August 6, 2018

David Barfield
Chief Engineer
Division of Water Resources
Kansas Department of Agriculture
1320 Research Park Drive
Manhattan, Kansas 66502

Re: Review of Water Pack and Keller-Bliesner Engineering R9 Ranch Reports

Dear Mr. Barfield:

Burns & McDonnell (BMcD) reviewed the information presented by WaterPACK's retained consultant, Dr. Andrew Keller of Keller-Bliesner Engineering (KBE), during a public meeting in Greensburg, Kansas on June 21, 2018. Our review focused on KBE's conclusion that groundwater-level trends on the R9 Ranch and vicinity are declining, as described in the first 11 slides of the PowerPoint presented by WaterPACK at the Greensburg public meeting.

Following our receipt of KBE's PowerPoint and audio narration we evaluated the information presented using publicly available data from the Kansas State Weather Data Library, Office of the State Climatologist, the U.S. Drought Monitor, and the Kansas Geological Survey Water Well Level Database. In addition, we reviewed data from 15 water-level monitoring wells installed on the R9 Ranch to evaluate whether KBE's conclusion that water levels are declining is consistent with observed water levels on and near the R9 Ranch. Our review indicates that KBE's conclusion that water levels are declining on the R9 Ranch is flawed for numerous reasons:

- For the water-level analysis, KBE selected the ten wells shown in yellow on slide five from his PowerPoint and in Figure 1 below.
    a. Only two of the ten wells KBE selected (#4 and #5) are actually on the R9 Ranch.
    b. The remaining wells range from 1.25 miles to more than 4.5 miles from the nearest R9 Ranch boundary.
        i. Three wells are 1.25–2.5 miles away,
        ii. Two wells are 2.5–3.5 miles away,
        iii. Three wells are 3.5–4.5 miles away, and
        iv. One well is over 4.5 miles away from the R9 Ranch.

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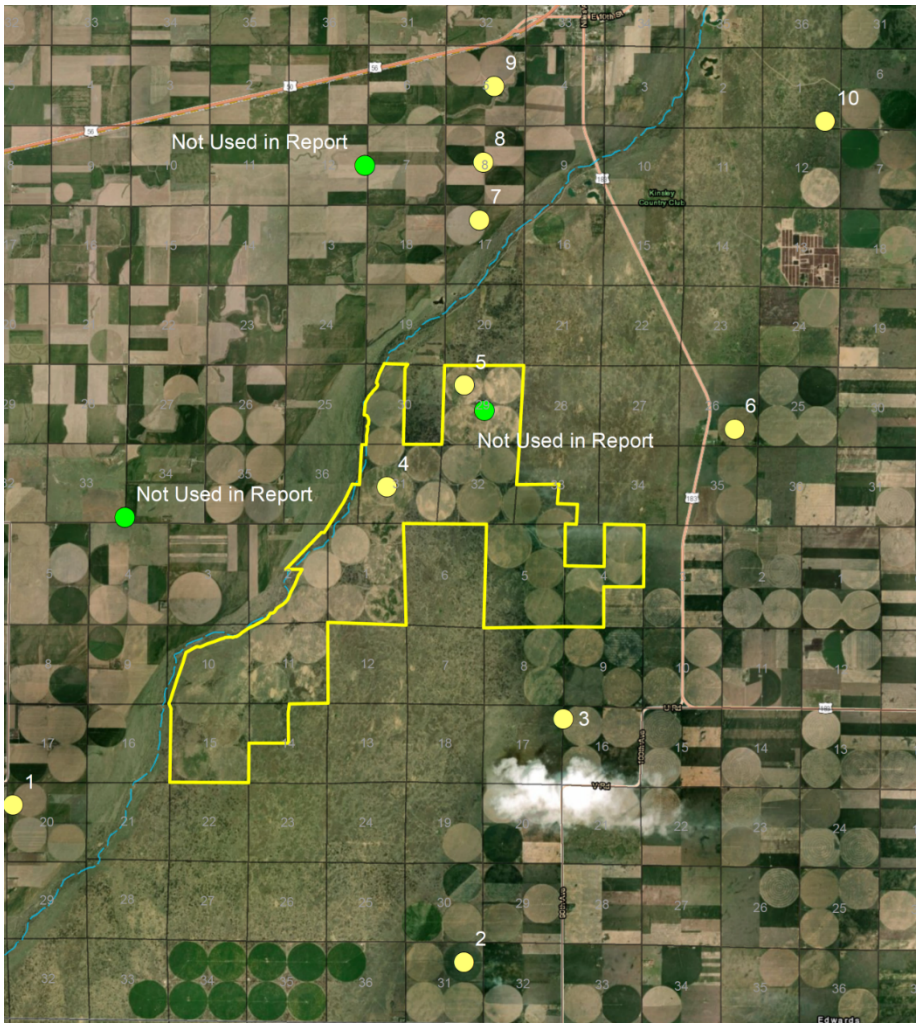

Figure 1 – Groundwater Level Measurement Sites

- There was additional publicly available water-level data that KBE could have used but did not. Those sites are shown in green on Figure 1.
    a. It is unclear why KBE declined to use water levels from the additional data point available within the boundaries of the R9 Ranch.
    b. It is unclear why KBE selected the specific wells plotted in yellow within Figure 1, as many are too far from the R9 Ranch, with too many changes in pumping density, to reasonably correlate to water level trends on the R9 Ranch itself, and too far to have any bearing on the water rights change applications.

c. It is unclear why KBE excluded a number of publicly available water level monitoring sites in the vicinity of the R9 Ranch (as plotted in green in Figure 1) that are as close or closer to the R9 Ranch than those that KBE selected.

