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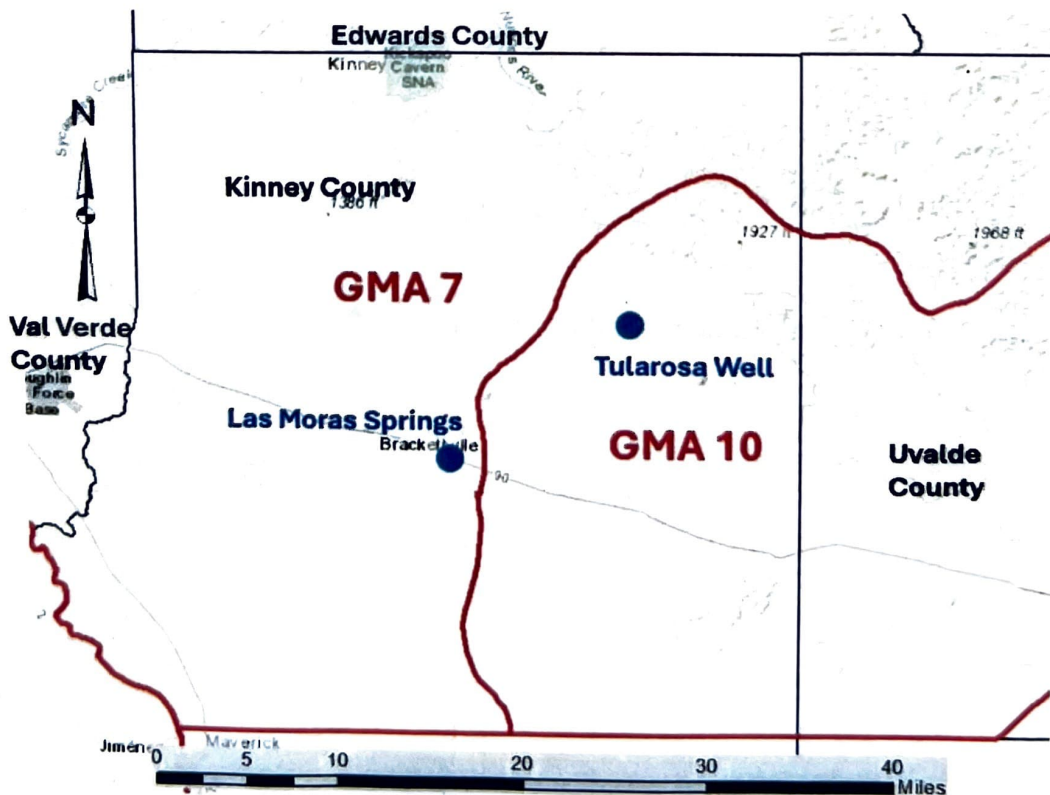
June 3, 2024

Genell Hobbs, General Manager
Kinney County Groundwater Conservation District
PO Box 369
Brackettville, TX 78832

Re: Comparisons of Actual Data and Desired Future Conditions for 2023: Las Moras Spring Flow and Well 70-38-902

Dear Ms. Hobbs:

As required in the Kinney County Groundwater Conservation District Management Plan (management plan), this letter documents the 2023 comparison of actual data and the desired future conditions (DFCs) for Las Moras Spring Flow in the GMA 7 portion of Kinney County, and Well 70-38-902 in the GMA 10 portion of Kinney County. A map of Kinney County with the GMA boundaries and the locations of Las Moras Springs and the Tularosa Well is presented below.



Las Moras Spring Flow (GMA 7 Portion of Kinney County)

As stated in Section 5.8.1 of the management plan adopted on January 18, 2023:

The District will assess annually the end-of-year Las Moras spring flow and annual precipitation to evaluate consistency with the desired future condition.

The performance standard is stated as:

Each year, data on annual precipitation from Quad 807 (obtained from TWDB) and end-of-year Las Moras spring flow will be collected. The results will be reported as an agenda item at the first Board meeting after the annual precipitation data are available from TWDB, and final (not provisional) Las Moras Springs flow data are available from the USGS.

