Environmental Stewardship
A Sustainable Ecosphere

December 19, 2013

By hand at Joint Planning Meeting and by email

District Representatives
Groundwater Management Area-12
Post Oak Savannah GCD
Fayette County GCD
Lost Pines GCD
Mid-East Texas GCD
Brazos Valley GCD

Re: Impacts of Groundwater Pumping on the Colorado River

Dear Member Districts:

Environmental Stewardship (ES) is providing GMA-12 member districts with a copy of a report prepared for Lost Pines GCD which supports ES's contention that the GAM is a useful tool in predicting trends regarding the impact of groundwater pumping on surface waters, the Colorado and Brazos rivers, and other aquifers.

We respectfully request that the GMA-12 provide an opportunity for ES and its hydrologist, George Rice, to present additional information to the members at the next scheduled meeting by placing such on the agenda.

Information for Consideration

1. Impacts of requested pumping on other aquifers, surface waters and the Colorado River.

Environmental Stewardship retained the professional services of certified hydrogeologist, George Rice, to investigate the use of the Central Queen City-Sparta Groundwater Availability Model (GAM), used by the Districts, to estimate the impacts of pumping large quantities of groundwater on surface waters, the Colorado River, and other aquifers. See George Rice report and sworn affidavit[1] (Attached).

1.1 Impacts on other aquifers – Rice concludes (Section 2.0): proposed pumping would affect the Hooper, Simsboro, Calvert Bluff, and Carrizo aquifers. Proposed pumping would create a cone of depression (region of reduced hydraulic heads) that extends to the contact of the Hooper Aquifer and the underlying Midway Group[2]. Thus, it would affect both confined[3] and unconfined[4] portions of the aquifers. Where the aquifers are confined, the reduced heads would cause water levels in wells

[1] Rice Report and Affidavit (Attachment B).
[2] Figure 2 of Rice Report shows that the cone of depression extends to the model boundary. This boundary represents the contact of the Hooper Aquifer and the Midway Group (TWDB 2004a, page 6-3). The extent of the cone of depression can also be seen by comparing LPGCD's GAM output files for runs 50 (baseline) and 54 (Phased-in Forestar pumping).
[3] A confined aquifer is buried below geologic units that have a relatively low hydraulic conductivity. When a well taps a confined aquifer, the water level in the well will rise above the top of the aquifer.
[4] Unconfined aquifers are usually exposed at land surface. The water level in a well tapping an unconfined aquifer represents the position of the water table in the aquifer.

to decline. Where the aquifers are unconfined, the reduced heads would cause dewatering of the affected portions of the aquifers.

Table 1 in the Rice report demonstrates that the GAM predicts that pumping of 45,000 acre-feet per year is estimated by 2060 to cause drawdown of 624 feet in the Simsboro Aquifer (Layer 7) at the epicenter of the well field resulting in an average drawdown across the Lost Pines District of 114 feet. These drawdown values derived by Rice correspond directly to the drawdown depicted in Attachment C and Table 1 of the General Manager's recommendations[5]. With these correlations in mind, it is evident that the GAM also predicts that there will be associated average drawdowns across the District in other aquifers: 6 feet average across the District in the Carrizo (Layer 5), 34 feet in the Calvert Bluff (Layer 6), and 48 feet in the Hooper (Layer 8). Though drawdown maps have not been drawn for these other aquifers, it is reasonable to anticipate that similar drawdown maps can, and should be prepared to further evaluate the impact of such extensive pumping on surface features and domestic wells.

Rice also extracted estimates of the drawdown from existing permits[6] (Table 2: baseline) for the Carrizo, Calvert Bluff, Simsboro and Hooper aquifers. When the proposed pumping is added to the existing permits, the total combined permits, if fully exercised, are likely to exceed the adopted DFC drawdowns.