The omission of data from other wells on the R9 Ranch, and the inclusion of data from wells too far away from the R9 Ranch to be material, raises significant questions about KBE's interpretation of the local hydrogeology and the validity of their conclusions.

KBE graphs water levels and trend lines for the ten wells selected as a representation of water levels on the R9 Ranch, (see Figures 2 and 3 sourced from the KBE presentation). KBE concludes from these graphs that water levels on and near the R9 Ranch are in a state of decline.

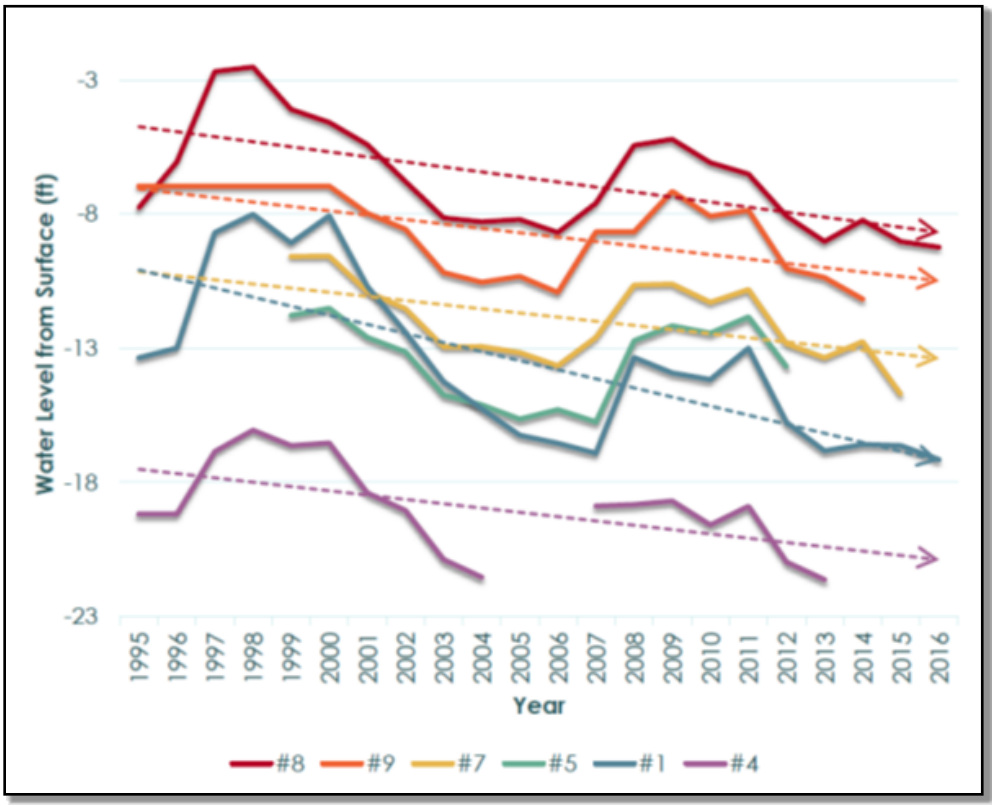

Figure 2 – Water level plots and trends from KBE's public presentation June 21, 2018

Figure 3 – Water level plots and trends from KBE's public presentation June 21, 2018

The water-level graphs KBE presented illustrate a skewed and unrealistically negative picture of water levels by selecting the period of 1995 through 2016. This period begins with several very wet years (1995-1997). Shallow groundwater systems such as that of the R9 Ranch are very responsive to recharge from annual precipitation, and this is reflected by water level rises in each of the hydrographs. The period of record ends in 2016 at the tail end of a historic drought period that began during the fall of 2010. This drought resulted in water level declines in each of the hydrographs. No justification was provided for utilizing the period from 1995-2016 nor for the exclusion of the additional water level data available for multiple sites both prior to 1995 and after 2016.

When the entire water level history is viewed with annual precipitation in context, it is clear that water levels on the R9 Ranch are in fact stable, and merely fluctuate sustainably within a range of four to five feet depending on precipitation.

