. Based on that information, I was able to calculate the depths of the top of
10 the Dakota formation to be 967 feet (3197-2230), the depth of the Kiowa formation to be
11 1227 feet (3197-1970), the depth of the Cheyenne formation to be 1297 feet (3197-1900),
12 the depth of the Morrison formation to be 1427 feet (3197-1770) and the depth of the top of
13 the Permian (Red Beds) formation to be 1497 feet (3197-1700). The depths are consistent
14 with the depths for the Upper Permian, Upper Jurassic, and Lower Cretaceous rocks in
15 Southwest Kansas as indicated by the USGS maps.

16 Further, I would point out that in Eck Exhibit #4, Mr. Eck testifies that there are
17 approximately 57 feet of red beds above the uppermost perforations in the Subject Well.
18 However, that is also inconsistent with KGS mapping of the area. For example, Bulletin 162
19 on the KGS website details the Geologic History of Kansas. In that bulletin, there is a figure
20 which provides an underground cross section of the upper Permian in Southwest Kansas. I
21 have attached a copy of that figure to my testimony as **Exhibit KS-8**. As that cross section
22 indicates, the thickness of the Taloga/Big Basin formation substantially decreases until it
23 disappears as you move north in Western Kansas. Similarly, the map depicts that the

1 northernmost limit of the Day Creek formation is south of where the Subject Well is located.
2 This cross section and map indicate that the Big Basin and Day Creek formations would not
3 be present at the location of the Subject Well and certainly would not be 42 and 41 feet thick
4 respectively.

5 **Q. Have you communicated with any geologists from outside of the KCC who have**
6 **indicated these samples came from above the Permian?**

7 A. Yes. In order to be thorough, I did reach out to Dr. Don Whittemore at KGS to express my
8 concern of quartz sandstone from above the Permian being pulled from the Subject Well. As
9 part of that communication, I provided him with the Section, Township, and Range of the
10 Subject Well, as well as the depth of Operator's highest perforations in the well. Based on
11 the elevation of the surface and thickness of formations in the area, he indicated that the
12 upper perforations in the Subject Well are either from the lower part of the Dockum Group
13 or from the Entrada Sandstone in the Morrison formation. His determination also means that
14 the Subject Well is perforated above the minimum depth established by Table II. I have
15 attached my email correspondence with Dr. Whittemore to my testimony as *Exhibit KS-9*.

16 **Q. Do you have any doubts that the formation solids collected by District #1 Staff came**
17 **from above the Permian Formation?**

18 A. No. After reviewing the electric logs and mapping data, everything correlates to the Subject
19 Well being perforated in a lower sand unit of the Morrison Formation. The sample of the
20 sand that was brought to surface as part of Operator's swab tests was further indication the
21 Subject Well is perforated above the Permian formation as it matches the description of the
22 Morrison Sand. Furthermore, there is no example of the upper Permian being anything other
23 than predominantly red in color, and as such is referred to as red beds. There is also no

1 dolomite observed in the sample as one would expect to see from the Day Creek Dolomite
2 Formation.

3 Q. **Have you been able to inspect samples or cuttings from any of the formations**
4 **referenced in your testimony?**

5 A. Yes, I have. On October 17, 2025, Mr. Bryant visited the KGS sample library in Wichita
6 and was able to locate a box of cuttings from the AEC Test Hole #5 which is located in the
7 Northeast Quarter of Section 22, Township 19 South, Range 37 West, Wichita County. Mr.
8 Bryant chose this well because the Day Creek Dolomite was picked at a depth of 1282 to
9 1285 feet. Unfortunately, the box of cuttings was missing the envelope from 1280 to 1290
10 feet but did have cuttings from directly above and below the Day Creek depths. I have
11 attached pictures that Mr. Bryant sent to me of those cuttings to my testimony as ***Exhibit***
12 ***KS-10***. Mr. Bryant was able to check the box of cuttings out from the sample library, and we
13 viewed the samples together on October 22, 2025. I was able to pick out what I believe to be
14 cuttings from the Morrison formation from 1180 to 1200 feet. I have included pictures of
15 those cuttings next to the formation sample taken from the Subject Well in ***Exhibit KS-10***.

16 The Morrison cuttings are similar to the sand brought to surface during the swab tests
17 conducted by Operator and discussed in my testimony above. I plan to continue looking for
18 cuttings from the Day Creek Dolomite, so that it can be discussed in greater detail either
19 through supplemental testimony or at hearing. However, there is some relevant information
20 to consider based on the samples that were available. Both of the samples above and below
21 the Day Creek formation have the distinctive red color that gives the Upper Permian its
22 nickname. Additionally, the Day Creek formation was determined to be three feet thick in

1 this area which is consistent with KGS data and nowhere near the 40 plus feet alleged in Mr.
2 Eck's Exhibit #4.

3 **Q. On page 4, line 9 through page 5 line 1 of his testimony, Mr. Eck testifies that there are**
4 **sufficient confining layers above the injection interval. Do you agree with his**
5 **testimony?**

6 A. No, I do not agree that there are sufficient confining layers above the proposed injection
7 interval. As I have stated multiple times, the Subject Well is perforated above the minimum
8 depth established by Table II. As shown in the Dakota Aquifer Program of the Kansas
9 Geological Survey, in areas where the aquifer is directly above the top of the Permian or has
10 a very thin layer of Jurassic between the aquifer and the Permian. The Permian is able to
11 naturally leak into the upper aquifers due to the Permian's higher pressure and natural
12 fractures into the formations.

13 For this area, while there is Jurassic between the aquifer and the Permian, the margin is
14 thin. The higher pressure still exists in the Permian, and the natural fracturing is still present.
15 Further, the KGS study regarding the Dakota Aquifer Water Quality supports the lack of
16 confining layers between the Permian formation and usable water. It states, "The present
17 salinity pattern of Dakota waters is mainly dependent on the rate at which freshwater is able
18 to enter from above and along the long flow paths in the aquifer in comparison with the rate
19 of saltwater intrusion from the underlying Permian Rocks." If there was such an
20 impermeable interval between the Permian formations and the Dakota formations, then
21 saltwater from the Permian would not be able to intrude into the usable water formations
22 above. I have attached a copy of the relevant page from the KGS's report to my testimony as
23 ***Exhibit KS-11.***

1 **Q. On page 5, lines 6 through 12 of his testimony, Mr. Eck testified that the Subject Well**
2 **would be injecting into the Day Creek, Whitehorse, and Cedar Hills formations. Do**
3 **you believe that testimony is consistent with the evidence and documentation you have**
4 **reviewed?**

5 A. No. As I testified above, the Day Creek formation is not likely present in this area and the
6 upper perforations in the Subject Well are clearly above Table II. I believe that the Middle
7 perforations are most likely in the Whitehorse formation. However, Staff would be opposed
8 to injection in the Whitehorse formation because it presents the same threat to usable water
9 and there is a lack of sufficient confining layers between Operator's proposed injection and
10 usable water. I believe that the logs provided by Operator clearly indicate that the lower
11 perforations in the Subject Well are in the Blaine formation. The Blaine formation is easily
12 identifiable due to its high Spontaneous Potential (SP) and resistivity readings. The top of
13 the Cedar Hills formation is down around 2100 feet. This is corroborated by the KGS maps
14 that are attached to my testimony as Exhibit KS-7. Based on the depths indicated on the
15 KGS maps, I have attached a marked log of the Subject Well to my testimony as ***Exhibit***
16 ***KS-12***. This exhibit identifies the depths of the various formations at the location of the
17 Subject Well and where Operator's perforations are in relation to those formations.

18 **Q. Could that impact the accuracy of the other footages provided by Operator?**

19 A. Yes. The fact that it appears that Operator confused the Blaine formation as being the Cedar
20 Hills likely caused Operator to be stratigraphically high when reading their logs which could
21 be an explanation of why Operator perforated where it did in the Subject Well.

1 **Q. On page 5 lines 16 through 18 of his testimony, Mr. Eck states that Operator's**
2 **proposed injection does not endanger usable water. Do you agree with that testimony?**

3 A. Absolutely not. For the reasons I state above, any injection in the Subject Well is a serious
4 threat to usable water. One thing I don't believe I have mentioned yet is that the static fluid
5 level in the Subject Well is around 700 feet below the surface. In reality, the Subject Well is
6 currently a threat and polluting usable water since Operator's perforations in the well have
7 been open and in communication with heightened chlorides for almost a year now. Operator
8 may need to potentially be held responsible for polluting usable water resources based on
9 the actions it has already taken by perforating the Subject Well within a usable water zone,
10 which has been left unresolved and unmitigated for an extended period of time.

11 **Q. On page 2, lines 16 through 24 of his testimony, Mr. Scarbrough discusses water**
12 **samples taken by ChampionX Corporation. Do you believe those samples are credible?**

13 A. Not really. I share the same concerns that Mr. Bryant addresses in his testimony. As I
14 testified above, the results are inconclusive based on the amount of time Operator had left
15 perforations in the Subject Well open before performing its tests. Additionally, I would note
16 that the threat the Subject Well currently presents is to the Dakota Aquifer System. The
17 Dakota Aquifer System consists of The Dakota formation, the Kiowa formation, and the
18 Cheyenne formation. These formations are considered to be fractured and in communication
19 with one another. There are no sufficient confining layers between Operator's proposed
20 injection and the Dakota Aquifer System.

21 KGS has also performed studies to determine the extent of usable water in the Dakota
22 Aquifer System and included information regarding the water resources of the Dakota
23 Aquifer in Bulletin 260. I have attached two relevant maps of southwest Kansas from the

1 study to my testimony as ***Exhibit KS-13***. These maps show that the level of total dissolved
2 solids (TDS) in the Dakota Aquifer System at the Subject Well location is 500 to 1,000
3 mg/L and the level of chlorides is 50 to 100 mg/L. These values clearly fall within the
4 definition of usable water referenced on page 2 lines 9 through 15 of Mr. Scarbrough's
5 testimony. Additionally, there is a 1984 study by USGS and KDHE which tested the water
6 quality of the Jurassic Aquifer System. I have attached two relevant pages from that study to
7 my testimony as ***Exhibit KS-14***. In the USGS Water-Resources Investigations Report 84-
8 4045, the mean chloride level of the Jurassic Aquifer System is 922 mg/L and a mean TDS
9 of 5,527 mg/L in the test area indicating the system is also a viable usable water option. To
10 definitively know the chloride and total dissolved solid levels of this zone in the area of the
11 Subject Well, a test well would need to be drilled upgradient of this well and collected from
12 the same zone without influence of the deeper Permian formations.

13 **Q. Is the Subject Well a threat to usable water?**

14 A. Yes. I believe my testimony above clearly shows that the Subject Well not only presents a
15 threat to usable water if Operator's Application is approved but currently presents a threat to
16 fresh and usable water since it has been perforated by Operator above and below the top of
17 the Permian formation. By doing this Operator has created a conduit that allows formation
18 water that is high in chlorides and total dissolved solids to flow upwards into usable water
19 zones. At the top of Table II, there is language that provides that depths greater than those
20 given may be required for some areas. I think that is necessary at the location of the Subject
21 Well for the reasons stated in my testimony above. Additionally, the decline of the Ogallala
22 Aquifer in the area of the Subject Well necessitates deeper injection. The decline has been
23 so severe that Wichita County has been designated a Local Enhanced Management Area

(LEMA) by Groundwater Management District #1. A LEMA is a tool that allows Groundwater Management Districts (GMDs) to set goals and control measures to aid in water conservation, at the approval of the chief engineer of the Kansas Department of Agriculture, Division of Water Resources.¹ In 2023, KGS published a status of the High Plains Aquifer which included Wichita County and a map showing the decline of the aquifer. I have attached a copy of the relevant map to my testimony as *Exhibit KS-15*. The map shows that the thickness of the aquifer has decreased over 60% at the location of the Subject Well. All of this is important because they serve as clear indications that the usable water zones in this area will be needed sooner than later and the Subject Well clearly presents a threat to those resources.

Q. Based on your review of the Application, what is your recommendation?

A. I would recommend Operator's Application be denied. I don't believe that Operator's Application complies with Table II as the Subject Well is perforated in the Morrison Formation which lies above the top of the Permian Red Beds. Additionally, any injection into the Whitehorse formation from 1522 to 1582 feet will also likely impact usable water. Thus, I believe if Operator's Application is granted, the ensuing injection will endanger usable water resources in the area. The Commission is tasked with protecting fresh and usable waters, preserving correlative rights, and preventing waste from oil and gas exploration and production. I do not believe permitting this application accomplishes those directives.

Q. Does this conclude your testimony?

A. Yes.

¹ See <https://www.gmdl.org/lema>.



SHAKESPEARE OIL COMPANY, INC.**Wells #2-27**

Timber Canyon West Prospect
 1540' FSL & 1360' FWL, SW/4, Sec. 27-16S-35W
 Wichita County, KS
 API# 15-203-20394
 EGL 3197'; EKB 3206'

Drilling Rig:	Duke Drilling Rig #4	620-793-0833
Toolpusher:	Hector Torres	620-682-3927
Wellsite Geologist:	Kent Matson	316-644-1975

DAILY DRILLING REPORT

11/06/24 MIRU Duke Drilling Rig #4. Spud at 5:15 pm. Drilled 12 1/4" hole to 237'. SHT @ 236' = 0°. **Ran 5 jts. used MPW LS 8 5/8", 23# csg., tally 226', set @ 237'.** Strapped 3 joints and welded all collars. **RU Swift Services and pumped 170 sx Class A, 2% gel, 3% cc. PD 11:05 pm. Cmt did circulate.**

11/07/24 Depth 237'. Drill out cmt plug w/ 7 7/8" PDC bit. SHT's @ 836' & 1181' = 3/4°.

11/08/24 Depth 1220'. SHT @ 1682' = 1/4° & 2180' = 3/4°.

11/09/24 Depth 2400'. SHT @ 2681' = 3/4°.

11/10/24 Depth 3410'. **Displace mud @ 3465'. TOH for 7 7/8" tri-cone bit @ 3548'.** SHT = 1/2°. **Pipe strap 2.31' long to board.**

11/11/24 Depth 3810'. **TOH @ 3940' & RU Trilobite Testing for DST #1.**

DST #1	Lecompton/Oread	3864' – 3940'	15 – 30 – 30 – 30
IF: Blow built to 4 3/4" – No return			
FF: Blow built to 6 1/4" – No return			
Rec: 80' OSM			
Total Fluid: 80'			
IFP: 17-41#	FFP: 42-78#	Chlorides: N/A	
ISIP: 1074#	FSIP: 1046#	BHT: 102° F	Oil Gravity: N/A

11/12/24 Depth 3980'. **TOH @ 4050' & RU Trilobite Testing for DST #2.**

DST #2	Toronto/Lansing A	3984' – 4050'	15 – 30 – 30 – 40
IF: Blow built to 5 ¾" – No return			
FF: Blow built to 8" – No return			
Rec: 70' WCM (15% W, 85% M)			
60' SWCM (5% W, 95% M)			
40' OSM			
Total Fluid: 170'			
IFP: 21-48#	FFP: 51-95#	Chlorides: 41,000 PPM	
ISIP: 1068#	FSIP: 1025#	BHT: 105° F	Oil Gravity: N/A

11/13/24 Depth 4101'. **TOH @ 4135' & RU Trilobite Testing for DST #3.**

DST #3	Lansing D	4115' – 4135'	15 – 30 – 30 – 30
IF: Blow built to 1" – No return			
FF: Blow built to 1" – No return			
Rec: 30' Mud			
Total Fluid: 30'			
IFP: 13-23#	FFP: 25-36#	Chlorides: N/A	
ISIP: 1073#	FSIP: 1043#	BHT: 106° F	Oil Gravity: N/A

11/14/24 Depth 4230'. **TOH @ 4260' & RU Trilobite Testing for DST #4.**

DST #4	Lansing H -- I	4196' – 4260'	15 – 30 – 30 – 30
IF: Blow built to 1 ½" – No return			
FF: Blow built to 1 ½" – No return			
Rec: 30' Mud			
Total Fluid: 30'			
IFP: 22-25#	FFP: 27-37#	Chlorides: N/A	
ISIP: 1068#	FSIP: 920#	BHT: 107° F	Oil Gravity: N/A

11/15/24 Depth 4315'. **TOH & RU Trilobite Testing for DST #5.**

DST #5	Lansing J -- K	4266' – 4315'	15 – 30 – 30 – 40
IF: Blow built to 5 ¼" – surface return			
FF: Blow built to 7 ¼" – surface return			
Rec: 100' MCW (15% M, 85% W)			
60' SWCM (5% W, 95% M)			
40' VSOCM (1% O, 99% M)			
Total Fluid: 200'			
IFP: 21-43#	FFP: 46-97#	Chlorides: 39,000 PPM	
ISIP: 1207#	FSIP: 1201#	BHT: 110° F	Oil Gravity: N/A

11/16/24 Depth 4486'. **TOH @ 4510' & RU Trilobite Testing for DST #6.**

DST #6	Marmaton A – C	4444' – 4510'	15 – 30 – 30 – 30
IF: Blow built to 1" – no return			
FF: Blow built to 2 ¼" – no return			
Rec: 15' GMCO (10% G, 15% M, 75% O)			
15' GO (10% G, 90% O)			
Total Fluid: 30'			
IFP: 23-30#	FFP: 30-30#	Chlorides: N/A	
ISIP: 1191#	FSIP: 1072#	BHT: 107° F	Oil Gravity: 24° API

11/17/24 Depth 4555'.