The annual precipitation in Quad 807 was obtained from:

<https://waterdatafortexas.org/lake-evaporation-rainfall>

Precipitation in Quad 807 for 2023 was 20.52 inches

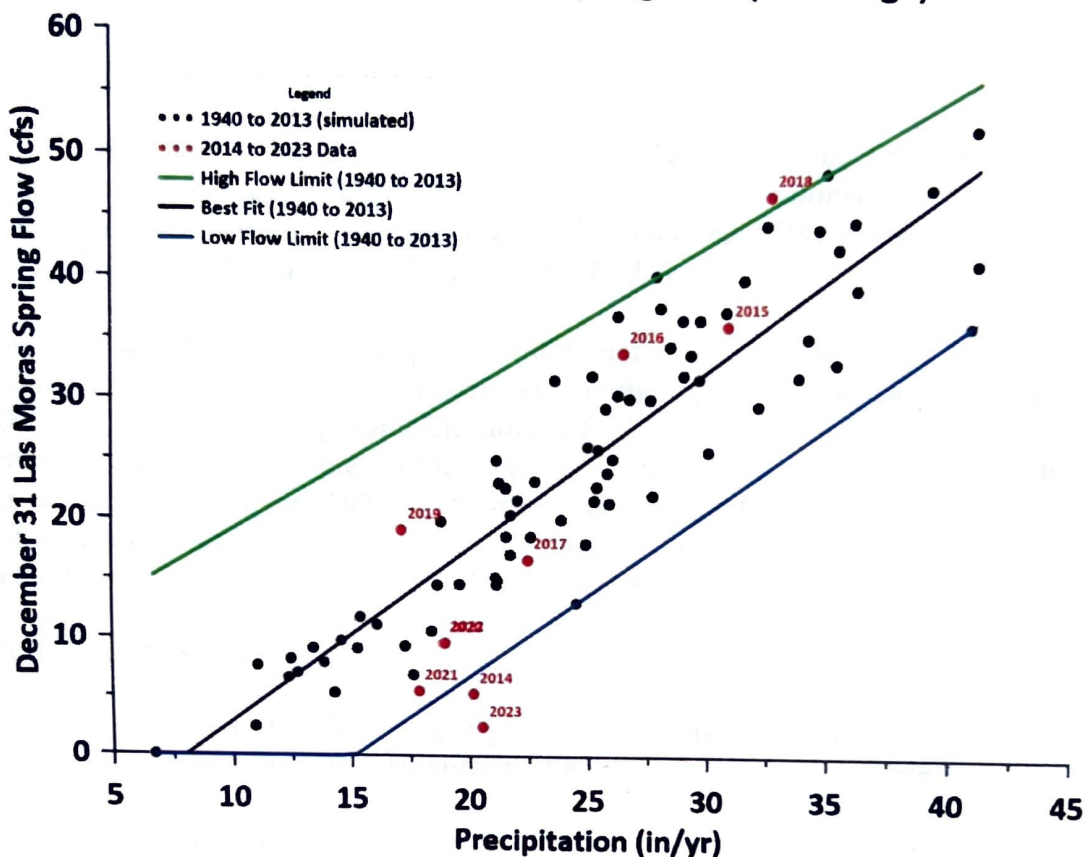
Spring flow from Las Moras Spring was obtained from:

<https://waterdata.usgs.gov/monitoring-location/08456310/>

The last measured spring flow on December 31, 2023 was 2.51 cubic feet per second (cfs).

Figure 7 of the management plan was updated with these data and is shown below:

Annual Precipitation (Quad 807) vs. December 31 Las Moras Spring Flow (New Gage)



Because of the persistently dry conditions, low spring flow is expected. However, the 2023 data point is outside the high and low bounds which means that the DFC was not achieved in 2023. Please also note that the 2014 and 2018 points are also outside the high and low bounds, yet the subsequent years (2015 and 2019, respectively) were within the high and low bounds which suggests that not achieving the DFC in any specific year is not necessarily indicative of an issue of future DFC achievement.

The management plan outlines the three management options if the DFC is not achieved. A discussion of these management options is presented below after a discussion of the GMA 10 comparison and a presentation of data that are useful to understand the reasons for non-achievement in 2023 in the GMA 7 portion of Kinney County.

Well 70-38-902 (GMA 10 Portion of Kinney County)

As stated in Section 5.8.2 of the management plan adopted on January 18, 2023:

The District use the groundwater elevation measured in Well 70-38-902 by the Texas Water Development Board to check consistency with the desired future condition.

The performance standard is stated as:

The measured groundwater elevation in Well 70-38-902 taken at the end of the year and the desired future condition minimum elevation will be reported to the Board at the first meeting of the calendar year when the data are made available by TWDB.