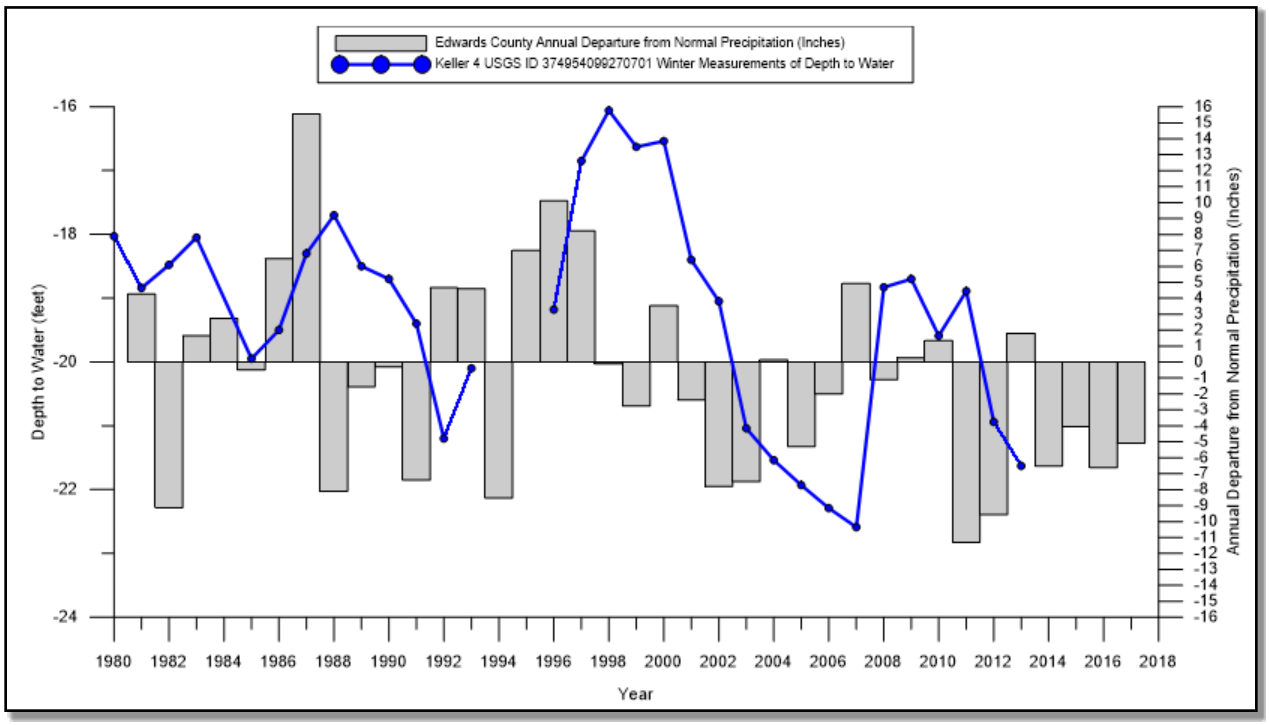

Figure 4 - KBE Well #4 (located on the R9 Ranch)

As shown in Figure 4, Edwards County received much greater than average precipitation in 1995, 1996, and 1997. This is the same time frame for which Keller begins graphing water levels. According to the U.S. Drought Monitor, Edwards County was in an "extreme" to "exceptional" drought for much of 2011–2013. Naturally, the water level for KBE Well #4 was on a downward cycle at the last available data point for depth to water in 2013. Note that examination of the full available period of record shows clear historic cycles of declines and rises in water-level changes proportional to annual precipitation.

A similar pattern of sustainable water-level fluctuation applies to KBE Well #5, the only other well located on the Ranch that was included in KBE's study.