11/18/24 Depth 4740'. **RTD 4897' @ 10:15 pm. TOH & RU ELI Wireline Services to run Triple-Combo OH Log Suite. LTD 4898'.**

We decided to set 5 ½" casing in the Anhydrite and make this a Cedar Hills SWD well for the Jantz 1-22.

COMPARISON of LOG TOPS

FORMATION	SOCO Wells #2-27 27-16S-35W LOG Tops KB 3206'		Reference A SOCO Wells #1-27 27-16S-35W D&A KB 3207'		Reference B SOCO Jantz #1-22 22-16S-35W Producer KB 3204'		Structural Comparison: Ref. A Ref. B	
B/Anhydrite	2505	+701	2505	+702	2491	+713	-1'	-12'
Heebner	3988	-782	3994	-787	3975	-771	+5'	-11'
Muncie Creek	4204	-998	4209	-1002	4192	-988	+4'	-10'
Stark	4299	-1093	4305	-1098	4288	-1084	+5'	-9'
Hushpuckney	4346	-1140	4351	-1144	4338	-1134	+4'	-6'
Marmaton	4453	-1247	4454	-1247	4449	-1245	Flat	-2'
Pawnee	4526	-1320	4529	-1322	4511	-1307	+2'	-13'
Cherokee	4608	-1402	4611	-1404	4589	-1385	+2'	-17'
Mississippian	4808	-1602	4804	-1597	4766	-1562	-5'	-40'
B/Anh-Heebner		1483		1489		1484	+6'	+1'
Heebner-Miss		820		810		791	-10'	-29'

DAILY MUD PROPERTIES

Day	Depth	Weight	Vis.	WL	PH	Chl	LCM
1				Native			
2							
3	1,329	9.0	28	N/C	7.0	890	2
4	2,597	9.7	29	N/C	7.0	29,000	2
5	3,457	9.7	29	N/C	7.0	31,000	2
6	3,805	8.8	56	5.8	11.0	8,200	2
7	4,050	9.0	54	10.0	11.0	9,100	2
8	4,135	9.1	57	6.8	11.0	10,500	2
9	4,260	9.2	58	10.0	11.5	11,800	2
10	4,315	9.2	59	9.6	11.0	9,000	2
11	4,491	9.1	63	8.0	11.5	10,000	2
12	4,570	9.2	67	9.6	10.0	11,000	2
13	4,708	9.4	67	10.4	9.0	10,000	1
14							

Casing Report

- 11/19/24 RTD 4897', LTD 4898'. RU Wyoming Casing Services. LDDP & DC. **Ran 59 jts new MWP 55 5 1/2" 15.5# R3 LTC 8rd. Tallied 2503', set @ 2500' KB.** Ran pkr shoe @ 2500', latch down @ 2457', turbolizers @ 2475', 2414', 2115', 2072', 2030', 1987', 1944', 1902', 1857' & 1817'. **Cmt baskets @ 2457' & 1693'.** CTCH 1 hr thru 5 1/2" w/ Desco. RU Swift. Set pkr shoe @ 1400#. **Cmt w/ 500 gal mud flush, 20 bbl 2% clafix wtr, 170 sx SMD @ 11.2 ppg, 200 sx SMD @ 12 ppg & 50 sx SMD @ 13 ppg. Circ. ~60 sx to the pit.** Landed plug w/ 1500# - latch down held. PD @ 9:50 pm. Set slips, jetted pits & released rig @ 11:30 pm. Plugged RH w/ 30 sx. **Total cmt 450 sx, 390 sx casing.** Left 3 jts MWP csg (tallied 103.23' threads off) on loc.
- 12/13/24 MIRU Wild West Well Service DD. SDFN.
- 12/16/24 **RU Midwest to run SCBL/GR, PBTD 2450', TOC 0'.** Have fair to good bond throughout. **Perforate Cedar Hills 1900-2000 (100') w/ 3 1/2" strip jets, 1 spf.** TIH w/ tbg & bit. RU AA Fishing Tools air foam unit. Circ. 3 hrs & last 2 hrs no returns. SDFN.
- 12/17/24 Ran bit to 2007'. **RU Tiger to acidize w/ 500 gal 15% DWA w/ extra surfactants.** Load casing & spot acid. Shut in backside - let sit 15 min. Pressured to 500# & lost 100# in 15 sec. Increased press. to 1000# & started feeding @ 0.3 bpm. Press. slowly dropped to 900# at 1/2 bpm at the end, ISIP 900#, 10 min 850#, TL 27 bbl. RU AA foam unit & circ for 2 hrs. 1st hr - good returns of red bed & cement. 2nd hr - clean. TOH w/ tbg & bit. SDFN.
- 12/18/24 RU Midwest Wireline. **Perforate Cedar Hills 1800-1900 (100') w/ 3 1/2" strip jets, 1 spf & 1850-60 (10') w/ 4" HSC, 1 spf.** RU casing swab - fluid @ surface. Swab down to 1800'. Rec 41.76 bbl. Let sit 30 min - no fill up. SD until Dec 30th.
- 12/30/24 RIH w/ casing swab and had no fillup. Loaded casing out of the swab tank. RU Midwest. **Perforate 1522-1582 (60') w/ 3 1/2" strip jets, 1 spf & White Horse 1452-76 (24') w/ 4" HSC, 2 spf.** Swab down to 1250' & let sit 30 min. Tag fluid @ 850' - some white sand in the cups. Very windy. SDFN.
- 12/31/24 TIH w/ tbg & bit to 1615'. RU AA Fishing Tools air foam unit. Foamed for 2 hrs. Had a little bit of sand at the beginning but cleaned up quick - not kicking in any fluid. RD AA & TOH w/ tbg & bit. RU casing swab. Made 6 pulls & started getting sand and foam. SDFN.
- 1/02/25 Tag fluid @ 750' from surface. Swab steady & FL dropped to 1000'. Rec. 3" red & white sand per pull then decreased to 1/2" sand per pull. HU csg to swab tank. Took 168 bbl water in 40 min on vac. SI csg. SDFN.

1/03/25 TIH w/ empty casing jars and had **PBTD @ 2350'**. RD casing swab & TIH w/ packer and tbg as follows:

2 3/8" Sealtite lined tailpipe	2.30'
5 1/2" x 2 3/8" Sealtite lined AD-1 packer	2.90'
44 jts used 2 3/8" Sealtite tbg	1428.20'
	1433.40'
3' KB adj	3.00'
	1436.40'

RU Walker Tank & flushed annulus w/ 40 bbl treated fresh water. **Set pkr @ 20K over and set in slips @ 1434'**. Loaded annulus & pressured to 340#. Held for 30 min. SDFWE.

4/03/25 MIRU Wild West Well Service DD. RU for tbg. Pulled slips & let pkr rubber relax. TOH w/ Sealtite tbg & 5 1/2" AD-1 packer. Workstring arrived & unloaded tbg. TIH w/ tbg & RBP to 1509'. Set RBP & TOH w/ tbg. Started to rain. SDFN.

4/04/25 SDFWE – too muddy.

4/07/25 Shut down.

4/08/25 Shut down.

4/09/25 TIH w/ tbg & catcher. Rel. RBP & set **RBP @ 1637'**. TOH w/ tbg & catcher. **RU casing swab to test the Whitehorse sand (1452-76) and top Cedar Hills perms (1520-82)**. Tag fluid & 800' from surface. Made 4 pulls & starting to recover sand. SDFN.

4/10/25 Total Lease arrived & dug a 600 bbl pit w/ the excavator. Put in pit liner. Tag fluid @ 800' from surface. Swab steady & fluid level dropped to 950' from surface. **Started off w/ 2" of red sand** a run in the sample bucket. Swab approx. 300 bbl. **Took samples @ 210', 240', 270' & 300 bbls out.** SDFN.

4/11/25 Tag fluid @ 800' from surface. Champion arrived & tested water samples. Laid down swab & RU sand pump. Cleaned sand off the RBP. Laid down sand pump & TIH w/ tbg & catcher. Rel. RBP & **set RBP @ 1507'**. TOH w/ tbg and catcher. **RU casing swab to test the Whitehorse sand.** Tag fluid @ 800'. Swab steady & rec approx. 120 bbls. Fluid level steady @ 1050' & **rec white sand**. Took water samples & SDFWE.

4/14/25 Tag fluid @ 750' from surface. Swab steady & **took water samples at 120, 210, & 300 bbls out.** FL steady @ 1050' and **rec 1/2" white sand** in the sample bucket. SDFN.

KCC OIL/GAS REGULATORY OFFICES

Date: 8/22/25

District: 1

Case #: _____



New Situation



Response to Request



Follow-Up



Lease Inspection



Complaint



Field Report

Operator License No: 7311

API Well Number: 15-203-20394-00-00

Op Name: Shakespeare Oil Co Inc

Spot: SW NE SW Sec 27 Twp 16 S Rng 35 ☐ E / ☒ W

Address 1: 202 W. Main

1540 Feet from ☐ N / ☒ S Line of Section

Address 2: _____

1360 Feet from ☐ E / ☒ W Line of Section

City: Salem

GPS: Lat: _____ Long: _____ Date: _____

State: Illinois Zip Code: 62881 -

Lease Name: Wells Well #: 2-27

Operator Phone #: (618) 548-1585

County: Wichita

Reason for Investigation:

Obtain sand samples and take photos

Problem:

Persons Contacted:

None

Findings:

- 8-18-25 Collect a sample of the buff colored sand swabbed from the upper perforations @ 1452-1476 per District Supervisor request.
- 8-22-25 Take 6 photos of the well location, trench and lined pit where the above sample was collected per District Supervisor request.

Action/Recommendations:

Follow Up Required



Yes



No



Date: _____

Verification Sources:



RBDMS



T-I Database



Other: _____



KGS



District Files



TA Program



Courthouse

Photos Taken: _____

By: Ken Jehlik

ECRS

Retain 1 Copy District Office
Send 1 Copy to Conservation Division

Form: _____

Exhibit KS-3

Page 1 of 8

Date: _____ District: 1 License #: 7311
 Op Name: 7311 Spot: SW NE SW Sec 27 Twp 16 S Rng 35 ☐ E ☒ W
 County: Wichita Lease Name: Wells Well #: 2-27

I.D. Sign ☒ Yes ☐ No 

☐ Tank Battery Condition
 Condition: ☐ Good ☐ Questionable ☐ Overflowing 

☐ Pits, Injection Site
 Fluid Depth: _____ ft; Approx. Size: _____ ft. x _____ ft.

☐ Oil Spill Evidence

☐ Abandoned Well Potential Pollution Problem ☐ Yes ☐ No 

☒ Lease Cleanliness 

☐ Very Good ☒ Satisfactory ☐ Poor ☐ Very Bad

Gas Venting ☐ Yes ☒ No 

☐ Pits
 Fluid Depth: _____ ft; Approx. Size: _____ ft. x _____ ft.

☐ Saltwater Pipelines  
 Leaks Visible: ☐ Y ☐ N Tested for Leaks: ☐ Y ☐ N

☐ Flowing Holes

☐ TA Wells

☐ Monitoring Records

SWD/ER Injection Well ☐ Yes ☐ No Wichita 

Gauge Connections ☐ Yes ☐ No 

Permit #: _____ Pressure – Actual: _____ psi; Authorized: _____ psi Tubing: _____; T/C Annulus: _____; C/SP Annulus: _____
 Permit #: _____ Pressure – Actual: _____ psi; Authorized: _____ psi Tubing: _____; T/C Annulus: _____; C/SP Annulus: _____
 Permit #: _____ Pressure – Actual: _____ psi; Authorized: _____ psi Tubing: _____; T/C Annulus: _____; C/SP Annulus: _____
 Permit #: _____ Pressure – Actual: _____ psi; Authorized: _____ psi Tubing: _____; T/C Annulus: _____; C/SP Annulus: _____

API Number	Footages	Spot Location	GPS	Well #	Well Status



8/22/2025

Shakespeare Oil Co., Inc.

Wells #2-27 Wellhead to Ditch



8/22/2025

Shakespeare Oil Co., Inc.

Wells #2-27 Ditch to Pit



8/22/2025

Shakespeare Oil Co., Inc.

Wells #2-27 Sand Collection Location



8/22/2025

Shakespeare Oil Co., Inc.

Wells #2-27 Pit



8/22/2025

Shakespeare Oil Co., Inc.

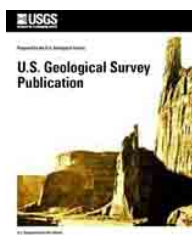
Wells #2-27 Wellhead



8/22/2025

Shakespeare Oil Co., Inc.

Wells #2-27 Location



Depth and thickness of selected units in Upper Permian, Upper Jurassic, and Lower Cretaceous rocks in southwestern Kansas

Water-Resources Investigations Report 83-4095

By: Jack Kume and Joseph M. Spinazola

<https://doi.org/10.3133/wri834095>

Metrics

[Web analytics dashboard](#)

[Metrics definitions](#)

Links

- Plates:
 - [Plate 1 \(pdf\)](#)
 - [Plate 2 \(pdf\)](#)
 - [Plate 3 \(pdf\)](#)
 - [Plate 4 \(pdf\)](#)
 - [Plate 5 \(pdf\)](#)
 - [Plate 6 \(pdf\)](#)
 - [Plate 7 \(pdf\)](#)
- Download citation as: [RIS](#) | [Dublin Core](#)

Abstract

As ground-water reserves decline in the Ogallala aquifer in an area of about 17,400 square miles in 26 counties of southwestern Kansas, sandstone aquifers in underlying Upper Jurassic and Lower and Upper Cretaceous rocks may be developed to supplement or replace the Ogallala as a source of water for some uses. Maps show that depths from land surface to Upper Permian rocks range from 0 at the outcrop to over 2,100 feet, depths to Upper Jurassic rocks ran from 0 at the outcrop to about 2,000 feet, depths to the Cheyenne Sandstone range from about 150 to about 1,950 feet, and depths to the Dakota Formation range from 0 at the outcrop to about 1,650 feet. Additional maps show that the thickness of

Upper Jurassic rocks, where present, ranges from less than 50 feet to about 250 feet, the thickness of the Cheyenne Sandstone, where present, ranges from about 20 feet to about 250 feet, and the thickness of the Dakota Formation, where present, ranges from about 60 feet to about 460 feet. (USGS)

Additional publication details

Publication type	Report
Publication Subtype	USGS Numbered Series
Title	Depth and thickness of selected units in Upper Permian, Upper Jurassic, and Lower Cretaceous rocks in southwestern Kansas
Series title	Water-Resources Investigations Report
Series number	83-4095
DOI	10.3133/wri834095
Year Published	1984
Language	ENGLISH
Description	7 maps : col. ; sheets 64 x 75 cm., folded in envelope 30 x 24 cm.

