Kansas Geological Survey Educational Materials

GROUNDWATER LEVEL ANALYSIS ACTIVITY

KANSAS GEOLOGICAL SURVEY

The University of Kansas

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Short Description

Students will study graphs and maps documenting the Kansas High Plains aquifer's groundwater reserves. This activity uses the "Annual and Continuous (Index Well) Water-Level Networks over the Kansas High Plains Aquifer Region" online mapper, which contains decades of data gathered from more than 1,400 wells across the state. Students will need a computer or tablet with Internet access.

Learning Goals (Students will be able to...)

- Identify key components of groundwater maps/data
- Use graphs to describe regional trends in groundwater levels
- Use maps to describe regional trends in groundwater levels
- Calculate changes in water levels
- Explain how pumping impacts groundwater levels

Education Level

These activities were designed for grades 9-12.

Standards

The activities in this document meet the following Kansas educational standards:

- HS-ESS3-1
- HS-ESS3-6

GROUNDWATER LEVEL ANALYSIS ACTIVITY

Background Information

Aquifers are important sources of groundwater that communities across Kansas rely on for domestic use and agriculture. Groundwater is a limited resource that requires data-informed management in order to sustainably support Kansan livelihoods for the future. The data necessary to inform water mangement is collected by geohydrologists, who use **wells** to measure the water level of aquifers. By annually measuring these wells, scientists can report on fluctuations in water levels and document aquifer water reserves over time.

Materials

Students will need a computer or tablet with Internet access.

Example Well Data Entry

Students will explore data from wells spread throughout Kansas. The following well entry (copied on the next page) serves as an example of the terminology and numbers in the site information for each well.

General Well Site Information

USGS ID:	382539100541601	**KGS Local Well ID:**	19S 32W 06CCB 01
County:	Scott	**PLSS Description:**	19S 32W 6 NWSWSW
HUC 8 Code:	11030002	**GMD:**	Western Kansas GMD #1
Longitude:	-100.90593	**Lat/Long Source:**	GPS (within 50 feet)
Latitude:	38.4281	**Lat/Long Accuracy:**	5 seconds
Surface Elevation (ft):	2937	**Depth of Well (ft):**	102
Geological Unit Codes:	QA TO	**USGS Map Name:**	Scott City

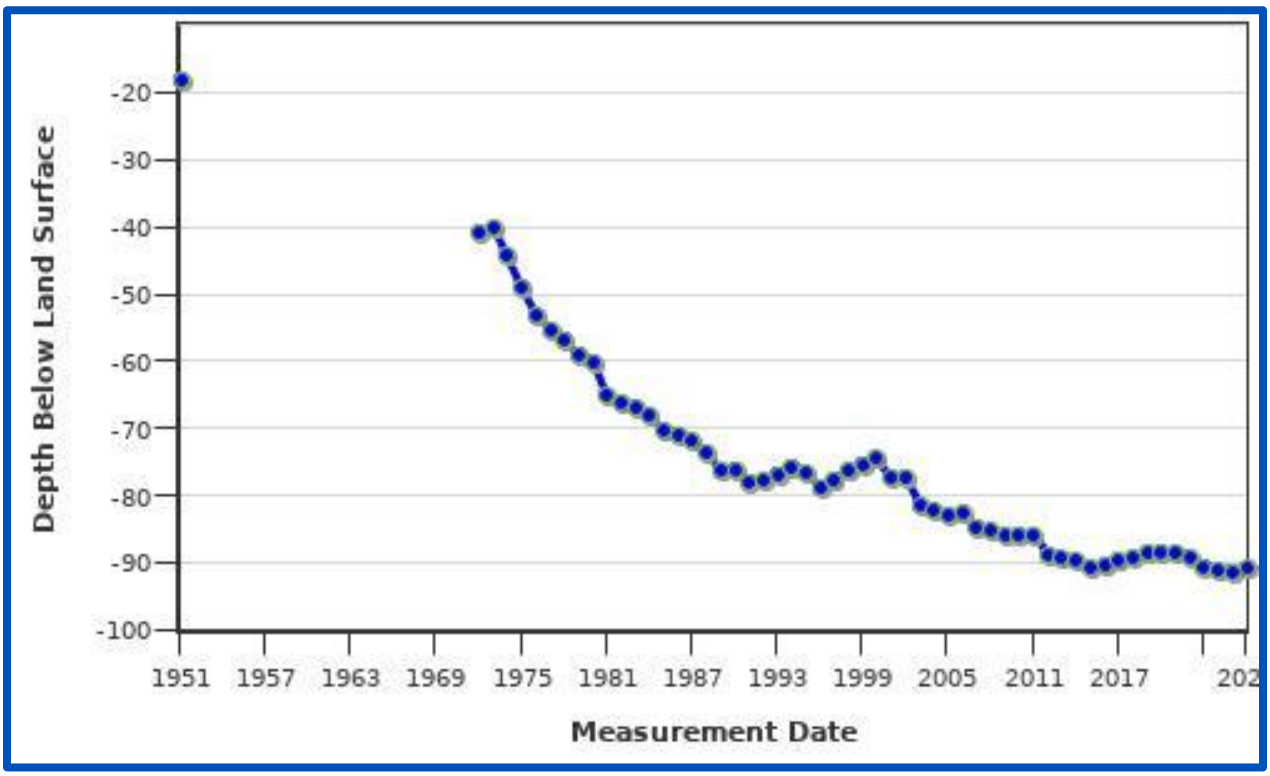
General Well Site Information Vocabulary