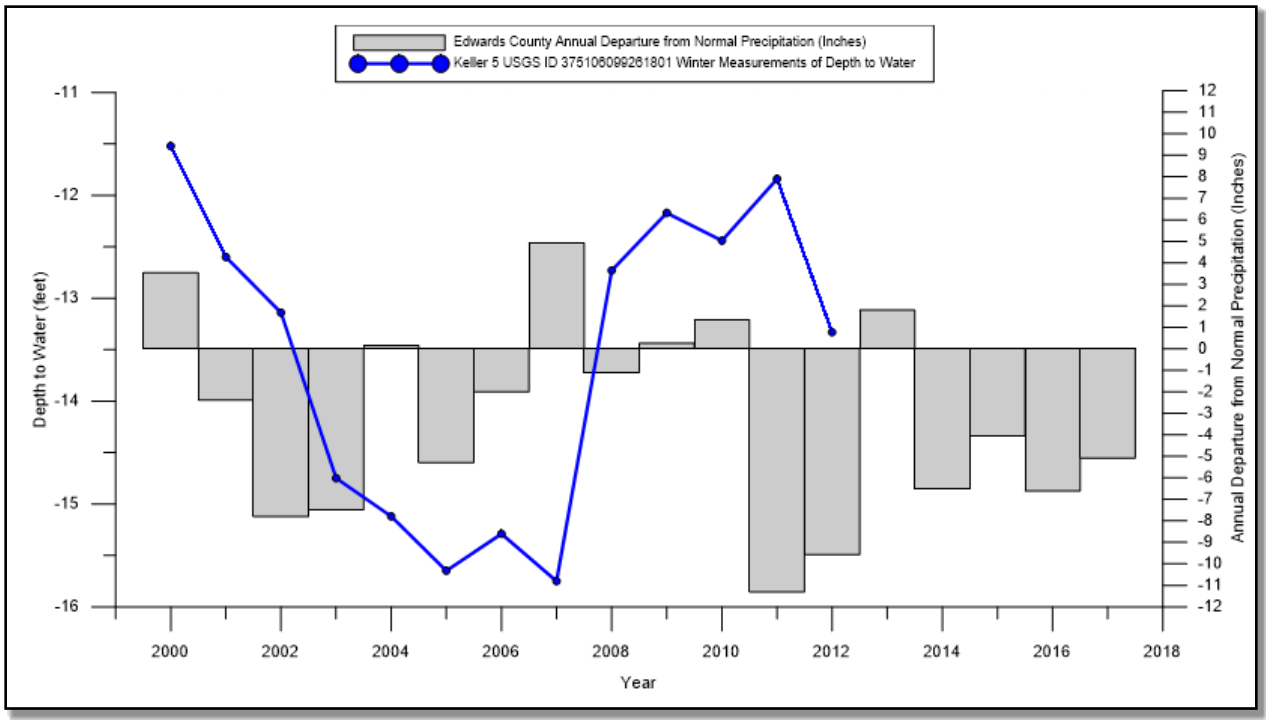

Figure 5 - KBE Well #5 (located on the R9 Ranch)

Another well (USGS ID 375055099255301) located immediately to the southeast of KBE Well #5, had data available but KBE declined to include in their study, confirms a similar water-level fluctuation of approximately four feet that cycles with precipitation, but does not indicate any long-term downward trend (Figure 6).

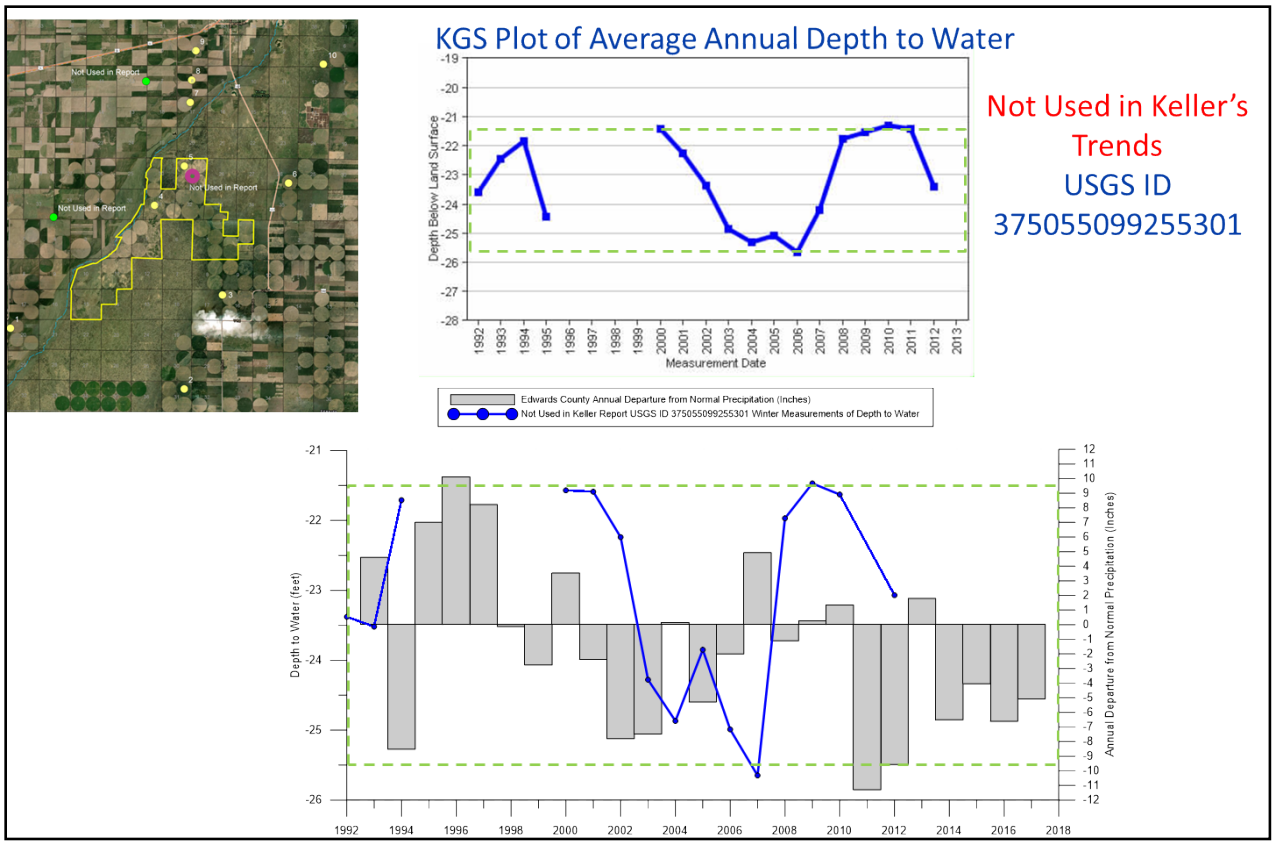

Figure 6 - Water Level Monitoring Point 375055099255301 (located on the R9 Ranch)

Each of the hydrographs presented above for sites on the R9 Ranch clearly fluctuate with precipitation and provide no evidence of a declining trend as KBE incorrectly concludes. In addition, the above results are consistent with monitoring wells installed across the R9 Ranch, which all have water levels that are stable or in slight incline over the past several years.