Part or all of this report is presented in Portable Document Format (PDF). For best results viewing and printing PDF documents, it is recommended that you download the documents to your computer and open them with Adobe Reader. PDF documents opened from your browser may not display or print as intended. Download the latest version of [Adobe Reader](#), free of charge. More information about viewing, downloading, and printing report files can be found at the [common download problems FAQ](#).

[DOI Privacy Policy](#) | [Legal](#) | [Accessibility](#) | [Site Map](#) | [Contact USGS](#)

[U.S. Department of the Interior](#) | [DOI Inspector General](#) | [White House](#) | [E-gov](#) | [No Fear Act](#) | [FOIA](#)

Whitehorse disposals

From Rene Stucky <r.stucky@kcc.ks.gov>

Date Tue 5/4/2021 11:28 AM

To Todd Bryant <t.bryant@kcc.ks.gov>; Jake Eastes <j.eastes@kcc.ks.gov>

Cc Kenny Sullivan <k.sullivan@kcc.ks.gov>; Ryan A. Hoffman <r.hoffman@kcc.ks.gov>

Hi Guys,

I just recently received an amendment application to increase the pressure in a Whitehorse disposal from 0 psi to 275 psi in Greeley County. As you may know this is a zone that is above the Cedar Hills in far southwest Kansas and is right underneath the Dakota. It has been used mostly for gas wells in the area but does extend over into Logan and Thomas counties as there are some Whitehorse disposals there also. RBDMS shows 26 active Whitehorse disposals and range from 0 psi to 300 psi with rates ranging from 200 bwpd to 4000 bwpd. This formation has been used since the Cedar Hills will not take fluid in the area but have been quite worrisome because of their close proximity to the "usable" water in the area. This has always been a big concern of District 1, both Scott and now Kenny.

I am going to deny the amended application because of the close proximity to the Dakota and with the blessings of District 1. I am toying with the idea of banning any new Whitehorse disposals but for the time being we will go with the Cedar Hills model of no pressure and 500 barrels maximum for any new or amended applications. The Operator of the referenced amendment chose 275 psi because he has another Whitehorse disposal in the area that is allowed 275 psi. I will not decrease any existing disposals but just have this affect anything new and will use the date of January 1, 2021. I'm sure there will be some pushback on this from the Operator.

I did want to let you guys know of the new policy and did want to make sure you don't have any applications for the Whitehorse or have issued anything this year on the Whitehorse formation.

If you have any questions don't hesitate to give me a call.

Thanks,

Rene

Rene Stucky

UIC Director, Production Supervisor



Conservation Division

Kansas Corporation Commission

266 N. Main Ste 220 | Wichita, KS | 67202

Office 316-337-6223 | Mobile 316-217-4306 | <http://kcc.ks.gov/>

This transmission, email and any files transmitted with it, may be: (1) subject to the Attorney-Client Privilege, (2) an attorney work product, or (3) strictly confidential under federal or state law. If you are not the intended recipient of this message, you may not use, disclose, print, copy or disseminate this information. If you have received this transmission in error, notify the sender (only) and delete the message. This message may also be subject to disclosure under the KORA, K.S.A. 45-215 et seq.



Kansas Corporation Commission
Conservation Division
266 N. Main St., Suite 220
Wichita, KS 67202-1513

KCC WICHITA

AUG 13 2018

RECEIVED

Chair Shari Feist Albrecht
Commissioner Jay Scott Emler
Commissioner Dwight D. Keen

Re: Cedar Hills Sandstone Salt Water Disposals

During my over 30 years as an operator in Kansas, I have come to the realization that Cedar Hills Sandstone Salt Water Disposal (SWD) poses a threat to some of our fresh water sources. Specifically, the area of Kansas I am worried about is the Ness and Hodgeman County areas. As American Warrior has drilled many wells in these counties my experience has allowed me to gather quite a bit of information about the Cedar Hills Sandstone over the years.

Scott Corsair, a Petroleum Geologist and Petroleum Engineer, who has worked for me since 1987 has over 30 years' experience in these counties. He and I have discussed the Cedar Hills Sandstone SWD many times.

When we first started working in Ness and Hodgeman counties we acquired numerous leases that had Cedar Hills Sandstone SWDs. We quickly realized that as we moved to lower surface elevations these wells would flow. While drilling east of Bazine Kansas we encountered the Cedar Hill Sandstone on a well that flowed at a rate of over 500 gallons per minute. This caused us to evaluate whether we wanted to operate any Cedar Hill Sandstone SWDs. We made the decision to try to avoid having any Cedar Hill Sandstone SWD. At one time we did have as many as 10 Cedar Hill Sandstone SWDs. Over time we were able to plug most of these and strategically locate Arbuckle SWDs to take our produced water.

After talking to Scott Corsair, here are some key points about the Cedar Hills Sandstone formation. In the Ness and Hodgeman County areas, it starts at a depth of approximately 850' and is about 300' thick. It is a closed aquifer, meaning it is not fed by any surface water and is isolated from any other aquifer by shale. It lies below the Dakota Sandstone that is a fresh water source for many farmers in the area. Specifically, we are aware of several farmsteads that get all their fresh water from Dakota wells that are over 400' deep. The Cedar Hills Sandstone covers a large area. As you move west the surface elevation becomes higher and as a result the Cedar Hills is deeper relative to the surface. In those places where it is deeper, the Cedar Hills takes water much better. Since it is a closed aquifer, any water that is put into the Cedar Hills causes the pressure in the reservoir to increase and we have seen that in our wells in eastern Ness County. Historically, Halliburton in Ness City kept records of the Chloride content of the Cedar Hills and the early records show the Chlorides were in the 10,000-ppm range, they are now almost 20,000 ppm, this also shows that effect of putting produced water into the Cedar Hills.

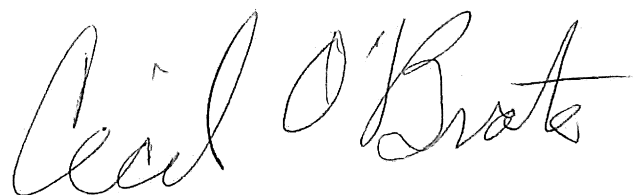
American Warrior, Inc.

P.O. Box 399 • Garden City, Kansas 67846 • (620) 275-9231

Exhibit KS-6
Page 1 of 2

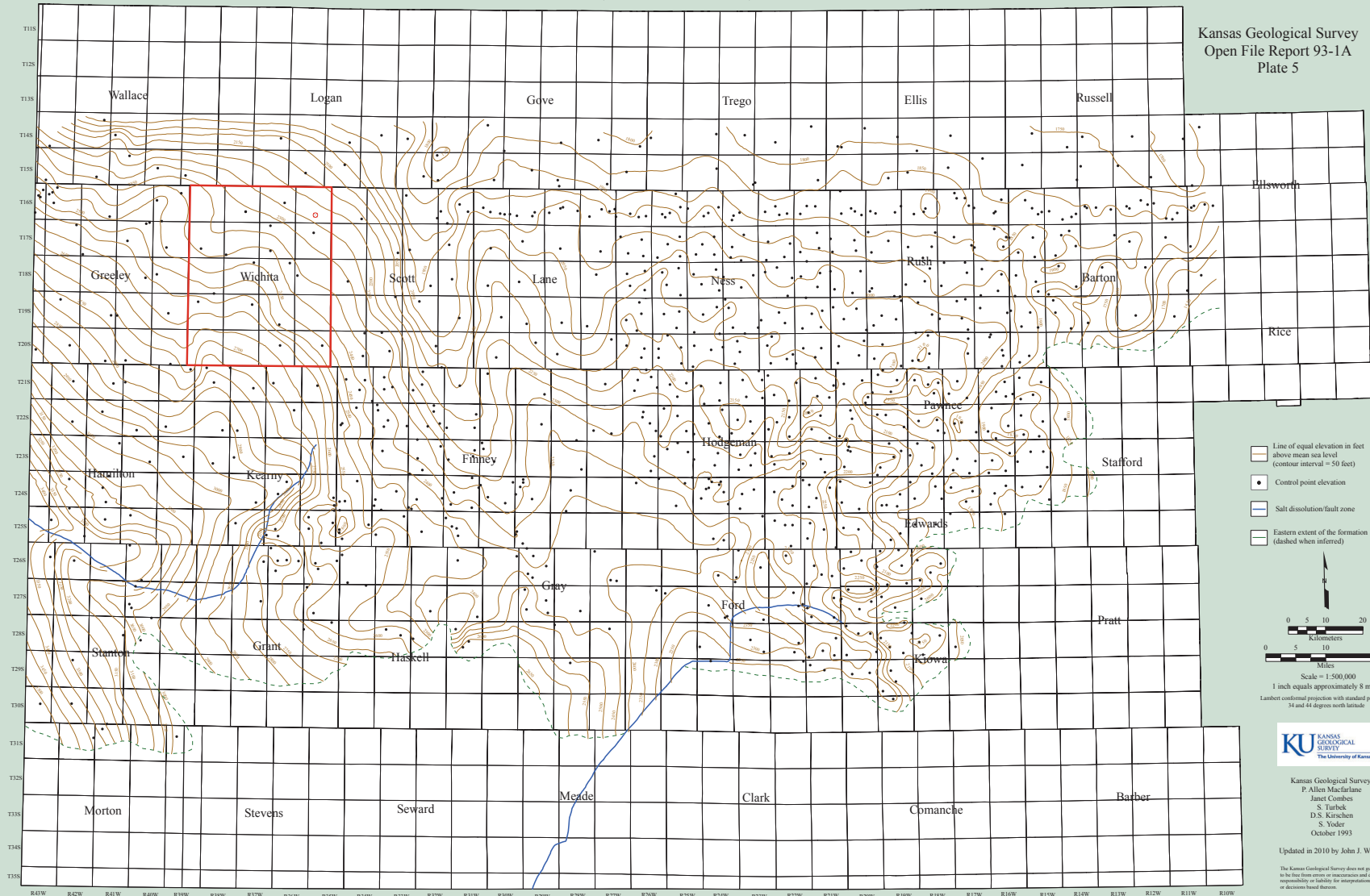
We are overloading the Cedar Hills with produced water. Even what we consider good Cedar Hills Sandstone SWDs, have static fluid levels that are less than 100' from surface and there are some Cedar Hills Sandstone SWDs that are injected into, these wells will flow and yet we still allow water to be injected into them. This means that the risk of contaminating the Dakota aquifer is certainly possible and shallow open aquifers could be at risk as well.

I realize completely prohibiting Cedar Hill Sandstone SWDs would cause an economic hardship. I do believe it is time to prohibit any injection at pressure into the Cedar Hills, only permit those that take water on a vacuum. I also believe the volume of fluid allowed to be disposed of should be restricted. It may also be time to look at removing the grandfather provisions for injecting at pressure. Since the Cedar Hills is located so close to the Dakota, a fresh water source, we need to do everything we can to protect it. When you compare the static fluid level of the Cedar Hills of less than 100' with that of the Arbuckle of about 1000', it is easy to understand why Arbuckle SWDs are American Warrior's choice for salt water disposal.

A handwritten signature in cursive script, reading "Cecil O'Brate". The signature is written in dark ink and is positioned in the lower right quadrant of the page.

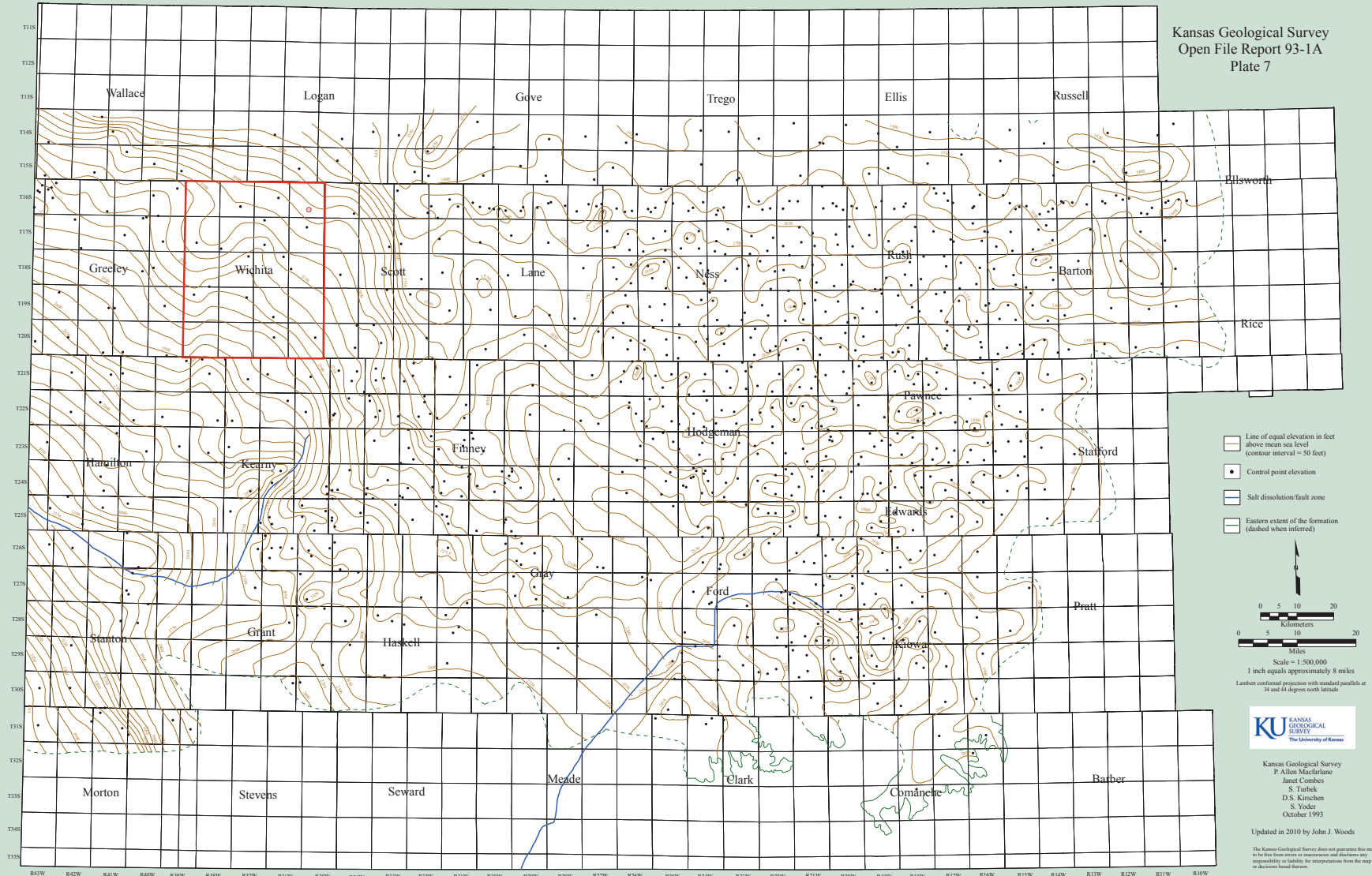
Top Configuration of the Upper Dakota Aquifer (Dakota Formation)

Kansas Geological Survey
Open File Report 93-1A
Plate 5



Top Configuration of the Kiowa Shale Aquitard (Unnamed Black Marine Shale, Kiowa Formation)