This data and conclusions by Rice, derived from the LPGCD's GAM run, support Environmental Stewardship's long held contention that the aquifers of the Carrizo-Wilcox Group communicate, as frequently reported in the literature[7,8], and are not isolated as claimed by some. Since the GAM predicts that leakage between aquifers will cause drainage of aquifers associated with the target aquifer (the Simsboro), it is important to carefully evaluate the impacts of pumping the Simsboro on the Carrizo, Calvert Bluff, and Hooper aquifers. It is especially important to investigate the potential impact on exempt domestic wells in the Carrizo and Calvert Bluff, as many residents of the counties rely on these aquifers.

1.2 Impact on the Main Stem of the Colorado River – Rice concludes in Figure 6 of his report that "Proposed phased-in pumping will decrease groundwater discharge to the Colorado River. After about 2040, the predicted effect of the phased-in pumping is little different from pumping at a constant rate of 45,000 acre-feet per year".

Using the pumping files provided by LPGCD[9], Rice shows that the GAM predicts that proposed pumping at 45,000 acre-feet per year, and phased-in pumping, will further decrease outflows from the aquifers to the main stem of the Colorado River when compared to baseline pumping, and that the impact from both pumping schemes are essentially the same after the year 2040.

Rice tested the GAM[10] to determine whether or not it could reliably predict trends in outflows from the aquifer to the Colorado River and concluded that the GAM predictions are consistent with expectations regarding the effects of pumping rates, duration, and distance from the river. Rice

[5] Joe P. Cooper, Memorandum to the Board of Directors: Forestar (USA) Real Estate Group, Inc., Application for Well Registrations, Operating Permits and Transfer Permits for Wells nos. 1-10. March 20, 2013.
[6] See Table 2 Estimates of drawdown from baseline pumping in Rice Report
[7] TWDB Report 109, Groundwater Resources of Bastrop County, Texas, page 34. March 1970.
[8] Bureau of Economic Geology, W. B. Ayers, Jr., and Amy H. Lewis, 1985. The Wilcox Group and Carrizo Sand (Paleogene) in East-Central Texas: Depositional Systems and Deep-Basin Lignite, pages 1-17.
[9] Andrew Donnelly provided GAM files in response to Environmental Stewardship's April 2, 2013 PIAR. Files were identified and copied to an external hard drive and sent directly by Mr. Donnelly to Mr. Rice on October 2, 2013.
[10] See section 3.2 of Rice Report

concludes[11] that: "**The results presented indicate that the GAM can reliably predict how pumping will affect trends in the discharge of groundwater to the Colorado River". As such, it is reasonable that the GAM is a useful model for predicting trends related to the impact of groundwater pumping on the Colorado River and its tributaries.**

Looking at the GAM results, depicted in Figure 6 from the Rice Report, it is clear that the trend is for *less* water to leave the aquifers each year as outflows to the river, thus the flow in the river each year will contain *less groundwater* contribution as high rates of pumping continue. It is also clear that this trend reduces outflow to the river as time passes and permitted pumping increases. The extremely negative slope of these trend lines signals a serious impact on outflows to the river over time. ES has concentrated its focus on the Colorado River, however, a clear inference from Rice's findings is that the same trends would be observed in the Brazos River watershed and in other surface features between the Colorado River and the proposed well field.