BMcD has been monitoring water levels on the R9 Ranch since 2014 at 15 monitoring well locations spread throughout the R9 Ranch property. The following slides show water level trends utilizing the data collected by BMcD. We assume that KBE was not aware of this data as it was not utilized within KBE's analysis, and neither KBE nor WaterPACK requested it.

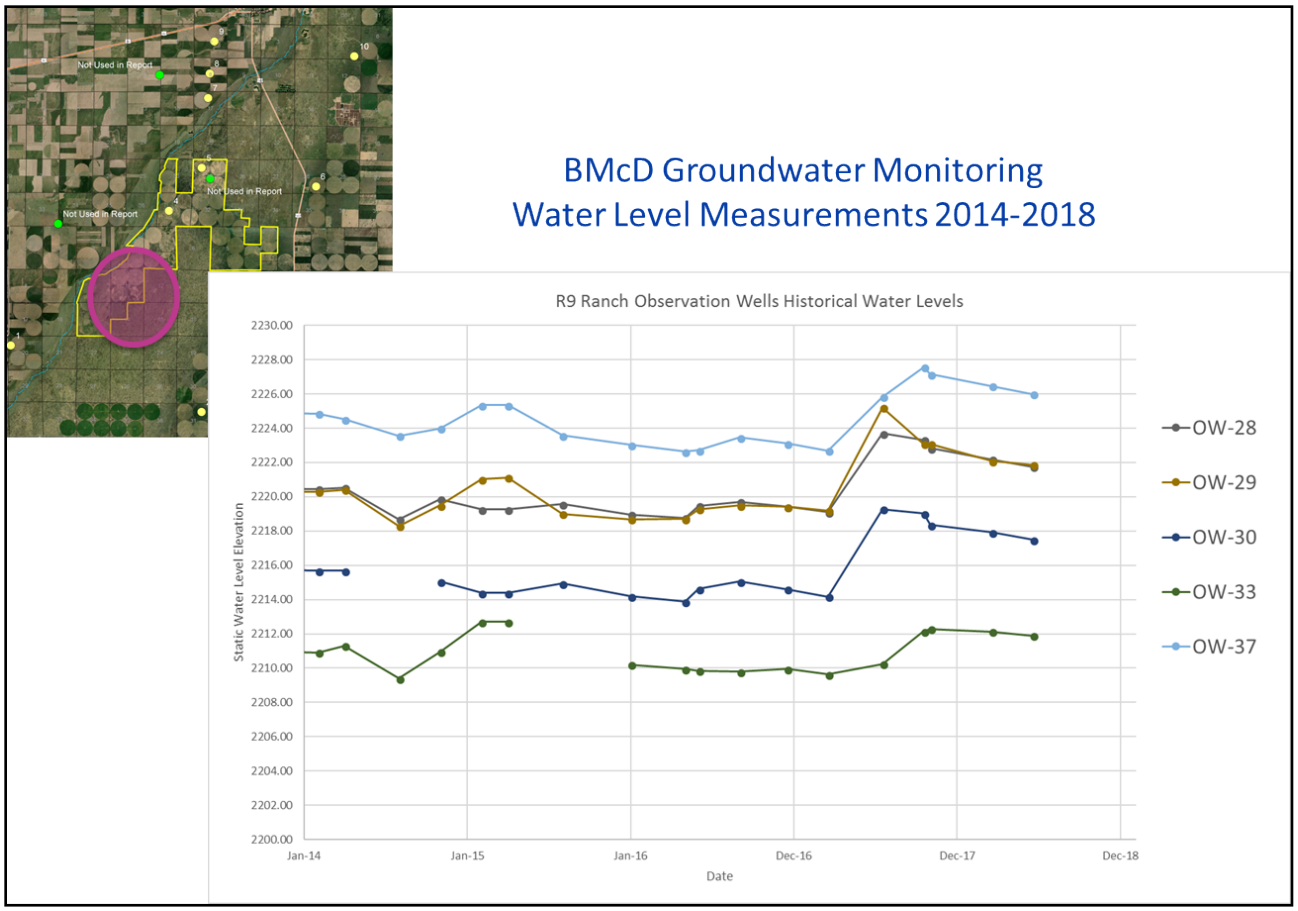

Figure 7 - Water Levels 2014-2018 from the Southern Portion of the Ranch