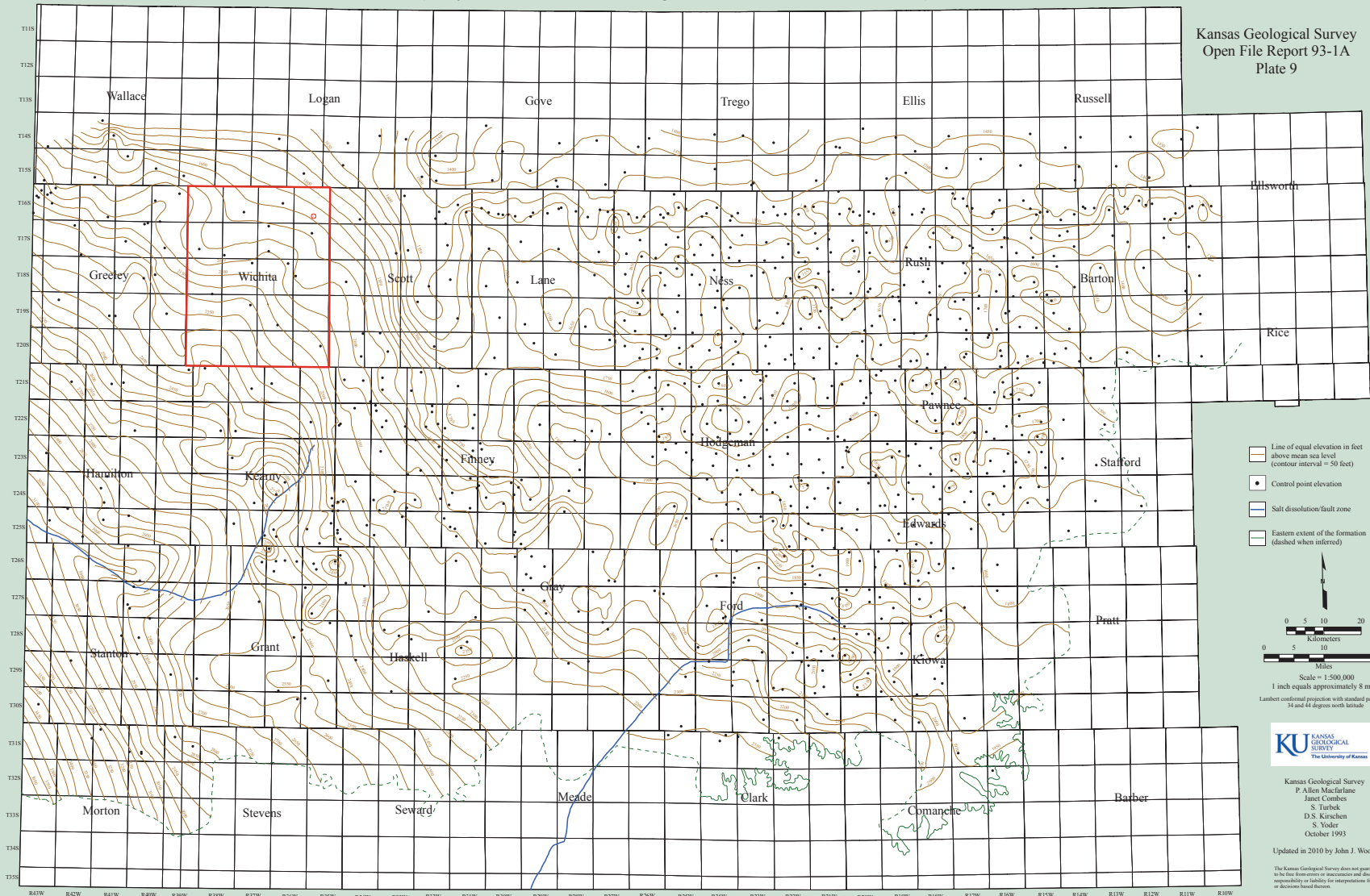
Kansas Geological Survey
Open File Report 93-1A
Plate 7



Top Configuration of the Lower Dakota Aquifer

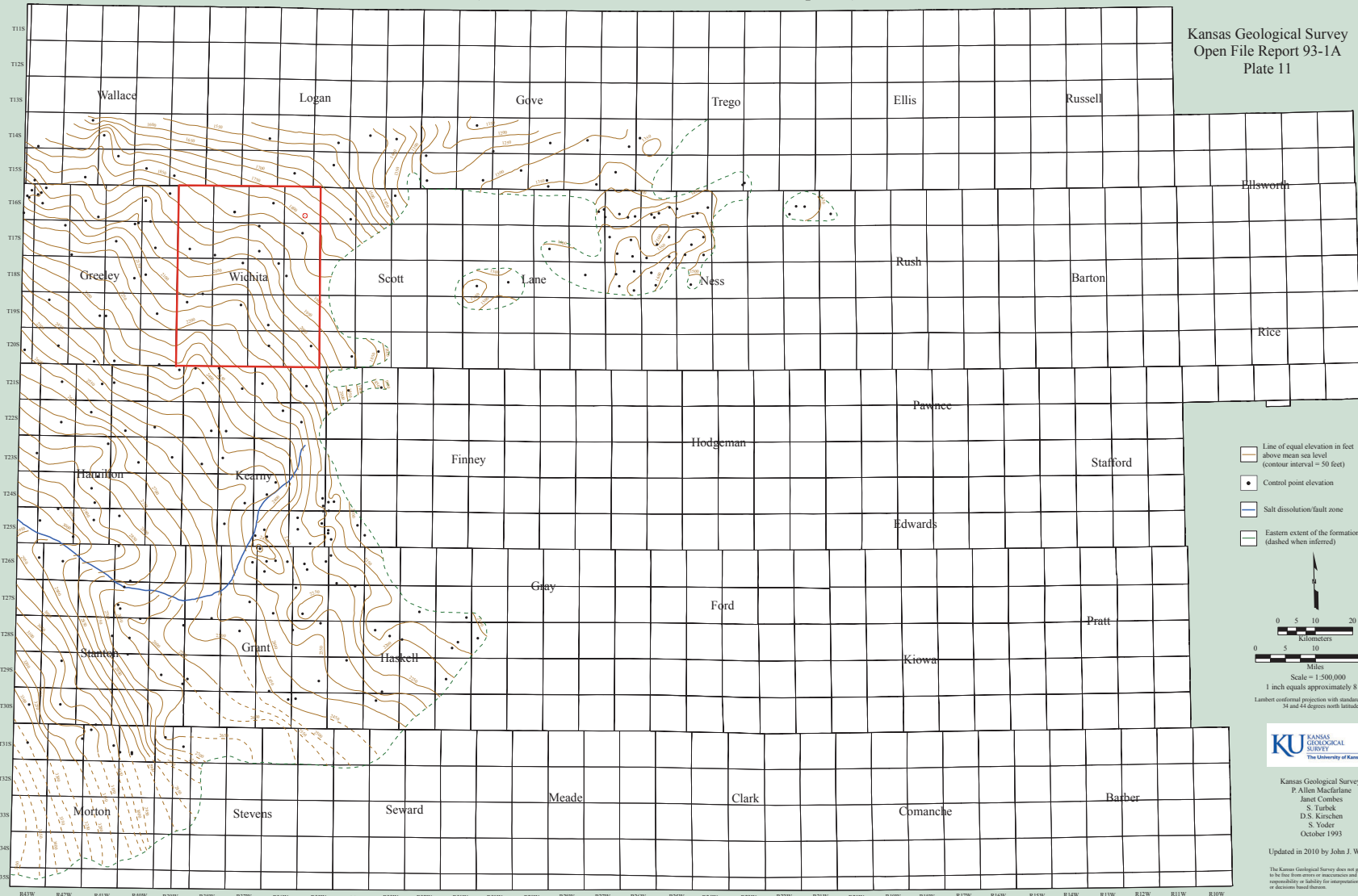
(Cheyenne Sandstone and Longford Member, Kiowa Formation)

Kansas Geological Survey
Open File Report 93-1A
Plate 9



Top Configuration of the Morrison-Dockum Aquifer (Undifferentiated Jurassic and Triassic Deposits)

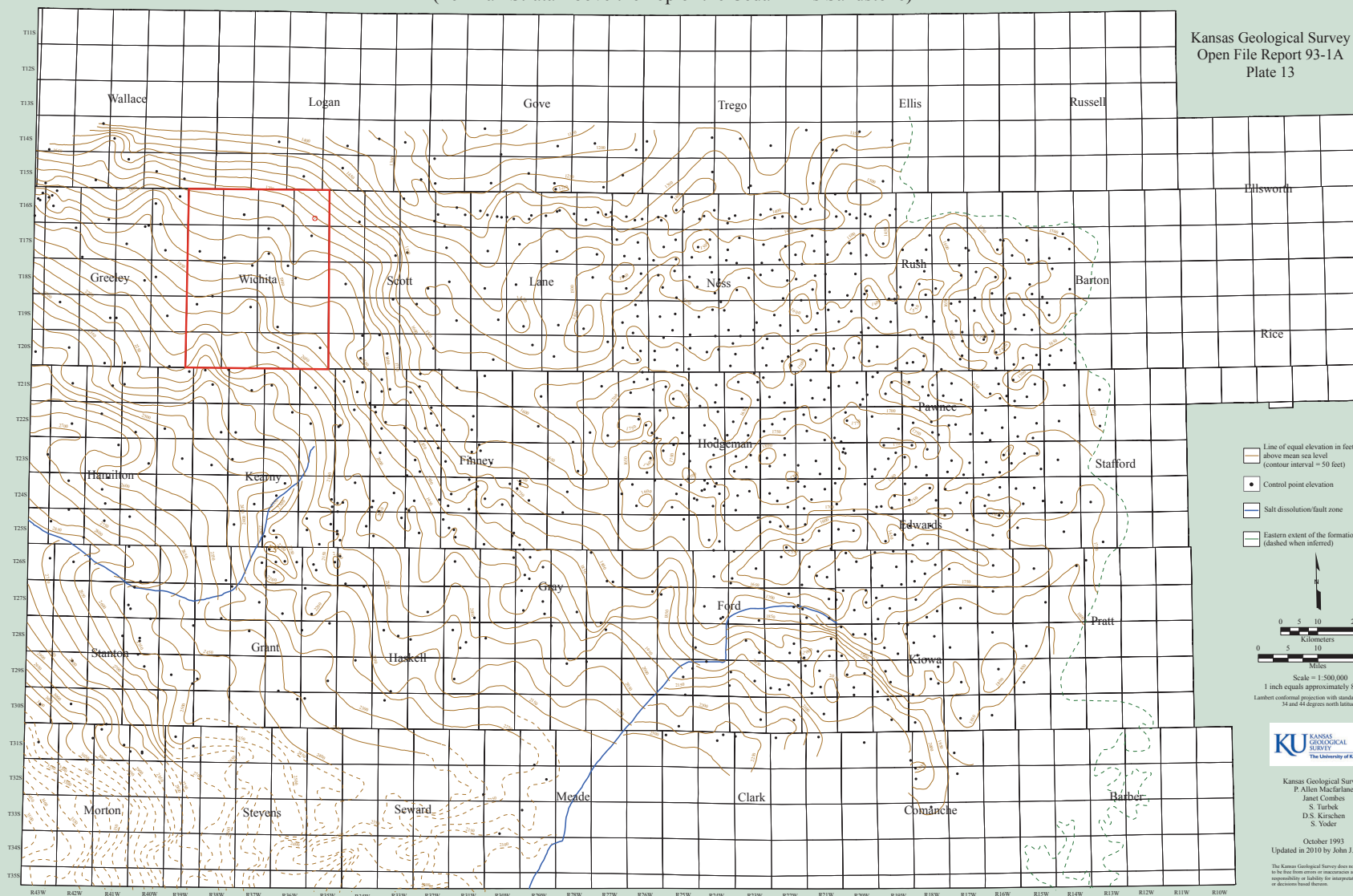
Kansas Geological Survey
Open File Report 93-1A
Plate 11



Top Configuration of the Upper Permian-Pennsylvanian Aquitard

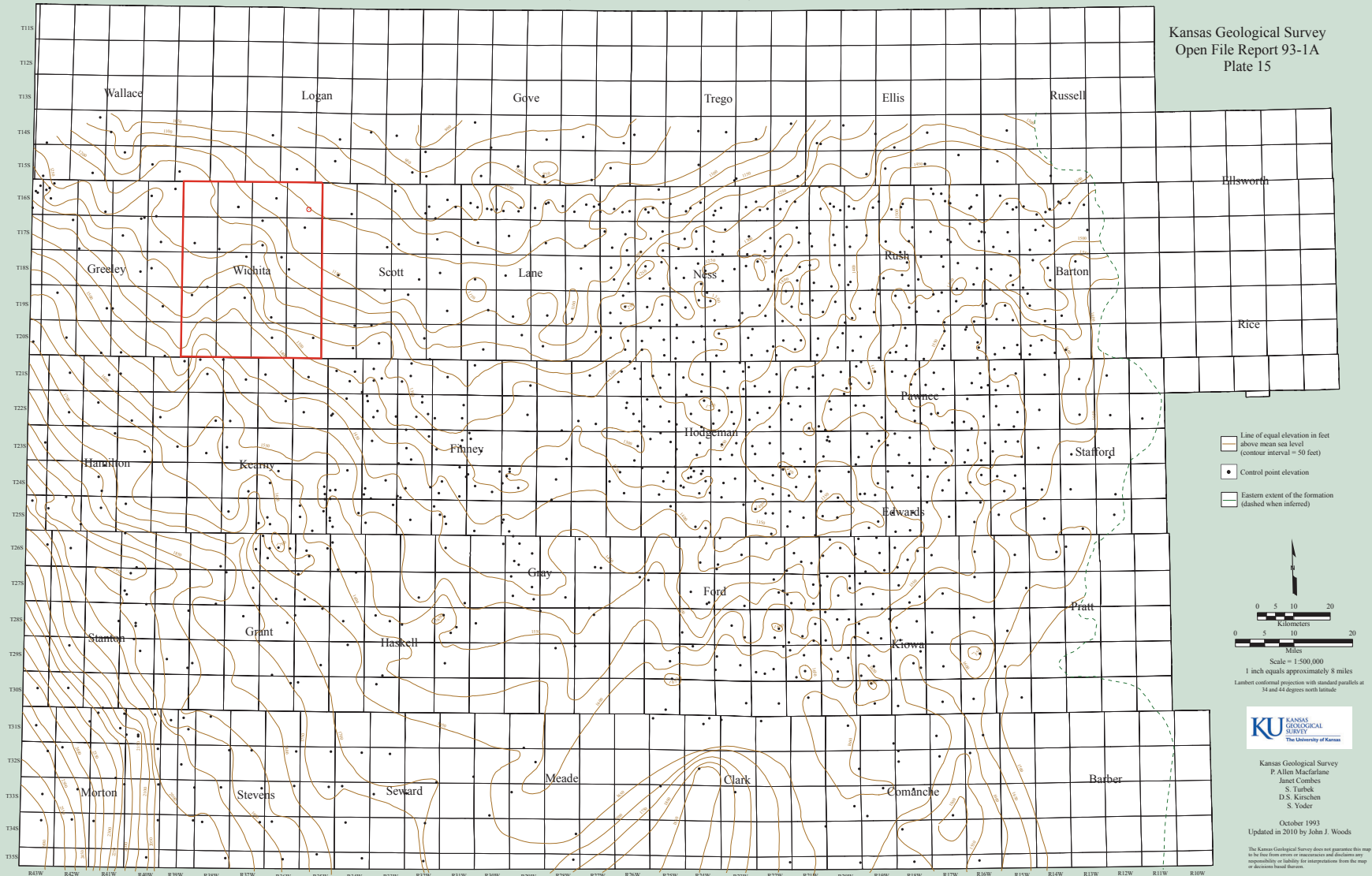
(Permian Strata Above the Top of the Cedar Hills Sandstone)