The last measured groundwater depth-to-water reading in 2023 is 191.10 ft. As reported in the management plan, there is a discrepancy in the reported measuring point elevation. TWDB reports a measuring point elevation of 1381.042 ft MSL and 1382 ft MSL in different references. This means the desired future condition expressed as a depth to water in the well is either 197.042 ft or 198 ft. Under the range of measuring point elevations, the measured groundwater elevation is about 6 to 7 feet above the desired future condition, and, therefore, the GMA 10 DFC was achieved in 2023.

Discussion of Results

In summary, the DFC for the GMA 7 portion of Kinney County was not achieved in 2023, but the DFC for the GMA 10 portion of Kinney County was achieved.

One significant difference between the two areas where DFCs are specified is that groundwater pumping is present in the general area of the spring (GMA 7 portion) while minimal groundwater pumping occurs in the general area of the Tularosa well (GMA 10 portion). Thus, it is reasonable to conclude that groundwater pumping has contributed to the lower-than-expected spring flow and the non-achievement of the GMA 7 DFC in 2023. Studies are ongoing to better characterize the nature of the connection between pumping and spring flow variation, including improving the understanding of which wells contribute to spring flow decline.

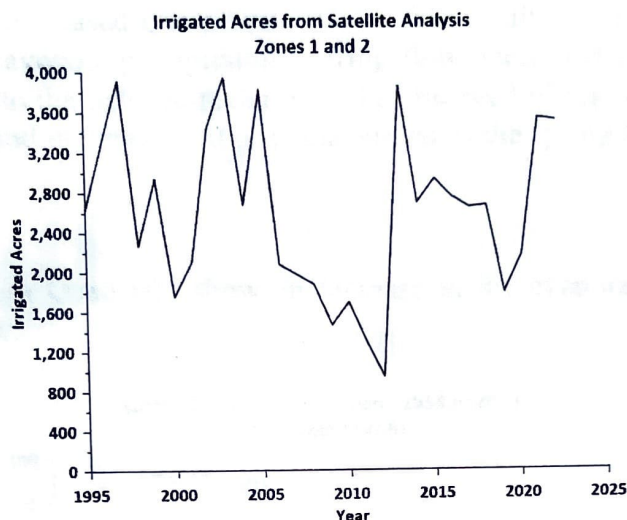
Important components of groundwater pumping for irrigation pumping consist of:

- Irrigated acreage
- Precipitation
- Evaporation

These components are discussed individually to provide context to the discussion regarding historic groundwater pumping that follows.

Irrigated Acreage

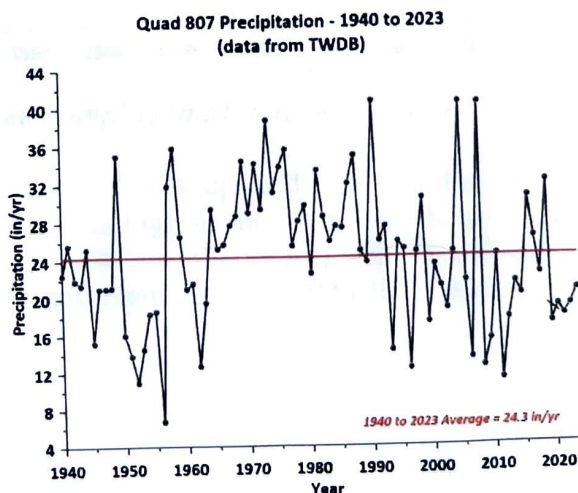
Annual irrigated acreage in management zones 1 and 2 (the areas of Kinney County where variation in groundwater levels show good to moderate correlation with spring flow variations) from 1995 to 2022 is shown below. This analysis was completed in late 2022 and has not yet been updated to include 2023.



Please note that there has been no long-term increase in irrigated acreage since 1995, and 2022 irrigated acreage does not represent the maximum.

Precipitation

As shown below, 2023 represents the fifth consecutive year of below average precipitation (24.3 inches per year).