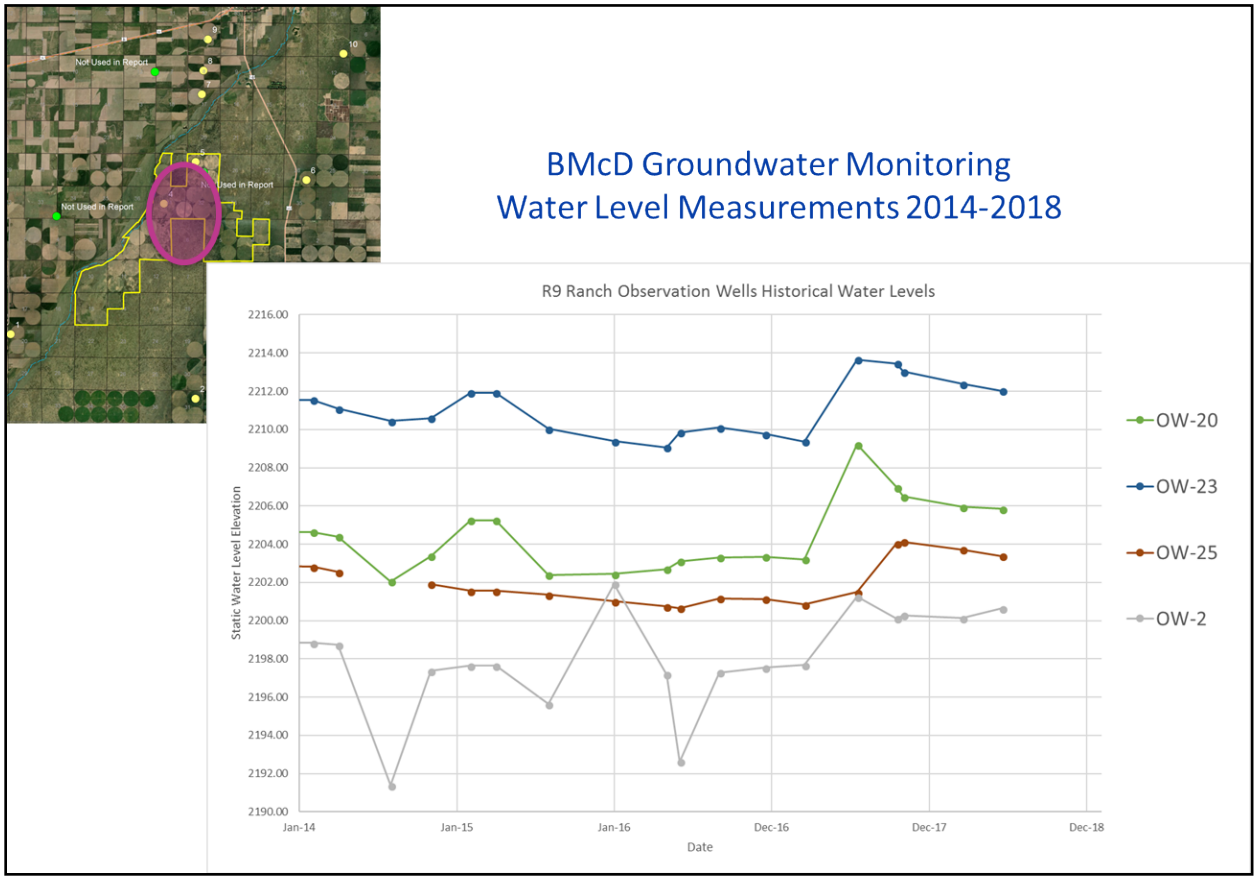

Figure 8 - Water Levels 2014-2018 from the Central Portion of the Ranch

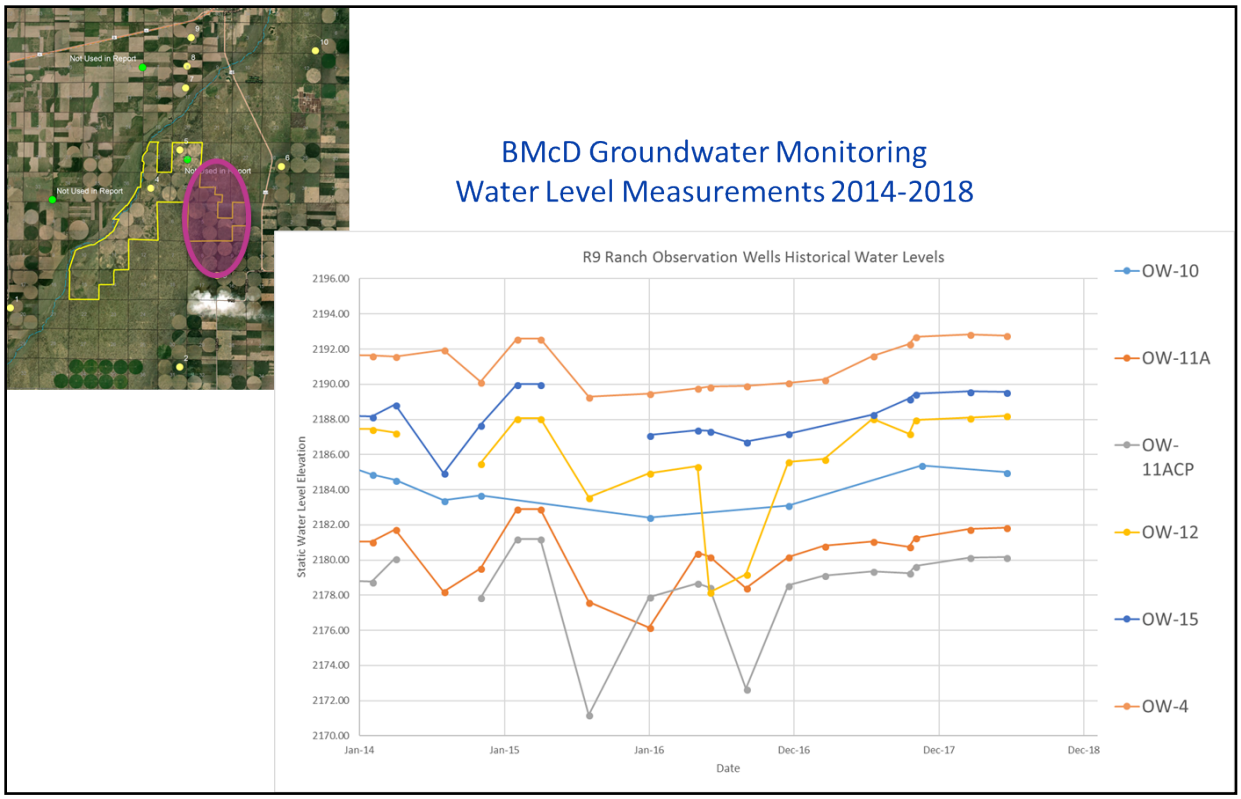

Figure 9 - Water Levels 2014-2018 from the Central and Eastern Portions of the Ranch

As shown in Figures 10 and 11, other wells included in KBE's study follow a similar sustainable water level pattern when the full period of record and all of the available data is included.