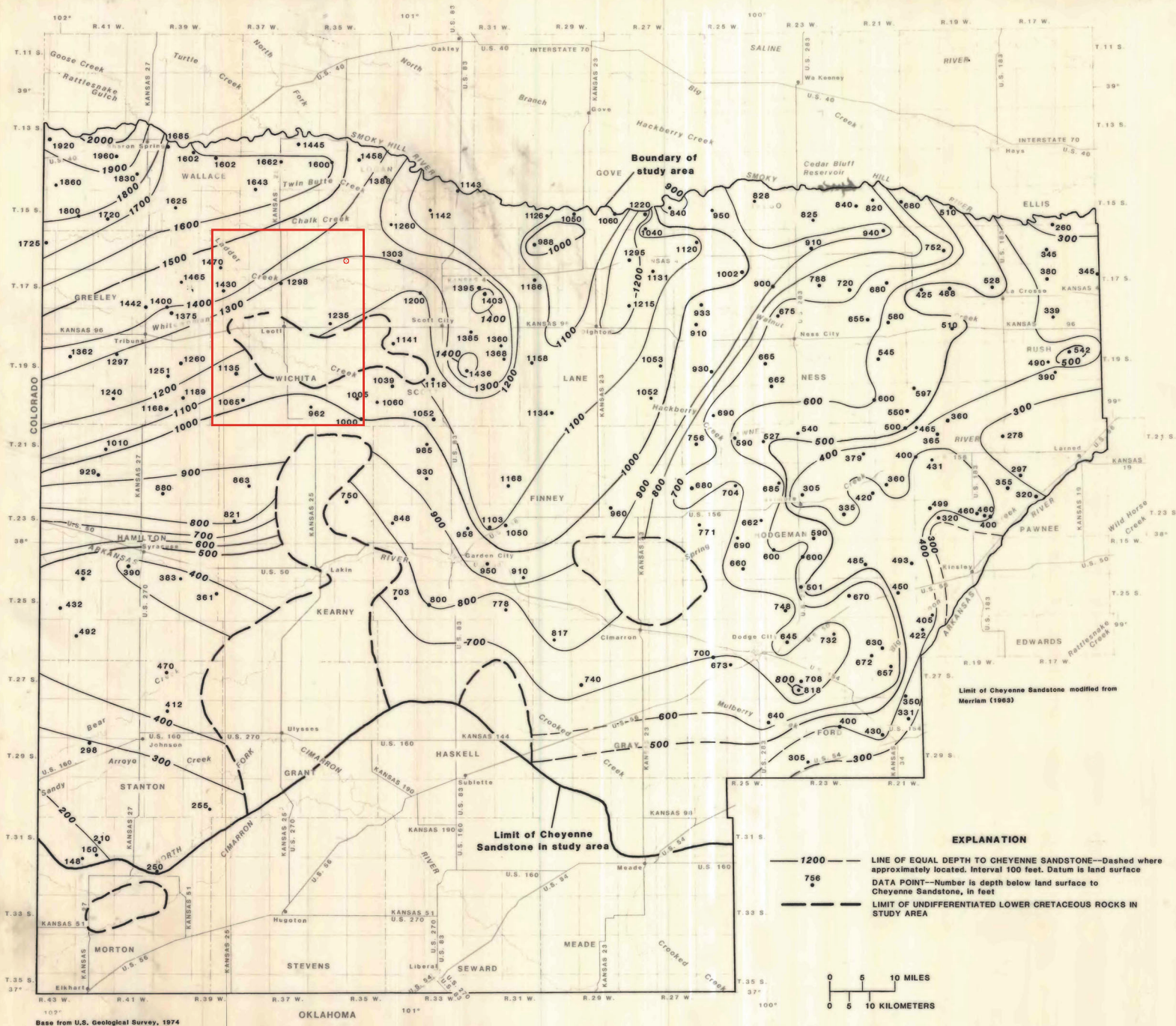
Kansas Geological Survey
Open File Report 93-1A
Plate 13



Top Configuration of the Cedar Hills Sandstone Aquifer (Cedar Hills Sandstone)

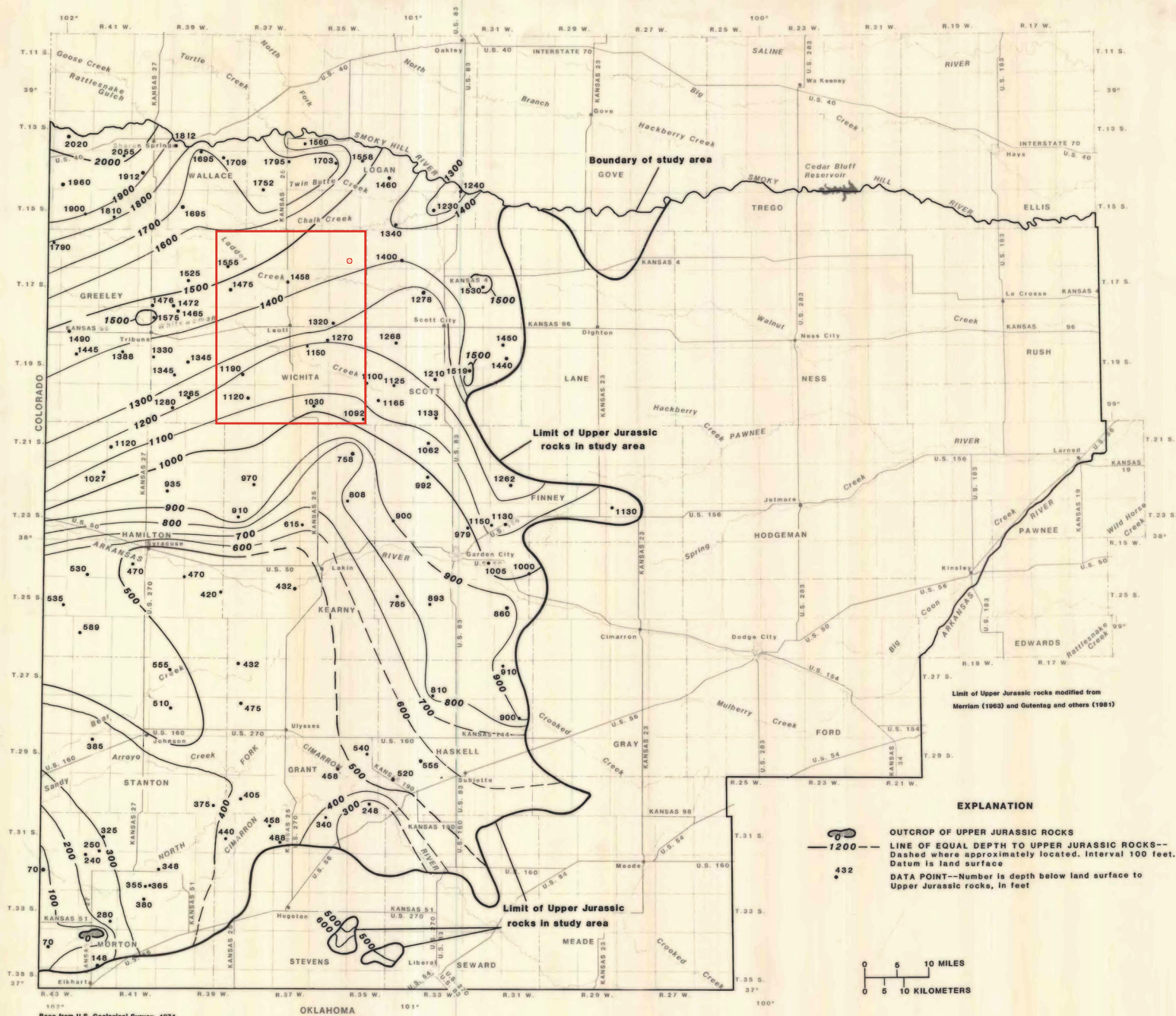
Kansas Geological Survey
Open File Report 93-1A
Plate 15





MAP SHOWING DEPTH BELOW LAND SURFACE TO CHEYENNE SANDSTONE, SOUTHWESTERN KANSAS

By
Jack Kume and Joseph M. Spinazola
1983

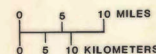


Upper Jurassic rocks occur in the western one-half of the study area. They crop out in Morton County. The upper Jurassic rock surface is deepest in Wallace County where it is about 2,000 feet below the land surface. In about one-third of the subcrop area, upper Jurassic rocks are less than 600-feet deep.

Limit of Upper Jurassic rocks modified from Merriam (1963) and Gutentag and others (1981)

EXPLANATION

- OUTCROP OF UPPER JURASSIC ROCKS
- LINE OF EQUAL DEPTH TO UPPER JURASSIC ROCKS--
Dashed where approximately located. Interval 100 feet.
Datum is land surface
- DATA POINT--Number is depth below land surface to upper Jurassic rocks, in feet



MAP SHOWING DEPTH BELOW LAND SURFACE TO UPPER JURASSIC ROCKS, SOUTHWESTERN KANSAS

By
Jack Kume and Joseph M. Spinazola
1983

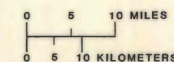


SELECTED REFERENCES

- Gutentag, E. D., Lohmeyer, D. H., and Slagle, S. E., 1981, Geohydrology of southwestern Kansas: Kansas Geological Survey Irrigation Series 7, 73 p.
- Keene, K. M., and Bayne, C. K., 1977, Ground water from Lower Cretaceous rocks in Kansas: Kansas Geological Survey Chemical Quality Series 5, 16 p.
- Kume, Jack, and Spinazola, J. M., 1982, Geohydrologic data from sandstone aquifers in southwestern Kansas: U.S. Geological Survey Open-File Report 82-868, 112 p.
- , 1984, Geohydrology of sandstone aquifers in southwestern Kansas: Kansas Geological Survey Irrigation Series (in press).
- Lohmeyer, D. H., and Weakly, E. C., 1979, Water in the Dakota Formation, Hodgeman and northern Ford Counties, southwestern Kansas: Kansas Geological Survey Irrigation Series 5, 41 p.
- Merriman, D. F., 1963, The geologic history of Kansas: Kansas Geological Survey Bulletin 162, 317 p.
- Zeller, D. E., 1968, The stratigraphic succession in Kansas: Kansas Geological Survey Bulletin 189, 31 p.

EXPLANATION

- OUTCROP OF UPPER PERMIAN ROCKS**
- 1200 —** LINE OF EQUAL DEPTH TO UPPER PERMIAN ROCKS --
Dashed where approximately located. Interval 100 feet.
Datum is land surface
- 662** DATA POINT--Number is depth below land surface to
Upper Permian rocks, in feet



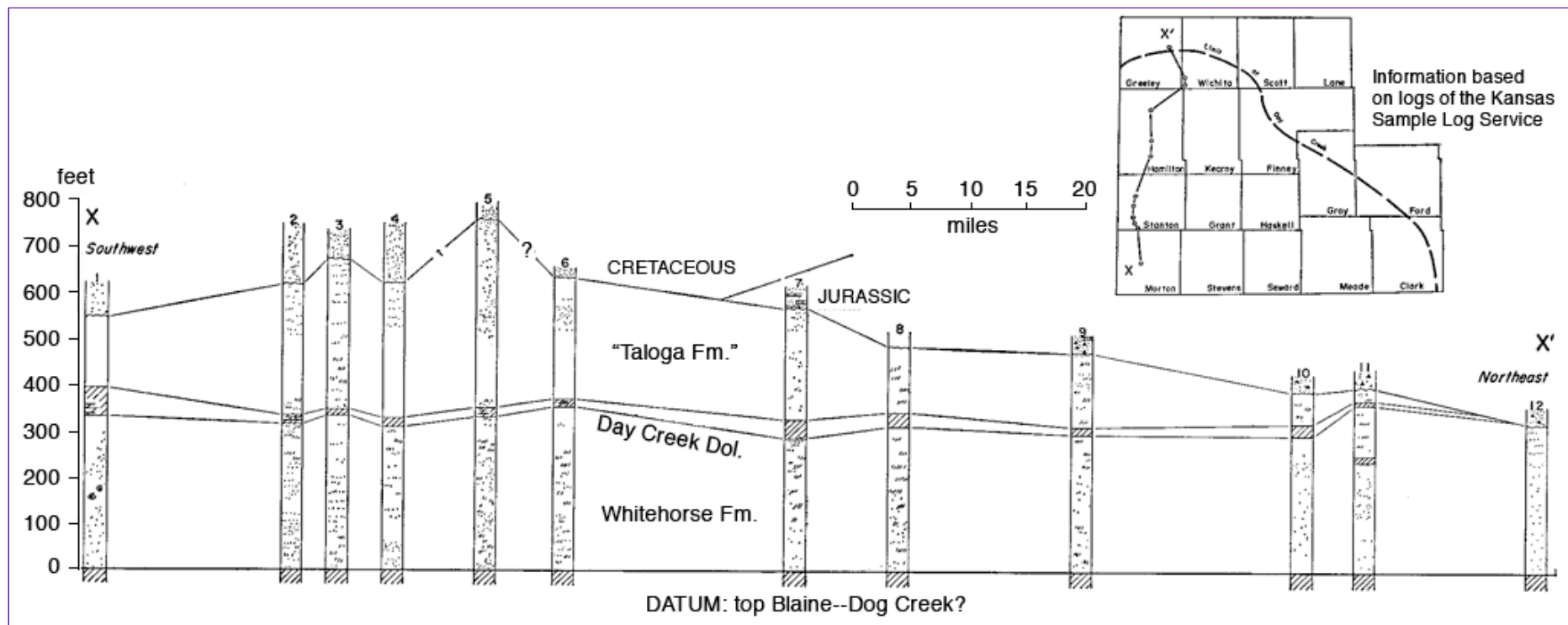
1983

Geologic History of Kansas

[Back to Upper Permian...](#)

Figure 36

Figure 36--Southwest-northeast cross section showing stratigraphic relations of beds in upper Permian in southwestern Kansas. Note uniform thickness of Whitehorse Formation, lateral persistence of Day Creek Dolomite, which is mostly anhydrite, and northward thinning of "Taloga Formation" by post-Permian erosion.



[Back to Upper Permian...](#)

[Kansas Geological Survey](#), Geologic History of Kansas

Comments to webadmin@kgs.ku.edu

Web version May 2006. Original publication date Dec. 1963.

URL=<http://www.kgs.ku.edu/Publications/Bulletins/162/fig036.html>

Kelcey Marsh [KCC]

From: Kenny Sullivan [KCC]
Sent: Thursday, October 16, 2025 6:09 PM
To: Kelcey Marsh [KCC]
Subject: Fw: Dakota Aquifer

Get [Outlook for iOS](#)

From: Whittemore, Donald O. <dwhitt@ku.edu>
Sent: Thursday, October 16, 2025 5:30 PM
To: Kenny Sullivan [KCC] <Kenny.Sullivan@ks.gov>
Cc: Andrzejewski, Kate Alexandra <k173r221@ku.edu>; Kalbas, Jay <jaykalbas@ku.edu>
Subject: RE: Dakota Aquifer

EXTERNAL: This email originated from outside of the organization. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Kenny,

Based on the elevation of the land surface from the USGS topographic map (~3200 ft) and the depth of the sand sample (1450'), the elevation of the sand sample is ~1750'. The maps to which I referred indicate that the top of the Morrison-Dockum at the well location is ~1795' and the top of the underlying Pennsylvanian-Permian aquitard is ~1715'. Thus, the sand appears to be from around the middle of the Morrison-Dockum.