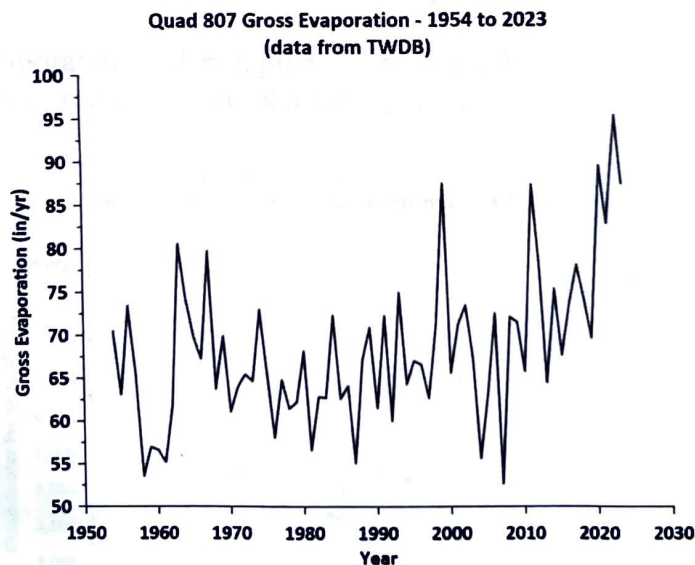


Note that the drought of the 1950s included seven consecutive years of below average precipitation. Since then, a period of above average precipitation was observed from the mid-1960s to the early 1990s. This was followed by about 30 years of below average precipitation that also included years with precipitation over 30 in/yr.

The years with above average precipitation during the last 30 years resulted in high aquifer recharge and increased groundwater levels that resulted in increased spring flow. In years with below average precipitation, spring flow decreased as groundwater levels declined in response to the reduced recharge. The observed filling and draining cycle are important to understand in the context of management of the spring flow.

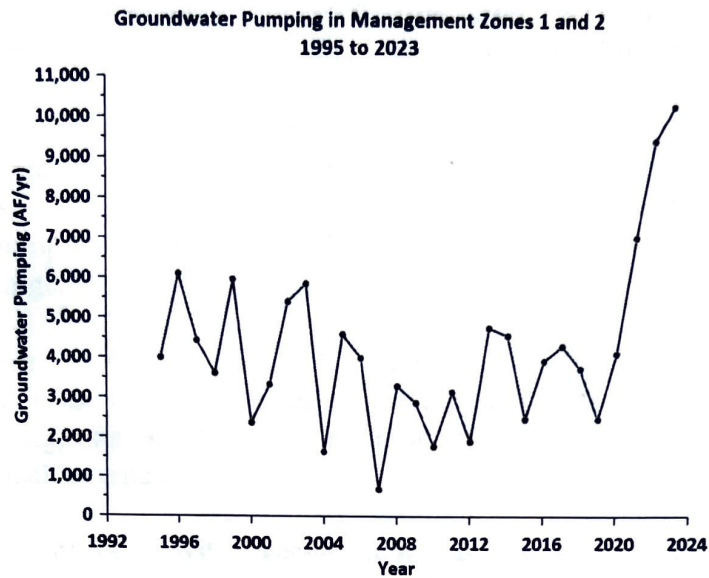
Evaporation

Evaporation data from Quad 807 show an increase in the evaporation rate since about 2010 as shown below.



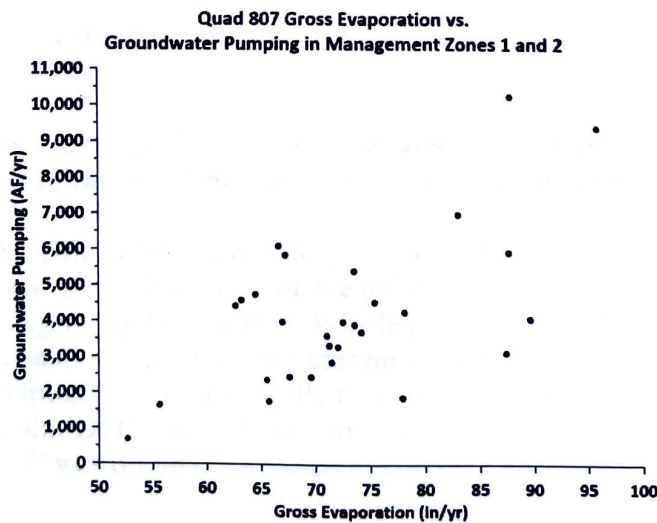
Permitted Groundwater Pumping in Management Zones 1 and 2

Permitted groundwater pumping (as reported by permit holders and through an analysis of satellite images) in areas with high to moderate correlation between groundwater levels and spring flow (management zones 1 and 2) was on a downward trend from 1995 to about 2020 and has been increasing from 2020 to 2023 as shown below.



Evaporation Rate vs. Permitted Groundwater Pumping

A cross plot of evaporation and pumping is presented below to provide context to the recent increase in evaporation and groundwater pumping.



Please note the moderate correlation between evaporation and pumping. Because the irrigated acreage has not increased, the increase in pumping appears to be partly a result of the recent increase in evaporation rates, which increases irrigation demand.