- KGS Local Well ID: the unique identification code assigned to the well by the Kansas Geological Survey. The KGS measures over 1,400 wells every year and uses this ID system to keep track of them.

- Surface Elevation (ft): the well's height above sea level.

- GMD: Groundwater Management District. These are districts where communities work together to set goals and standards for proper water management. There are five GMDs in Kansas, all of which are located atop the High Plains aquifer.

- Depth of Well (ft): The total vertical depth of the water column underground, measured from the surface downwards. This is how deep the water goes before it hits bedrock. In this example, the well depth is 102 feet.



Graph & Data Analysis

The graph above shows how water level depth has changed in the well since data collection began. The x-axis shows the dates at which measurements were taken. The y-axis shows the water level depth below the land surface at the time of observation.

Please note that “water level depth” refers to the number of feet below the surface before you hit water. The "depth of well" is the number of feet before you hit bedrock (and thus no more water). Depth of well will always be greater than water level depth.

Look at the table below the graph on the web page. The two important columns you will use are “Date” and “Depth to Water.” The first observation was on April 1st, 1951, with a water level depth of -18 feet below the surface. Scroll to the bottom of the page. As of May 2026, the most recent measurement was on January 5th, 2026.

The water level depth for that date entry is listed as -90.67 feet below the surface. That means the water level has dropped 72.67 feet belowground since it was first measured.

We can compare the final measurement of the water level to the total depth of the well. We know that the well is 102 feet deep. 102 – 90.67 = 11.33, meaning there are 11.33 feet of water left in the water column.

Activity

Part 1: Reading Well Data

Click on this link to access the Annual and Continuous (Index Well) Water-Level Networks over the Kansas High Plains Aquifer Region online mapper.

The mapper is a collection of data from wells across the state that the Kansas Geological Survey monitors to better understand water reserves in the High Plains aquifer.

Pick **three** wells and record the information listed below for each.

1) **Well 1**
    a) Copy and paste the well link:
    b) Well ID:
    c) County:
    d) Latitude and Longitude:
    e) GMD:
    f) Depth of the Well:
    g) Date of First Measurement:

h) Water Level Depth of First Measurement:

i) Date of Latest Measurement:

j) Water Level Depth of Latest Measurement:

k) Change in feet between the first and latest measurement:

l) Amount of water level in feet left in the water column:

2) Well 2

a) Copy and paste the well link:

b) Well ID:

c) County:

d) Latitude and Longitude:

e) GMD:

f) Depth of the Well:

g) Date of First Measurement:

h) Water Level Depth of First Measurement:

i) Date of Latest Measurement:

j) Water Level Depth of Latest Measurement:

k) Change in feet between the first and latest measurement:

l) Amount of water level in feet left in the water column:

3) Well 3

a) Copy and paste the well link:

b) Well ID:

c) County:

d) Latitude and Longitude:

e) GMD:

f) Depth of the Well:

g) Date of First Measurement:

h) Water Level Depth of First Measurement:

i) Date of Latest Measurement:

j) Water Level Depth of Latest Measurement:

k) Change in feet between the first and latest measurement:

l) Amount of water level in feet left in the water column:

4) Well Review

a) Of the three wells, which had the deepest well depth? Which had the shallowest?

b) Which well had the greatest change since the first measurement?

c) Which well has the least amount of water left in its column?

d) Why do you think there may be differences among the wells?

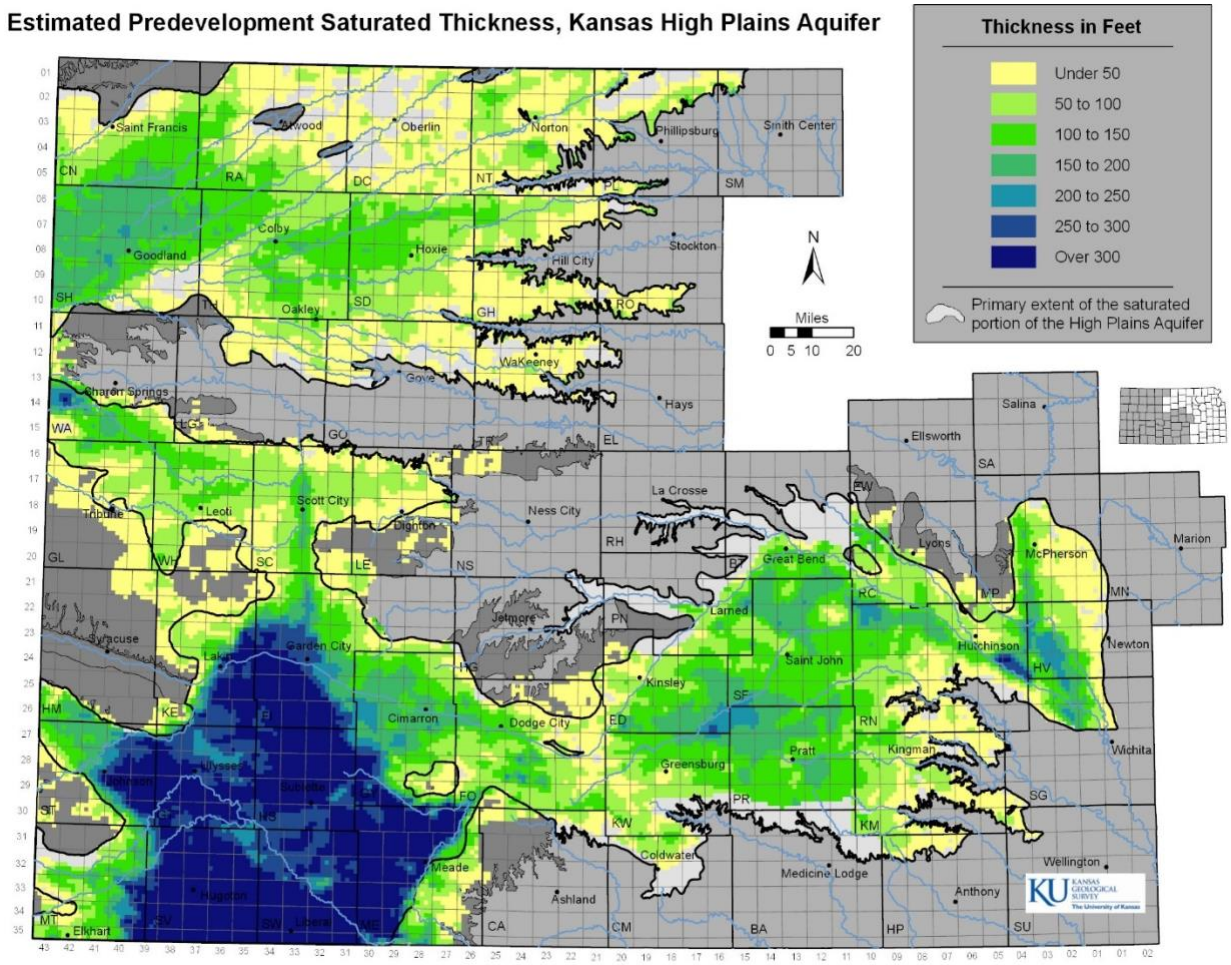
Part 2: Reading Maps