The text for the maps (https://www.kgs.ku.edu/Hydro/Publications/1993/OFR93_1a/index.html) includes the following description of the Morrison-Dockum (Jurassic and Triassic Systems):

"Strata within this mapping unit may belong to either the Dockum Group, the Entrada Sandstone, or the Morrison Formation. Neither the Dockum Group nor the Entrada Sandstone are officially recognized stratigraphic units in Kansas. Maclachlan (1972) describes the Dockum as consisting of distinct upper and lower portions. **The lower portion of the Dockum Group consists of orange-red, fine- to medium-grained sandstone.** Thin beds of coarse-grained sandstone, conglomeratic mudstone, limestone, and dolomite are common in this interval. The upper part of the Dockum consists of variegated mudstone interbedded with sandy mudstone, marlstone, limestone, dolomite, and sandstone. Limestone and dolomite pebbles are reported to be abundant at some localities. **The Entrada Sandstone in Baca County, Colorado, consists of massive beds of white, friable, very fine to medium extensively cross-bedded quartzose sandstone** and a few thin discontinuous layers of shale and siltstone (McLaughlin, (1954). The Morrison Formation consists of shale, sandstone, and limestone with minor amounts of chert and anhydrite (Merriam, 1955; Doveton and Chang, 1991).

Based on this information it appears that the sand is from either the lower part of the Dockum Group or from the Entrada Sandstone.

Hope this is helpful.

Don

From: Kenny Sullivan [KCC] <Kenny.Sullivan@ks.gov>
Sent: Thursday, October 16, 2025 1:39 PM
To: Whittemore, Donald O. <dwhitt@ku.edu>
Subject: RE: Dakota Aquifer

Thank you for that, the well is located in SW Sec. 27-T16S-R35W in Wichita County. The sand came from 1450' below surface.

From: Whittemore, Donald O. <dwhitt@ku.edu>
Sent: Thursday, October 16, 2025 12:58 PM
To: Kenny Sullivan [KCC] <Kenny.Sullivan@ks.gov>
Cc: Andrzejewski, Kate Alexandra <k173r221@ku.edu>; Kalbas, Jay <jaykalbas@ku.edu>
Subject: RE: Dakota Aquifer

EXTERNAL: This email originated from outside of the organization. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Kenny,

I think that the best way to start is to determine the strata from where the quartz sandstone was recovered based on location and depth. Allen Macfarlane and others produced a set of 18 plates of the top configurations and thickness of Cretaceous, Jurassic and Triassic, and Permian strata in southwestern Kansas – see the following link:

https://www.kgs.ku.edu/Hydro/Publications/1993/OFR93_1a/index.html

Do you have the location and specific depth from which the sand was recovered?

Don

From: Kenny Sullivan [KCC] <Kenny.Sullivan@ks.gov>
Sent: Thursday, October 16, 2025 10:13 AM
To: Whittemore, Donald O. <dwhitt@ku.edu>
Subject: FW: Dakota Aquifer

From: Kenny Sullivan [KCC]
Sent: Thursday, October 16, 2025 10:12 AM
To: Don Whittemore <dwhitt@home.ku.edu>
Subject: Dakota Aquifer

Dr. Whittemore-

I hope this email finds you well. I am not sure if you are the right person to reach out to or not, but we have recovered sand from an oil well we believe could be part of the Dakota Aquifer System. It is a gray/buff very fine quartz sandstone. I was just wondering if you knew if the Survey had any cuttings from the system in Southwest Kansas? Its likely from the lower portion of the aquifer, possibly Cheyenne. Anyways we are hoping to be able to identify the sample if we can. I can send you a picture of it if that would help? I know that isn't precise, but it might help.

Please let me know you thoughts.

Sincerely-

Kenny Sullivan, P.G.
District Supervisor

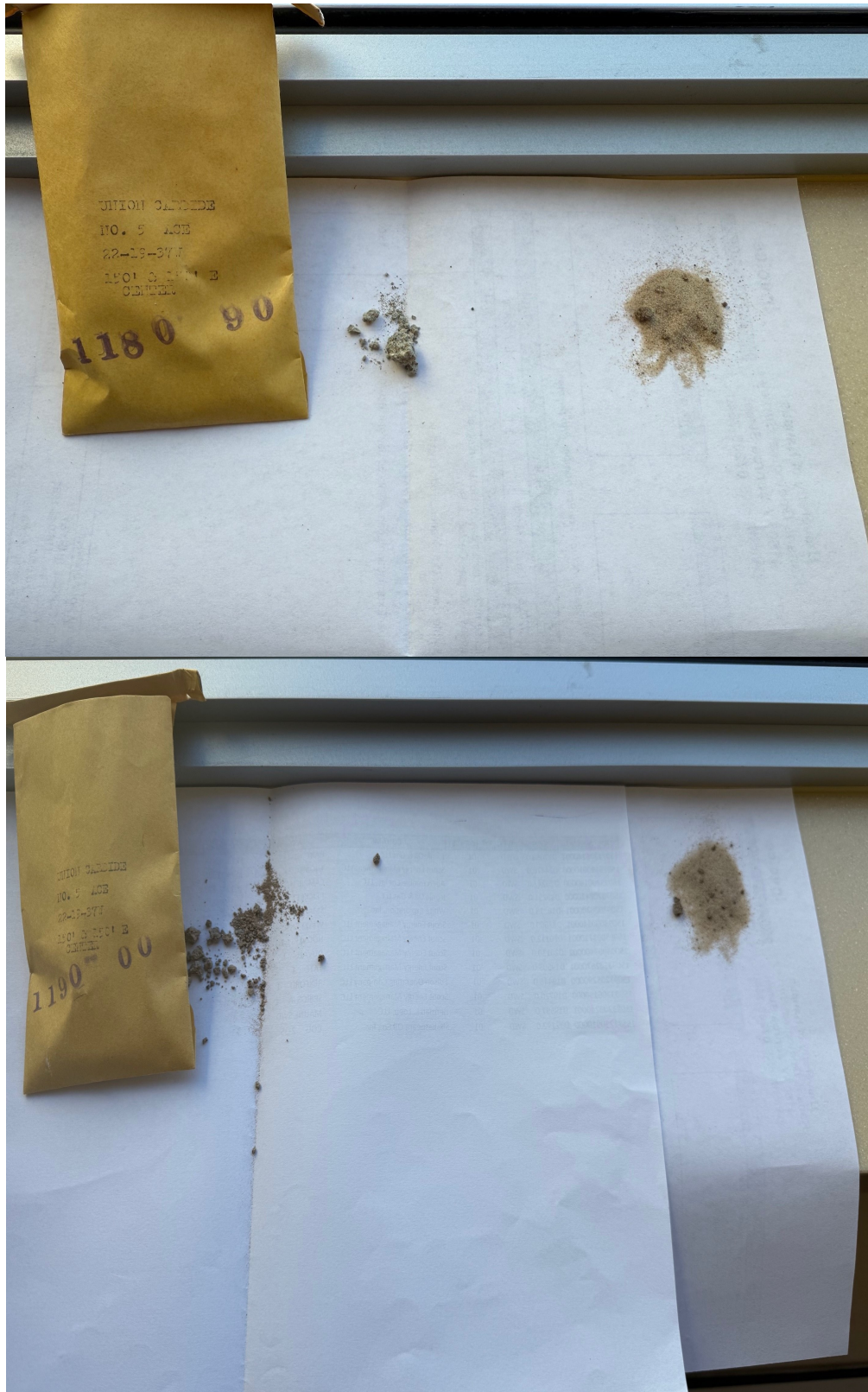


Conservation Division District 1
Kansas Corporation Commission
210 E. Frontview, Ste A | Dodge City, KS | 67801
Phone (620) 682-7928 | <http://kcc.ks.gov/>

This transmission, email and any files transmitted with it, may be: (1) subject to the Attorney-Client Privilege, (2) an attorney work product, or (3) strictly confidential under federal or state law. If you are not the intended recipient of this message, you may not use, disclose, print, copy or disseminate this information. If you have received this transmission in error, notify the sender (only) and delete the message. This message may also be subject to disclosure under the KORA, K.S.A. 2010 Supp. 45-215 et seq.



Cuttings from the AEC Test Hole #5 NE Sec. 22-T19S-R37W
Wichita County, KS. The sample on the left is from a depth of
1,270' to 1,280' and the sample on the right is from a depth of
1,290' to 1,300'



The sample on the right is sample collected from the Wells #2-27 upper perforations
The samples on the left are cuttings from the AEC Test Hole #5 in NE Sec. 22-T19S-R37W Wichita
County, KS. Per KGS Maps these samples would be from the Morrison Formation. The samples
when crushed were very similar to the sample from the Wells #2-27.

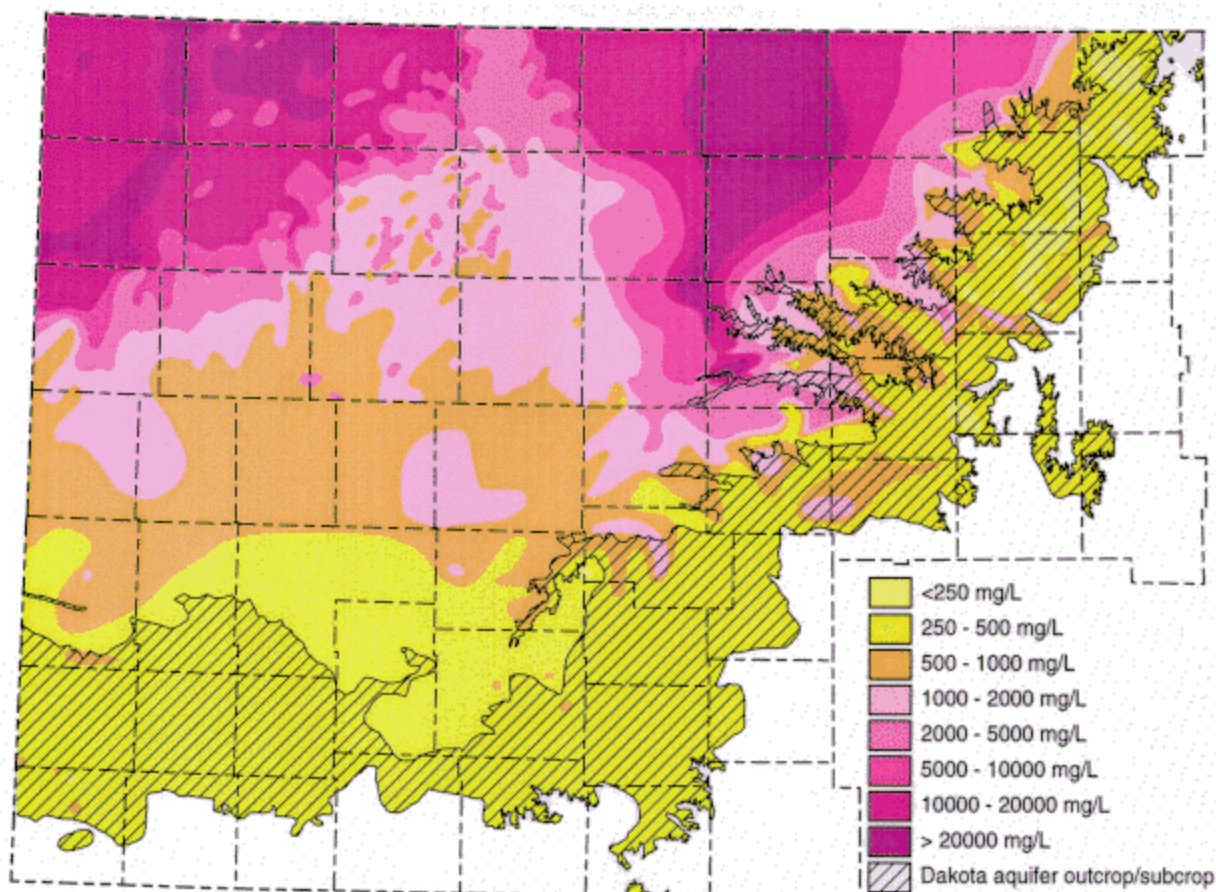


Kansas Geological Survey, Open-File Rept. 96-1a
[Proposed Management Areas](#)--Page 5 of 16

Dakota Aquifer Water Quality

Figure 3 shows the distribution of total-dissolved solids concentrations in the upper Dakota aquifer. The present salinity pattern of Dakota waters is mainly dependent on the rate at which freshwater is able to enter from above and along the long flow paths in the aquifer in comparison with the rate of saltwater intrusion from the underlying Permian rocks. In some regions the saltwater is able to more rapidly intrude into the bottom of the Dakota, such as in parts of central to north-central Kansas where the Dakota directly overlies the Cedar Hills Sandstone (Figure 1). In northwest Kansas the thickness of the confining units is great and the flow of freshwater throughflow is low. The Dakota rocks contain saltwater in both of these regions. Surface recharge along the outcrop belt of the Dakota aquifer in southeast Colorado and central Kansas occurs at a much greater rate than underlying saltwater intrusion, resulting in essentially complete flushing of any previous saltwater. Fresh recharge flowing through the Dakota sandstones in southwest Kansas have also removed nearly all salinity. The freshwater flowing through sandstones in the confined aquifer between northwest and central Kansas has removed much of the saltwater but enough dissolved salt remains to make much of the water slightly to moderately saline. As a result, the age of ground water ranges from 10s to 100s of thousands of years nearer the outcrop/subcrop belt and may exceed a million years in far northwest Kansas ([Macfarlane et al., 1995](#)). In general, the greater that distance from the edge of the confining zone, the greater the salinity.

Figure 3. Distribution of total dissolved solids (TDS) concentrations in ground waters in the Dakota aquifer in western and central Kansas. Water less than 1000 mg/L TDS is defined as fresh. Water with 1000-2000 mg/L TDS is usable for many purposes but is less desirable than freshwater. A concentration of 10,000 mg/L TDS is defined in the state regulations of the Kansas Corporation Commission as the upper limit of usable water; above 10,000 mg/L a water is classified as unusable or mineralized.



Ground water in the areas of the upper Dakota aquifer with high TDS or salinity (greater than 5,000 mg/L) shown in Figure 3 are of sodium-chloride type. Waters in the area of the confined aquifer with 500-2,000 mg/L TDS are generally soft (low calcium and magnesium content), sodium-bicarbonate in chemical type, and usually have elevated fluoride concentrations. Ground water with 2,000 to 5,000 mg/L TDS in the confined area are typically transitional between sodium-bicarbonate and sodium-chloride type. Waters in the outcrop and subcrop areas with less than 500 mg/L TDS are usually of calcium bicarbonate and sometimes of calcium, magnesium-bicarbonate type. Concentrations of TDS between 500 and 2,000 mg/L in waters in the outcrop/subcrop areas are often due to high calcium and sulfate levels such that the waters can be calcium-sulfate in type. Elevated sulfate concentrations can also produce sulfate type waters in less saline portions of the confined aquifer.

Where saline waters exist in the Dakota aquifer or in underlying strata, the salinity in the Dakota aquifer generally increases with depth. The rate of change with depth is seldom uniform; TDS is often substantially greater below low permeability layers which impede the upward movement of salinity. This is especially true where the Kiowa Formation is mainly shale and separates saltwater in the Cheyenne Sandstone from fresh or much less saline water in the overlying Dakota Formation.