Discussion of Management Options

As introduced above, the management plan identifies three potential management options when a DFC is not achieved. Each one is discussed separately below:

Analyze the inconsistency with updated data and information from ongoing hydrogeologic studies to determine if the inconsistency is significant.

As noted above, 2023 represents the fifth consecutive year of below average precipitation. Moreover, the recent increase in evaporation has resulted in increased irrigation demands. The combination of the two has contributed to the observed increase in groundwater pumping that appears to have resulted in non-achievement of the DFC for Las Moras Springs.

Also as noted above, the fact that the DFC comparisons in 2014 and 2018 were outside the high and low bounds while the subsequent years (2015 and 2019, respectively) were within the bounds suggests that there may be no long-term implications associated with a single year of non-achievement.

Simply put, a series of years with average or higher-than-average precipitation and an evaporation rate that is lower than recent years will result in spring flow that is consistent with the DFC, assuming that irrigated acreage does not increase. However, a continuation of low precipitation and high evaporation years could result in continued non-achievement of the DFC.

While it is difficult to precisely evaluate the significance of a single year of non-achievement of the DFC, the unusual precipitation and evaporation conditions are significant. These recent meteorological conditions need to be incorporated in updating the DFC.

Update the management goal with updated data and information that were not available at the time of the development of this management plan.

Building on the last point above, the next proposed DFC is due on May 1, 2026. The information contained in this letter is valuable information that the KCGCD Board should consider in proposing an updated DFC. Whether the updated DFC is based on spring flow or based on a nearby index well, the current meteorological conditions (fifth year of below average precipitation and historically high evaporation rates) must be factored into the any update of the DFC since these combined conditions were not in the historic record when the DFC was originally adopted in 2010.

The ongoing studies scheduled for completion by the end of 2024 will provide the foundation for the analyses needed to update the DFC.

Based on updated data and information from ongoing hydrogeologic studies, evaluate the need for pumping reductions, as appropriate, from a technical perspective and from a legal/property rights perspective.

As noted above, The spring flow DFC in the GAM 7 portion of Kinney County was not achieved in 2023 and the groundwater elevation DFC in the GMA 10 portion of Kinney County was achieved in 2023. Groundwater pumping has been higher in recent years in the general area of the spring and remains minimal in the area of the Tularosa well. Thus, it is reasonable to conclude that groundwater pumping in the area of the spring has contributed to reduced spring flow. An open question that is currently being addressed by ongoing studies is which wells are contributing to reduced spring flow.

From a DFC perspective, pumping reductions should be limited to wells which contribute to spring flow reduction and the pumping reductions should be limited to an amount that will result in DFC achievement.

During the first months of 2023, a Rules Committee that was appointed by the KCGCD Board has been meeting to develop recommendations for rules modifications, including a drought management policy that could include pumping reductions. The final recommendations of the committee have not yet been presented to the KCGCD Board.

Conclusions

The DFC is scheduled for an update in the next two years. The Rules Committee will be presenting its recommendations regarding drought management policies and potential pumping reductions in the near future.

The findings of DFC non-achievement in 2023 in this letter and the completion of ongoing studies scheduled for completion by the end of 2024 will be useful in the DFC update and may be useful to provide context to the Rules Committee recommendations. Two relevant elements to consider include the potential non-significance of a single year of non-achievement and the historically high evaporation rates in the last few years that have resulted in increased irrigation demands.

The lack of increase in irrigated acreage coupled with the recent increase in evaporation rate is the most significant factor when weighing management options. Based on these observations, it can be concluded that irrigators have increased pumping in response to meteorological conditions that have not previously been observed in the historic record (at least since 1954). One reasonable management response outlined in the management plan to the non-achievement of the DFC is to update to the DFC that fully takes the high evaporation rates into consideration. Moreover, because a single year of non-achievement of a DFC is not significant suggests that there is time to address the issue properly.

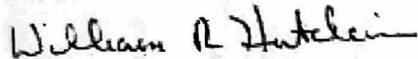
As noted above, one of the objectives of the ongoing studies is to better characterize the connections between pumping and spring flow reduction. This work is expected to be completed by the end of 2024. It is expected that the results of the work will be an integral part of the analyses and provide the technical foundation for the policy

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deliberations of the updated proposed DFC due on May 1, 2026. Once those studies are completed and the DFC is updated, more specific management options regarding groundwater pumping reductions to the specific wells that impact spring flow can be developed and incorporated into an updated management plan.

I appreciate the opportunity to assist you with these efforts. Please call or email with any questions.

Sincerely,



William R. Hutchison, Ph.D., P.E., P.G.