The Kansas Geological Survey uses the state well data to make **maps** to better interpret the High Plains aquifer and understand how groundwater pumping impacts water resources.

The map below shows the estimated saturated thickness of the aquifer before it was developed.

Saturated thickness: how many vertical feet of water-saturated sediment there are underground.

Predevelopment: the time before the aquifer was pumped for water on a large, industrial scale.



1) What colors designate the shallowest regions?

2) What colors designate the deepest regions?

3) What region of the state stores the largest amount of water?

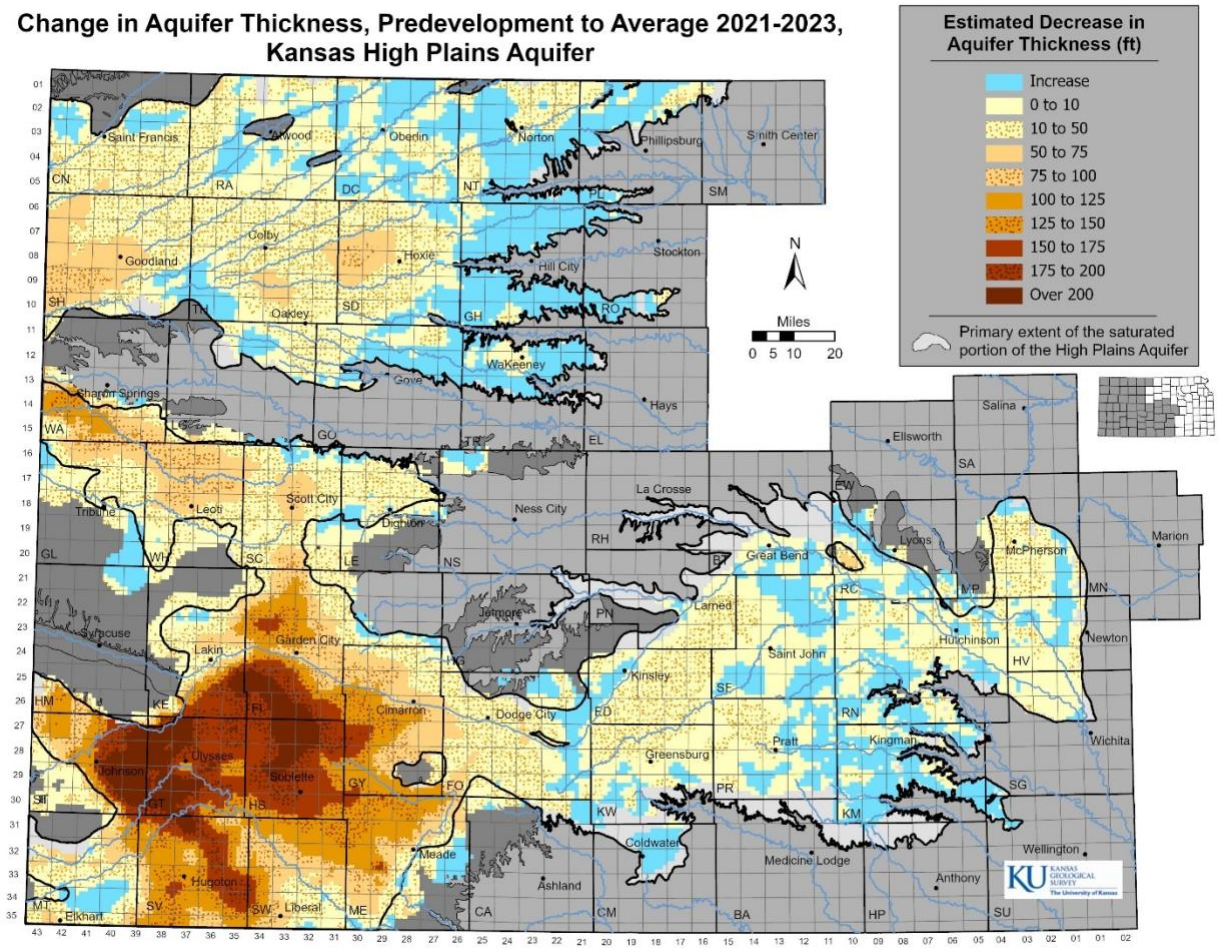
4) Review your three wells and compare it to the map's legend. Based on "Depth of Well," what would be the color for...