[Previous page--Ground-Water Flow Patterns](#) || [Next page--Local Effects of Well Pumping](#)
[Start of this report](#) || [Table of Contents](#)

Kansas Geological Survey, Dakota Aquifer Program
 Original report available from the Kansas Geological Survey.
 Electronic version placed online July 1996
 Scientific comments to [P. Allen Macfarlane](mailto:P.Allen.Macfarlane@kgs.ku.edu)
 Web comments to webadmin@kgs.ku.edu
 URL=<http://www.kgs.ku.edu/Dakota/vol3/ofr961a/man05.htm>

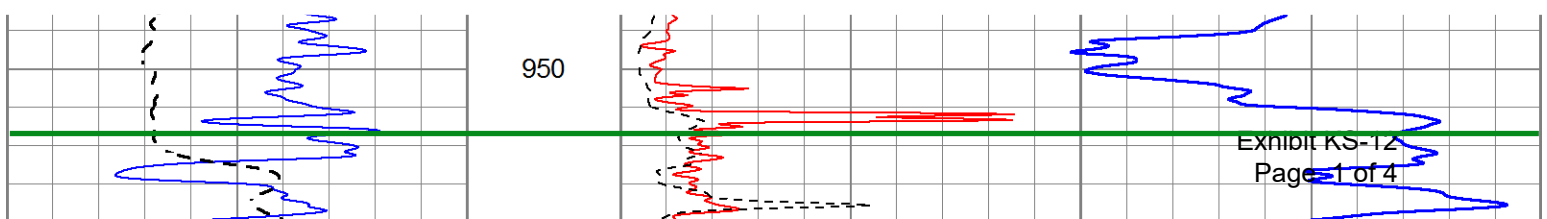
Exhibit KS-12

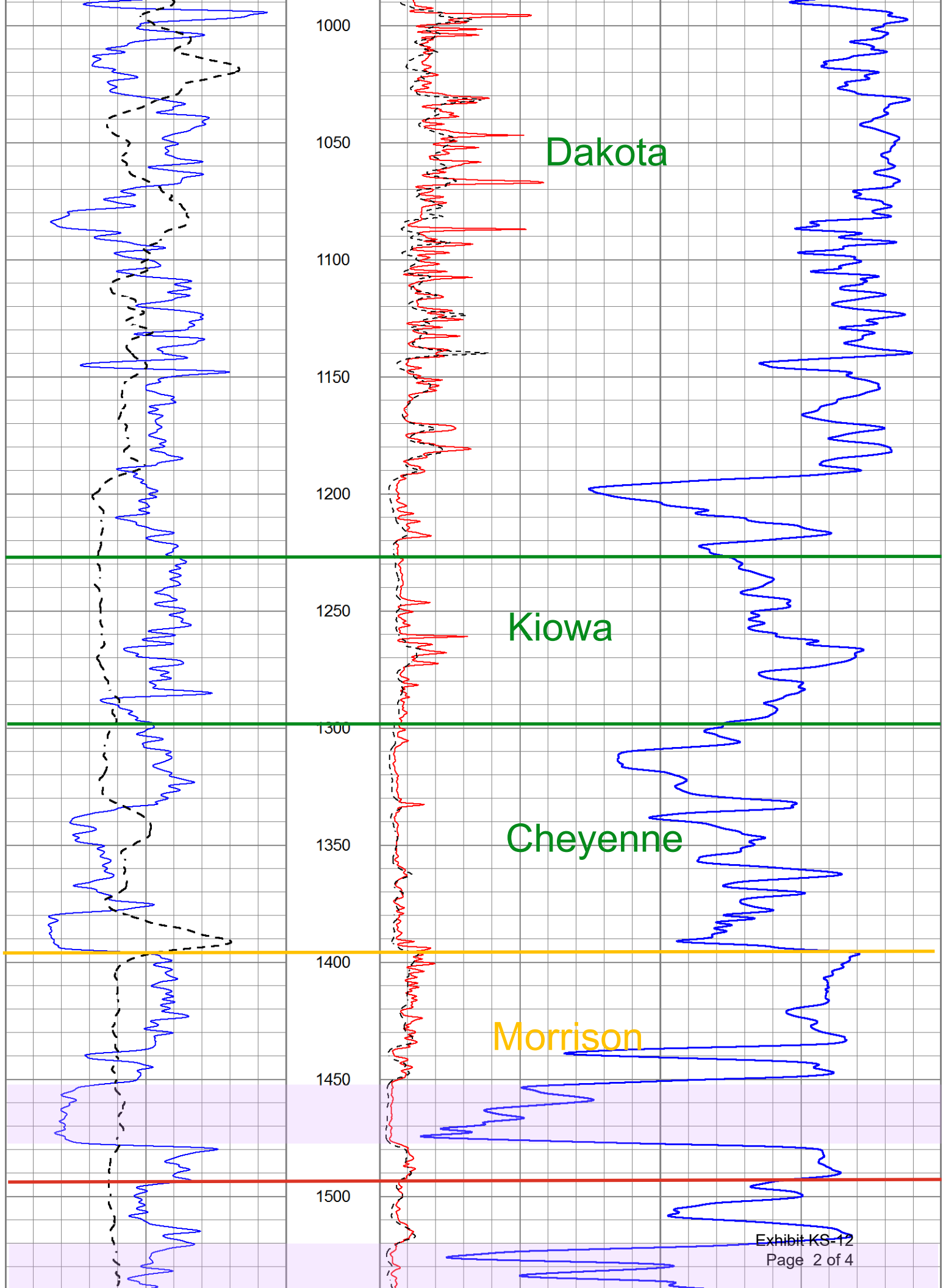
The lines and font in **green** represent the Cretaceous Formations

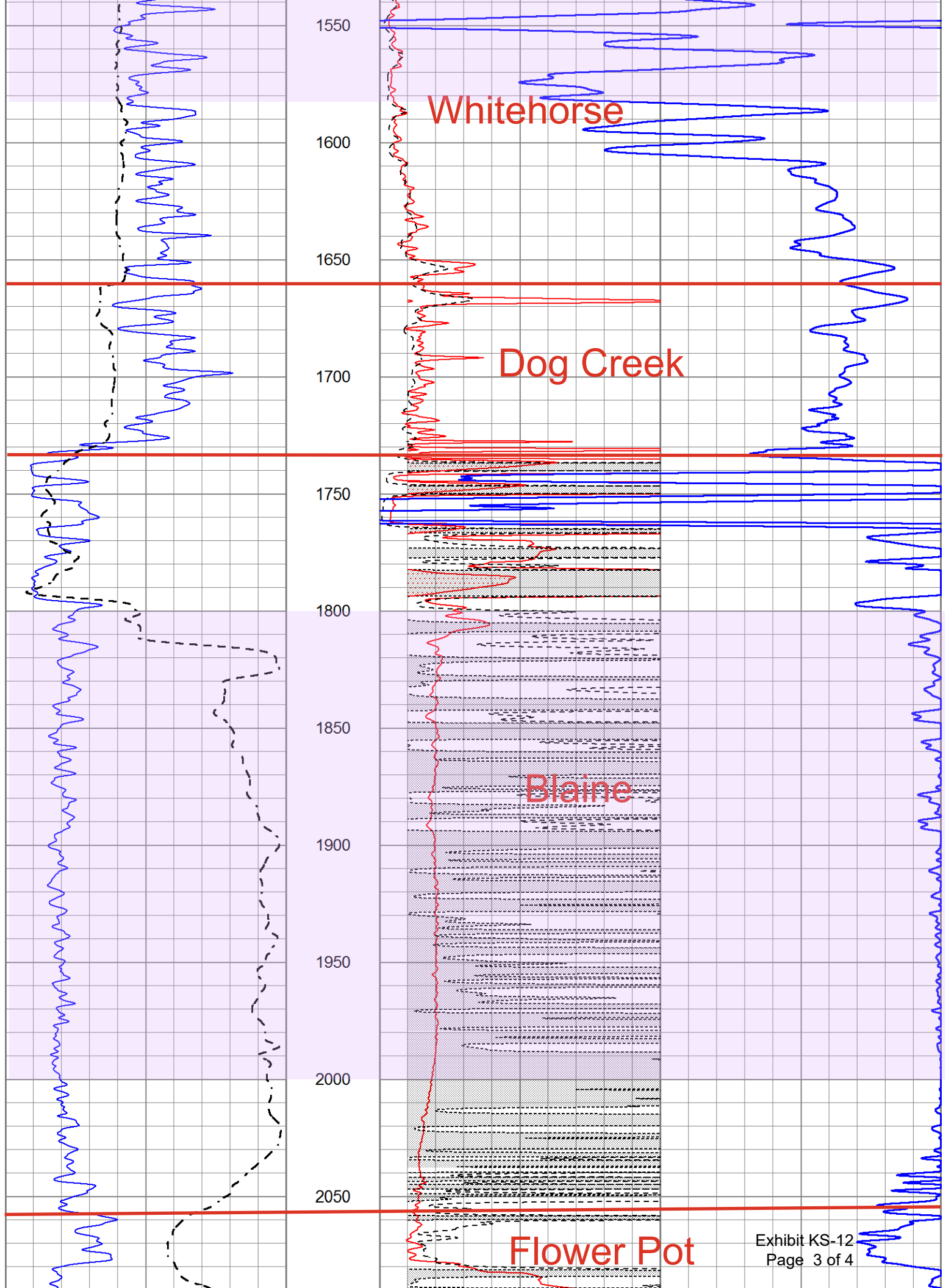
The lines and font in **yellow** represent the Jurassic Formation

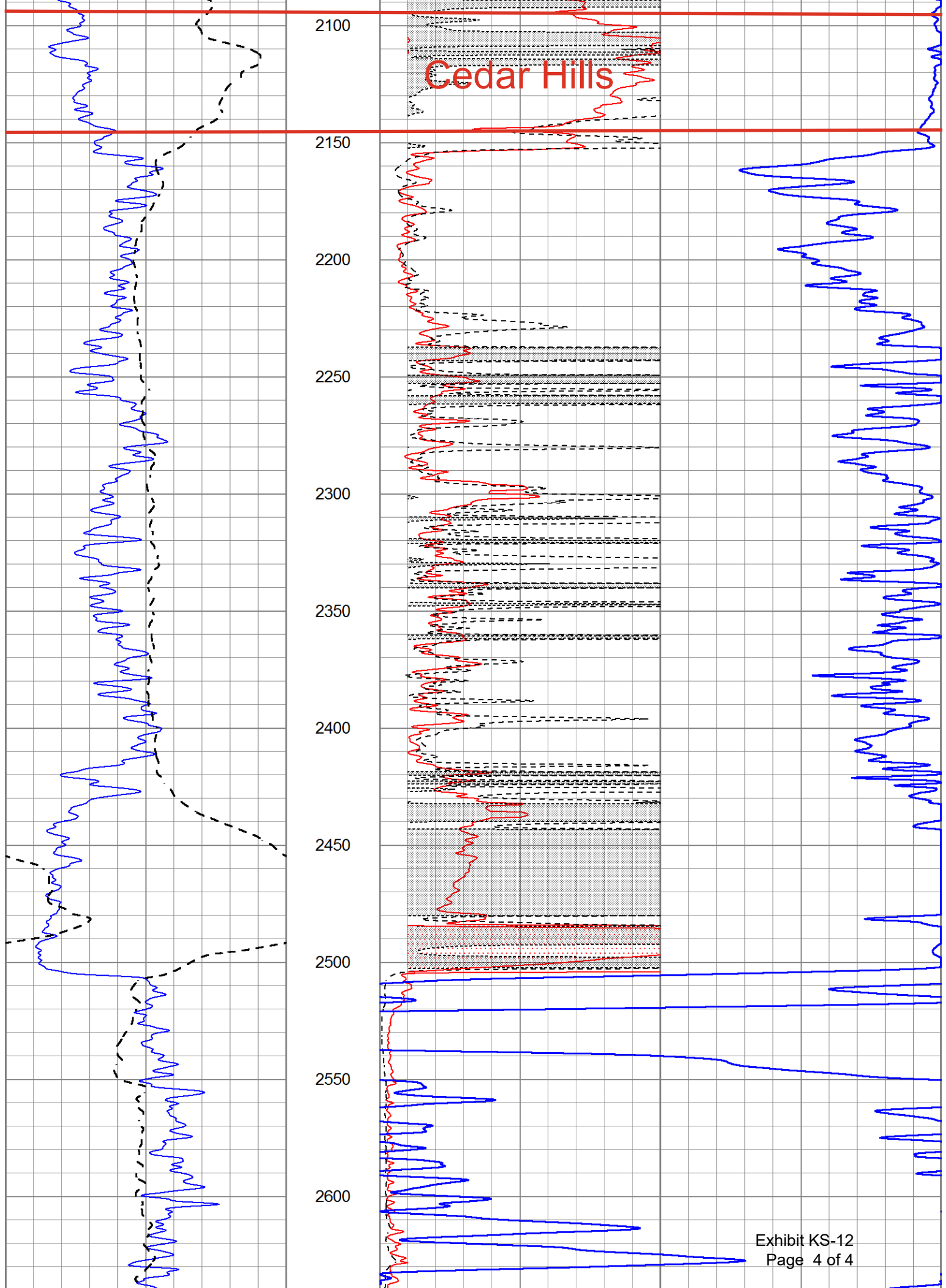
The lines and font in **red** represent the Permian Formations

The areas highlighted in **purple** represent the perforated intervals in the wellbore









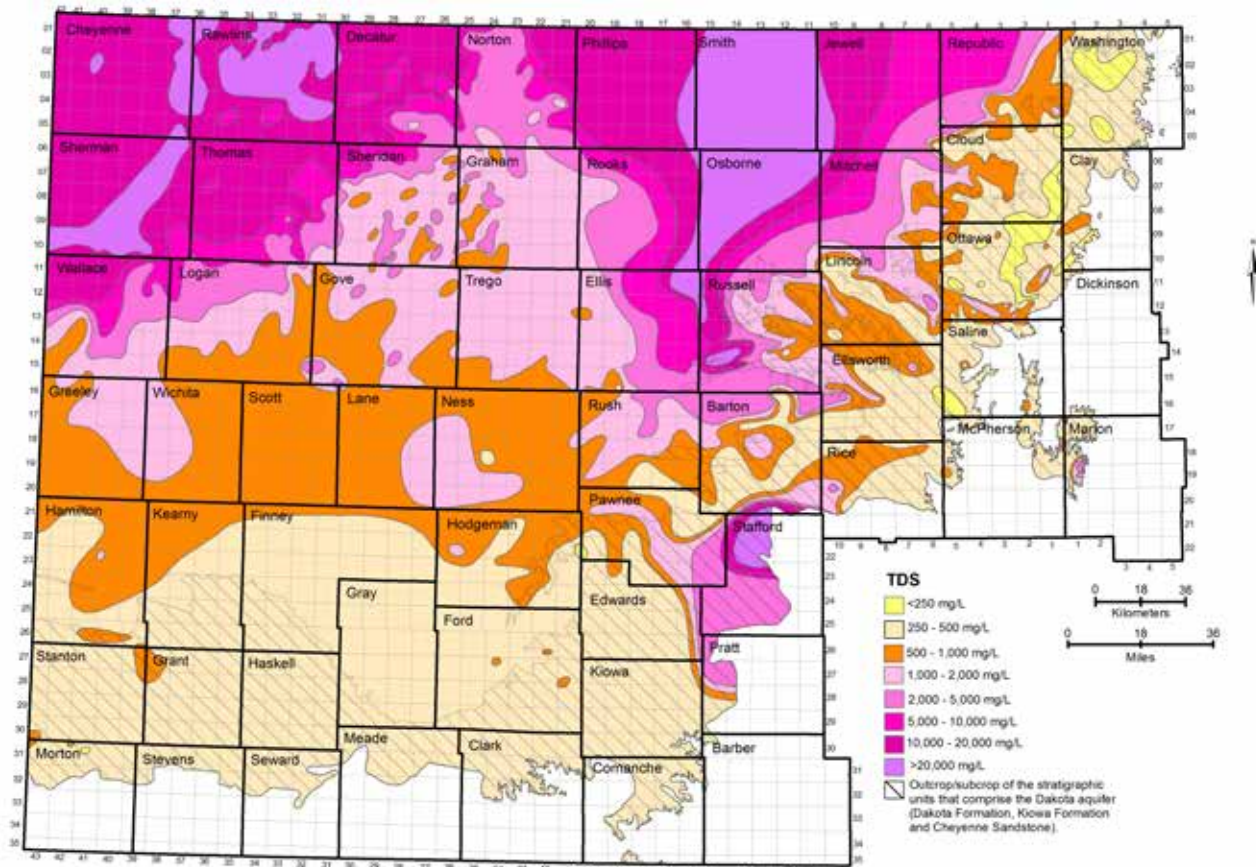


Figure 17. Distribution of total dissolved solids concentration in groundwaters in the upper Dakota aquifer.