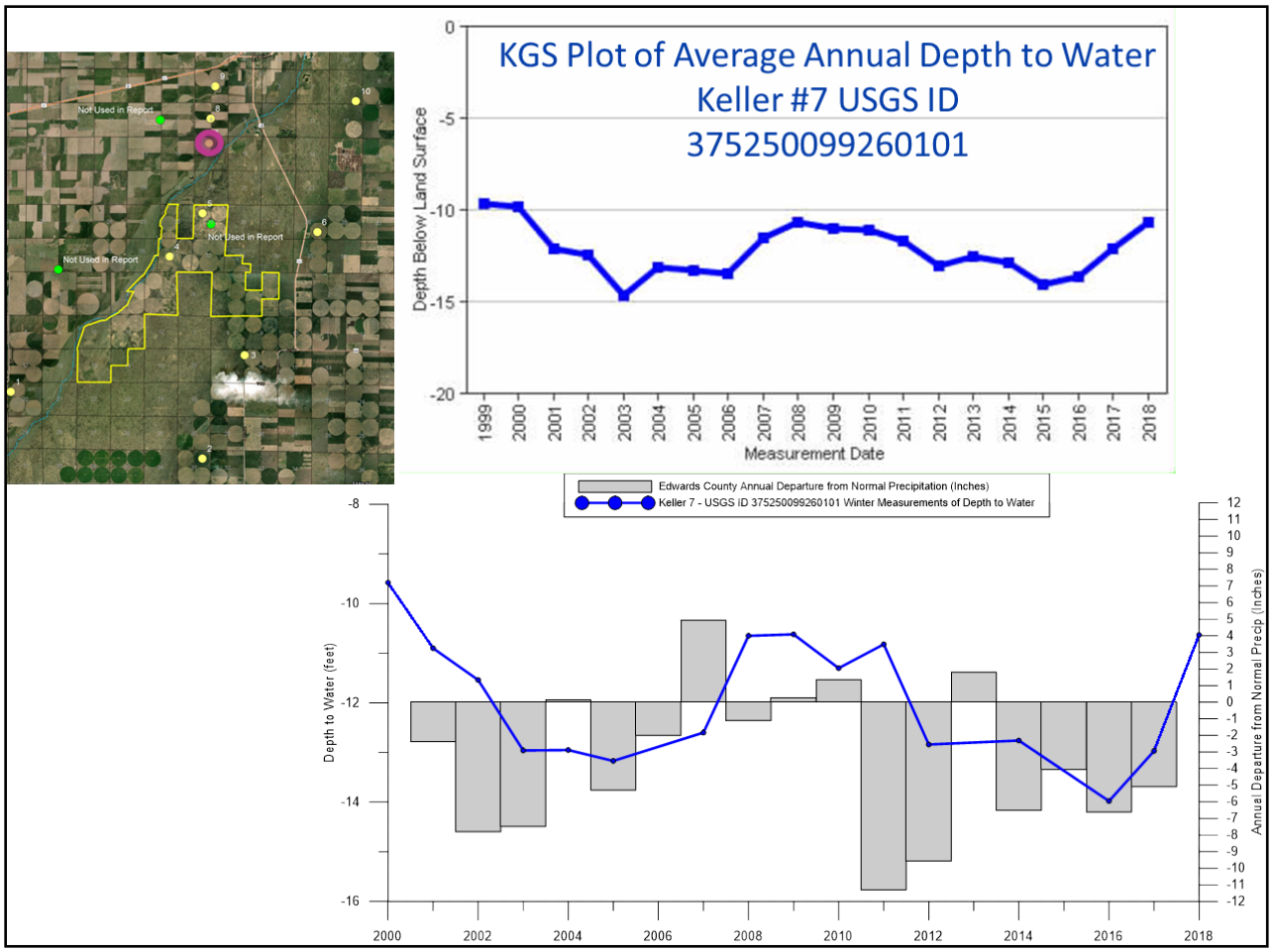

Figure 10 - KBE Well #7 located 1.8 miles north of the R9 Ranch

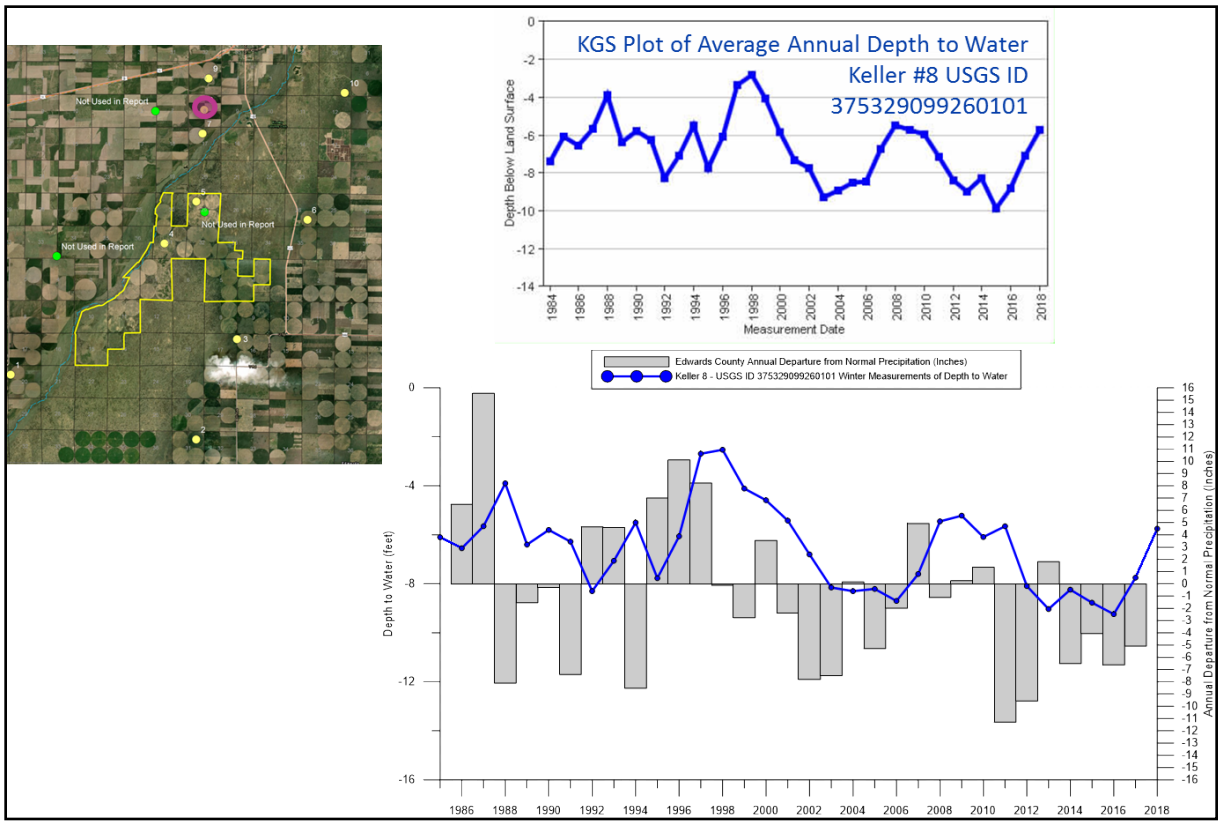

Figure 11 - Keller Well #8 located 2.5 miles north of the R9 Ranch

Nearly all of the wells near the R9 Ranch (and all of them on the R9 Ranch), reflect stable water levels when looking at the full period of record.

Consumptive Use

BMcD also reviewed KBE's consumptive-use report provided by WaterPACK. Adequate documentation to fully review the report conclusions was not provided, so a detailed review was not possible. However, KBE reported their calculation of the historic consumptive use of the groundwater applied during irrigation on the R9 Ranch through a series of evapotranspiration calculations.

After calculating evapotranspiration rates, KBE switches to an elementary daily soil balance model based on numerous assumptions to propose that an additional quantity should be

subtracted from historic consumptive use of applied irrigation. KBE proposes consideration of a future increase in the effective precipitation under restored grassland conditions. Subtractions or additions to historic applied consumptive irrigation use based on future changes in land use are not considered or authorized by DWR regulations.

In addition, KBE incorrectly compares changes to effective precipitation and subsequent aquifer recharge by equating a theoretical daily soil-water balance budget for switchgrass to the calculated annual 50-percent probable effective precipitation under corn and alfalfa.

Summary

Burns & McDonnell has reviewed the KBE report and found several discrepancies in the data presentation and methodology. Our review of all available data indicates that the assertion within the KBE report that water levels on the R9 Ranch have been declining is incorrect. In addition, the methodology proposed by KBE for calculating consumptive use is not supported by historical precedent or regulation. KBE does not provide sufficient documentation of the methodology used in their calculations to provide significant evidence supporting their conclusions. Therefore, the conclusions in KBE report are not a basis to modify the Draft Master Order or the Draft Change Approvals.

Sincerely,
BURNS & MCDONNELL

Paul A. McCormick, P.E.
Associate Geological Engineer