   a) Well 1?

   b) Well 2?

   c) Well 3?

Let's look at how much the water level has changed since predevelopment to today. The map below uses the difference between the first and last measurements to designate the different colors in the region.



5) What color indicates an increase in thickness?

6) What colors indicate the biggest decreases in thickness?

7) Where are the biggest decreases located in Kansas?

8) How do these big differences relate to the predevelopment depth as seen in the first map?

9) Where are the increases primarily found in Kansas? What do you think may account for those increases?

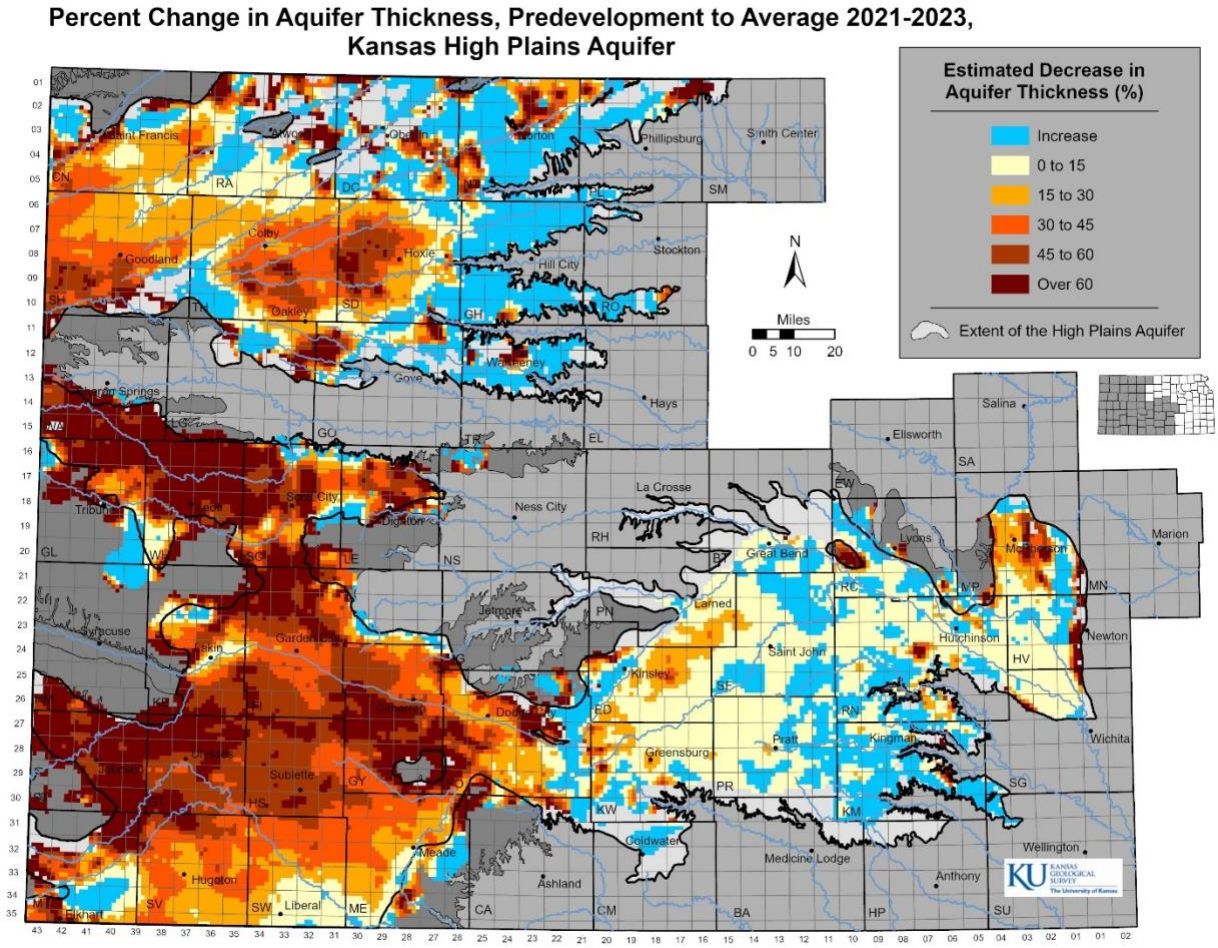
10) What color/symbol would you designate for the three wells you chose in Part 1?