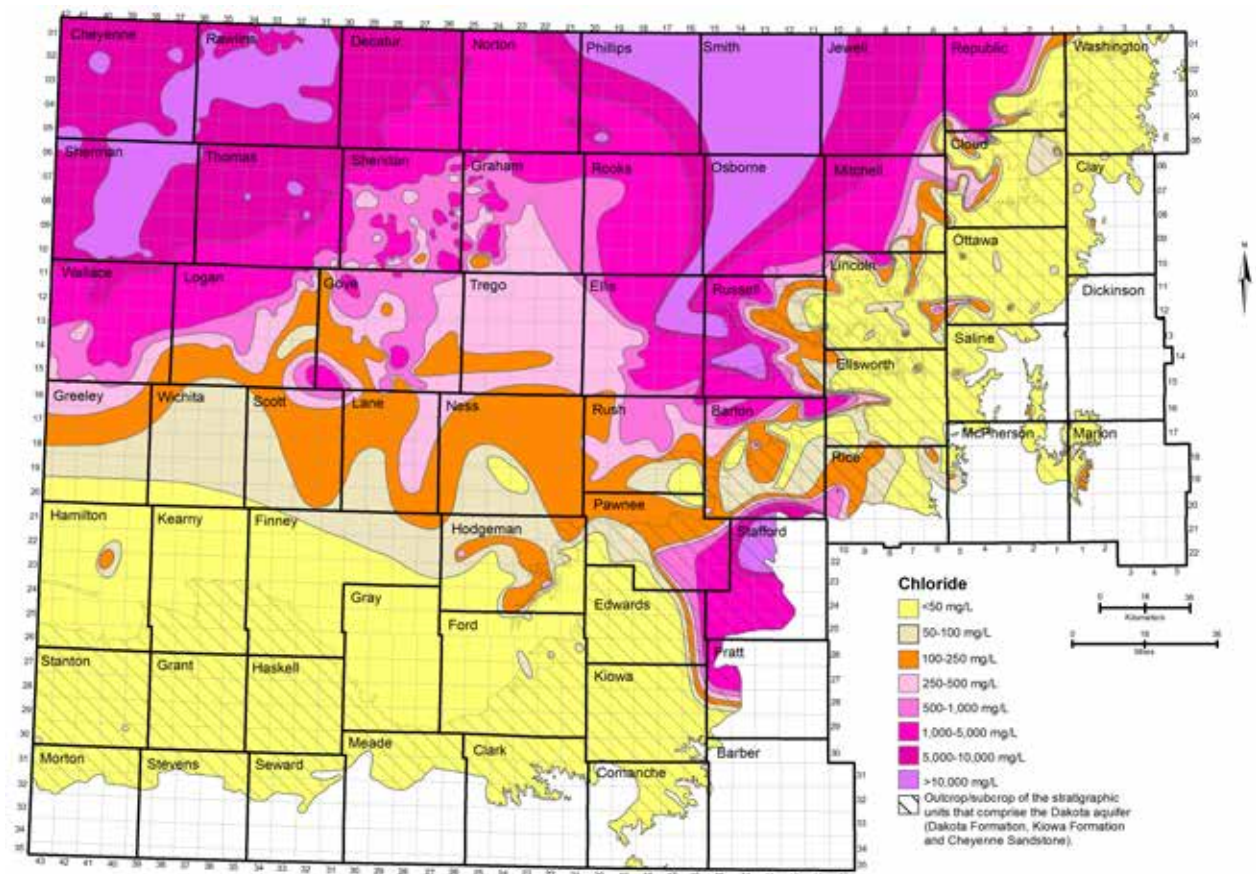


Figure 18. Distribution of chloride concentration in groundwaters in the upper Dakota aquifer.

Table 5.--Summary of chemical analyses of water from the Jurassic, Cheyenne, and Dakota aquifers
[Concentrations given in milligrams per liter (mg/L), except as noted]

Chemical constituent or physical property	Recommended maximum for public supply ^{1/}	JURASSIC AQUIFER Value or concentration					CHEYENNE AQUIFER Value or concentration					DAKOTA AQUIFER Value or concentration				
		Number of analy- ses	Minimum	Maximum	Mean	Median	Number of analy- ses	Minimum	Maximum	Mean	Median	Number of analy- ses	Minimum	Maximum	Mean	Median
Specific conductance (micromhos) ^{2/}	--	6	5,200	9,300	7,400	7,850	6	670	17,500	4,248	825	30	400	4,300	1,195	640
pH (standard units)	6.5-8.5	-	--	--	--	--	4	8.3	8.5	8.4	8.4	24	6.3	8.8	7.5	7.6
Temperature (°C) ^{3/}	--	6	19.5	26.5	22.4	20.8	6	17.5	25.5	20.9	19.5	30	16.0	23.0	18.3	18.0
Hardness (as CaCO ₃ , total)	--	6	520	1,600	963	815	5	8	260	113	65	26	8	2,000	282	180
Hardness (as CaCO ₃ , noncarbonate)	--	-	--	--	--	--	2	0	0	0	0	18	0	1,600	157	24
Calcium (Ca)	--	5	180	540	326	210	5	3.2	44	18	17	26	3.2	570	69	47.5
Magnesium (Mg)	--	6	0	58	26.5	22	5	0	40	16	5.5	26	0	170	31	19
Sodium (Na)	--	6	680	1,900	1,298	1,400	5	130	4,900	1,336	180	26	18	540	148	69.5
Sodium-adsorption-ratio (SAR)	--	6	7.5	32	21	24.5	5	6.8	143	47	26	26	0.6	35	7.0	2.0
Potassium (K)	--	6	0.1	37	24	27.5	5	3.0	41	16	6.6	26	3.0	18	6.2	5
Potassium 40 (K40) (pCi/L) ^{4/}	--	3	0.1	25	14	16	-	--	--	--	--	1	4.0	4.0	4.0	4.0
Bicarbonate (HCO ₃)	--	-	--	--	--	--	2	290	330	310	310	9	180	390	253	230
Carbonate (CO ₃)	--	-	--	--	--	--	2	0	0	0	0	9	0	10	1.1	0
Alkalinity (CaCO ₃)	--	-	--	--	--	--	3	220	270	243	240	23	140	380	217	190
Sulfate (SO ₄)	250	6	1,000	3,900	2,467	2,600	5	110	7,200	1,972	130	26	24	2,000	295	120

Chloride (Cl)	250	6	190	3,100	922	275	5	14	2,800	642	21	25	6.0	530	68	15
Fluoride (F)	1.4-2.4	6	0.3	1.0	0.7	0.8	5	0.9	2.3	1.9	2.0	23	0.5	3.3	1.6	1.5
Bromide (Br)	--	3	0	2.4	1.0	0.7	3	0.1	0.5	0.3	0.3	6	0	0.1	0.8	0.1
Iodide (I)	--	3	0.02	0.09	0.05	0.04	3	0.04	0.19	0.09	0.05	6	0.02	0.44	0.10	0.03
Silica (SiO ₂)	--	6	1.6	23	12	12	5	3.6	12	9.5	11	25	7	31	12	10
Dissolved solids (sum)	500	3	4,480	6,210	5,527	5,890	5	460	15,100	4,190	500	21	273	3,280	728	390
Nitrate (as N)	10	3	0	23	8.1	1.3	2	0.4	0.4	0.4	0.4	16	0	12	2.5	0.5
Boron (B)(μ g/L) ^{5/}	--	3	280	1,100	787	980	3	600	1,700	1,233	1,400	9	42	610	322	300
Cadmium (Cd)(μ g/L) ^{5/}	10	1	380	380	380	380	1	0	0	0	0	10	0	1.0	0.1	0
Lithium (Li)(μ g/L) ^{5/}	--	3	100	810	473	810	3	60	1,500	740	660	6	60	310	142	90
Organic carbon (C)	--	3	8	38	23	23	3	4.1	18	9.7	7.1	6	0.3	6.6	3.0	2.5
Ratios by weight:																
Potassium to sodium	--	6	0.0001	0.0195	0.0218	0.0246	5	0.0084	0.0508	0.0234	0.0177	26	0.0130	0.1667	0.0733	0.0734
Lithium to sodium	--	3	.0001	.0005	.0003	.0003	3	.0003	.0005	.0004	.0005	6	.0004	.0008	.0005	.0005
Sulfate to chloride	--	6	.3230	20.5263	9.8309	9.4576	5	2.5714	8.5714	6.3159	6.3889	25	.6604	18.7500	7.5070	7.7122
Fluoride to chloride	--	6	.0003	.0042	.0019	.0011	5	.0003	.1643	.0835	.1048	22	.0043	.2500	.0940	.0860
Bromide to chloride	--	3	0	.0086	.0029	.0002	3	.0002	.0071	.0027	.0008	6	0	.0167	.0045	.0012
Iodide to chloride	--	3	0	.0002	.0001	.0001	3	.0001	.0029	.0010	.0001	6	.0001	.0050	.0016	.0008
Boron to chloride	--	3	.0004	.0052	.0022	.0010	3	.0006	.0429	.0158	.0039	9	.0009	.0667	.0185	.0073
Sodium to chloride	--	6	.6129	8.9474	3.9726	2.5271	5	1.7500	12.8571	7.1198	8.0952	25	.9434	12.5000	4.6372	3.7142

¹ U.S. Environmental Protection Agency (1976; 1979).

² Micromhos per centimeter at 25° Celsius (micromhos).

³ Degrees Celsius (°C).

⁴ Picocuries per liter (pCi/L).

⁵ Micrograms per liter (μ g/L).

OGALLALA REGION OF THE HIGH PLAINS AQUIFER

Variations in Groundwater Levels and Groundwater Use

Groundwater levels have appreciably declined over the Ogallala region of the aquifer since the onset of substantial irrigation pumping (1940s to 1950s in most areas). The water levels have dropped so much in some areas of the Ogallala region that less than 40% of the original aquifer thickness remains (fig. 4).

The total declines in groundwater levels in the Ogallala region since predevelopment to the average water levels during 2021–2023 are 28 ft, 51 ft, and 101 ft for GMDs 4, 1, and 3, respectively. These declines represent a loss in aquifer thickness of 25%, 61%, and 45%, respectively. The average aquifer thicknesses remaining in GMDs 4, 1, and 3 are 75 ft, 32 ft, and 142 ft, respectively. During the 27 years for which the KGS has determined water-level changes in the HPA (1996–2022), the trends in the average annual water-level decline and the cumulative water-level declines (figs. 5 and 6, respectively) for these three GMDs have been the following (to the nearest tenth of a foot):

- GMD4: steady decline rate; average -0.5 ft/yr; cumulative -13.1 ft
- GMD1: steady decline rate; average -0.6 ft/yr; cumulative -15.0 ft
- GMD3: slightly increasing rate of decline; average -1.8 ft/yr; cumulative -47.2 ft

The above values are based on all wells in the HPA for which water levels have been measured for the period (see Appendix 1), excluding wells that are screened only in the bedrock, such as the Dakota aquifer. These values are also based on revisions to the data used in the first HPA status report (Whittemore et al., 2018). Those revisions are described in Appendix 1.

The annual variation in the water-level decline rates (fig. 5) and the change in the slope of the curves for the cumulative change (fig. 6) are directly related to precipitation, which is the primary driver of the annual amount of irrigation water pumped and the resultant water-level changes. This relationship can be seen in the similar patterns in the rainfall for the three western climate divisions in Kansas (fig. 7) and the annual water-level changes in each of the GMDs that lie within those divisions (fig. 5). Precipitation is represented by the Standardized Precipitation Index (SPI) in fig. 7; the SPI is a climatic index that quantifies precipitation surpluses and deficits and is normalized by long-term records (McKee et al., 1993).

During 1996–2022, the total annual water use generally declined for the three GMDs in the Ogallala region (fig. 8); the following trends are based on the 1996 and 2022 endpoints of the best-fit lines through the data:

- GMD4: decline of about 14.4%
- GMD1: decline of about 49.4%
- GMD3: decline of about 18.7%

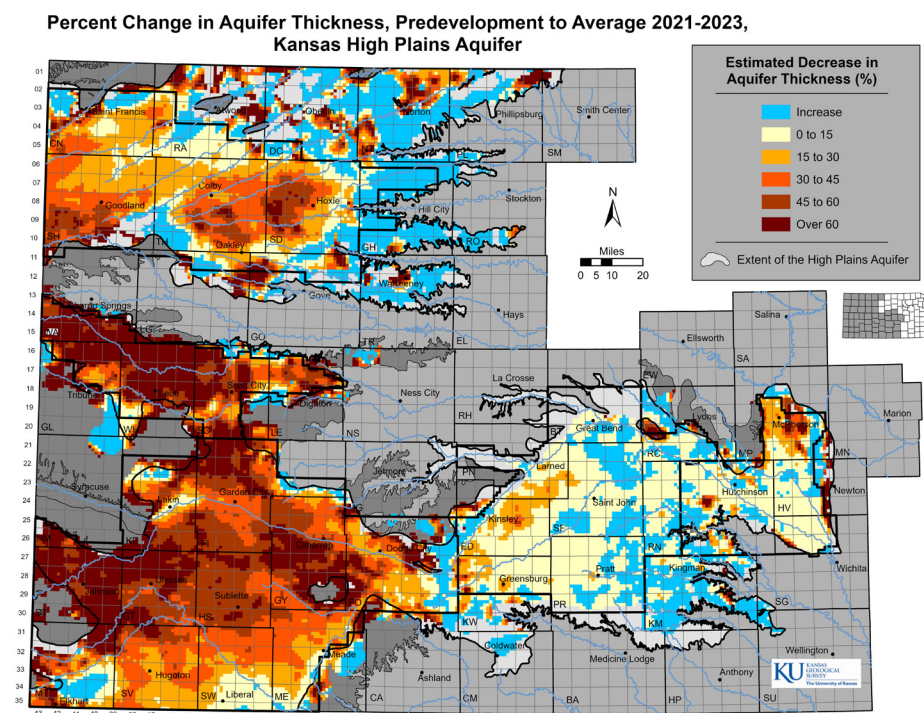


Figure 4. Percent change in aquifer thickness in the High Plains aquifer from predevelopment to the average for winter water-level conditions for 2021–2023. The areas of increase in the western third of the state are areas of thin aquifer with little to no groundwater development and are not of practical importance. The areas of dark gray have similar sediments but little groundwater.

CERTIFICATE OF SERVICE

25-CONS-3411-CUIC

I, the undersigned, certify that a true and correct copy of the attached Testimony has been served to the following by means of electronic service on October 24, 2025.

TODD BRYANT, GEOLOGIST SPECIALIST
KANSAS CORPORATION COMMISSION
266 N. Main St., Ste. 220
WICHITA, KS 67202-1513
todd.bryant@ks.gov

KELCEY MARSH, LITIGATION COUNSEL
KANSAS CORPORATION COMMISSION
CENTRAL OFFICE
266 N. MAIN ST, STE 220
WICHITA, KS 67202-1513
kelcey.marsh@ks.gov

JONATHAN R. MYERS, ASSISTANT GENERAL COUNSEL
KANSAS CORPORATION COMMISSION
266 N. Main St., Ste. 220
WICHITA, KS 67202-1513
jon.myers@ks.gov

JANESSA VANDEVEER
SHAKESPEARE OIL CO., INC.
202 W MAIN ST
SALEM, IL 62881-1519

DAVID E. BENGTON, ATTORNEY
STINSON LEONARD STREET LLP
1625 N WATERFRONT PKWY STE 300
WICHITA, KS 67206
david.bengtson@stinson.com

/s/ Sara Graves

Sara Graves