   a) Well 1:

   b) Well 2:

   c) Well 3:

The map below shows the percent decrease in thickness of the aquifer from predevelopment to today.

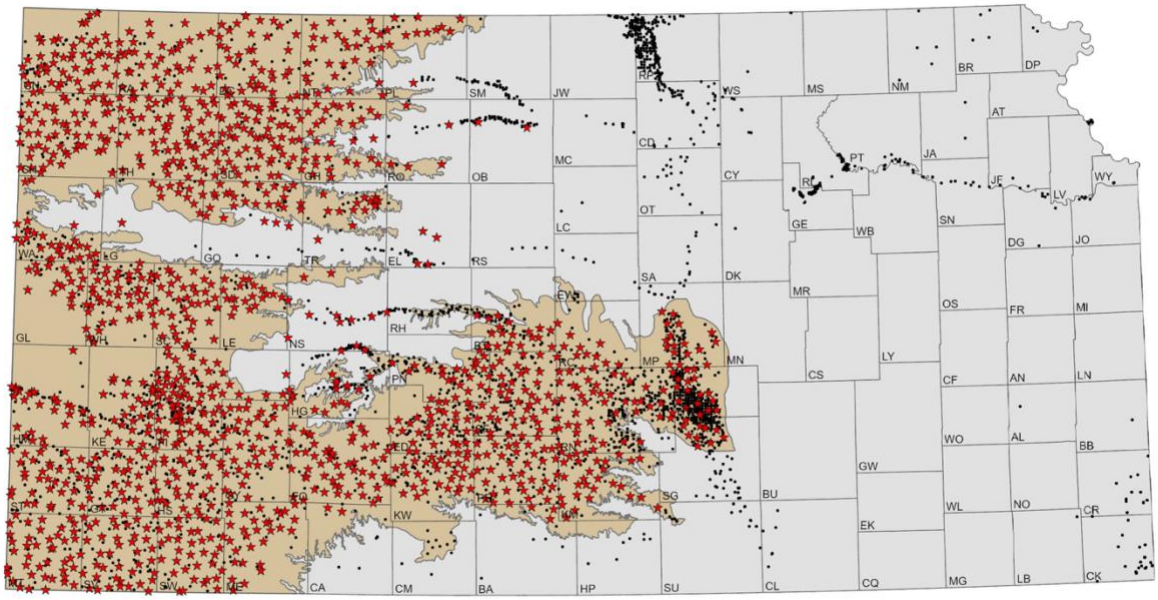


11) What color indicates the aquifer thickness is increasing?

12) What colors indicate the aquifer thickness is decreasing?

13) Which areas in Kansas have the biggest percentage decrease since development began?

The last map (below) shows pumping sites across Kansas. Each red star represents one groundwater pumping well.



14) Where do we see the most wells? How about the least?

15) Compare this map to the percentage change map. What connections can you draw between pumping wells and percentage change of water depth?