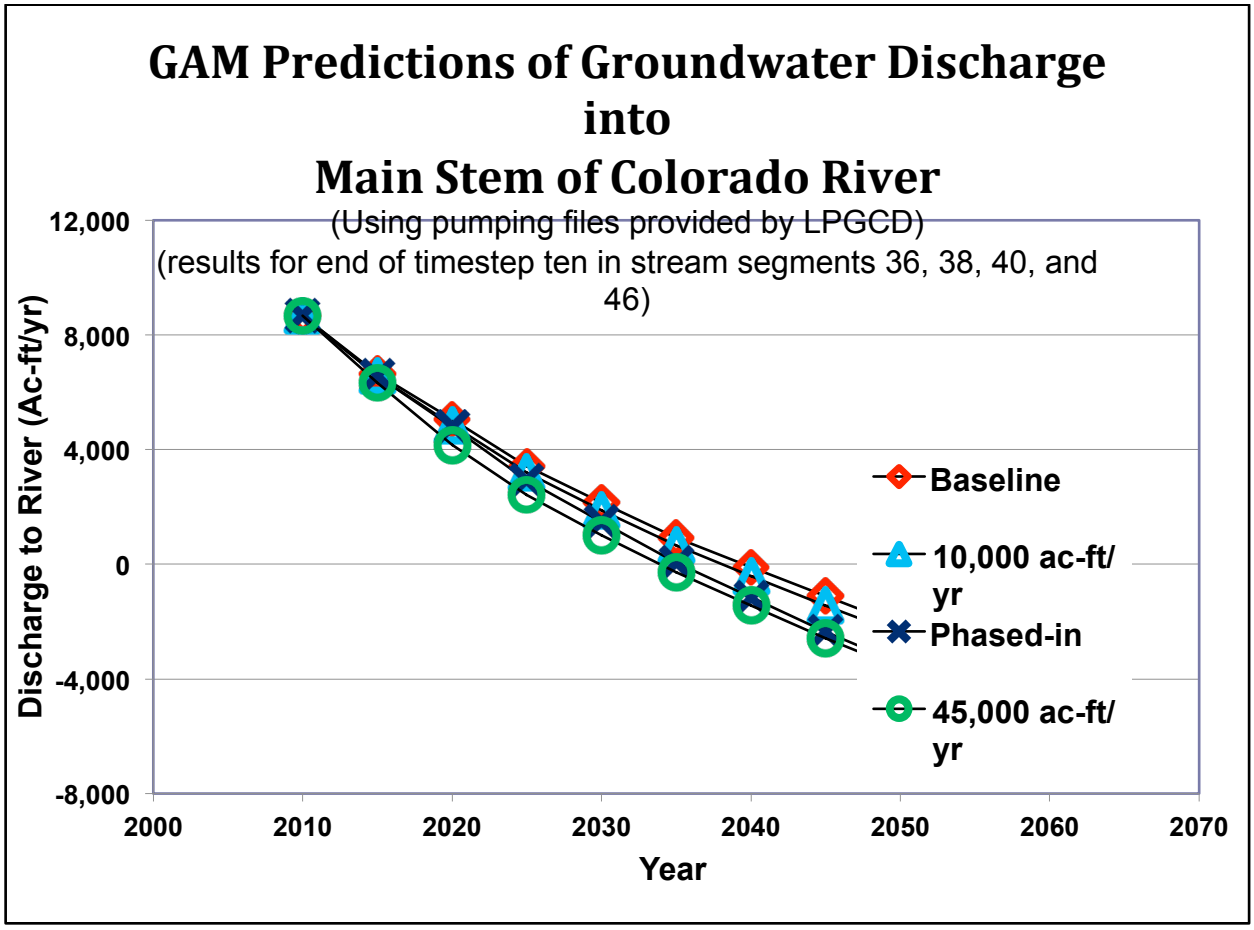


Figure 1: Figure 6 from Rice Report

The trend toward decreasing outflows to the river is critical during drought conditions. Though not as critical during wet years (years with average or greater rainfall in the watershed of the river), this trend becomes critical in drought years like we are now experiencing in Texas and the Colorado River basin. To put the impact of reduced outflows in perspective, consider the following scenario depicted in the USGS hydrograph of flow rates in the Colorado River at the

[11] Rice report, Section 3, page 8.

Bastrop Gage[12] (Figure): on September 14, 2013 at 6:11 am the flow of the Colorado River at the Bastrop Gage reached a record low for the year 2013 of 144 cubic feet per second[13]. The standing record low flow for recent years is 143 cubic feet per second set on November 21, 2008, at 3:14 am.

The TCEQ[14] has established environmental flow requirements for the Colorado River at Bastrop Gage during periods of drought to be 120 cubic feet per second. Measured groundwater discharge to the Colorado River ranges from 30-50[15] cubic feet per second. In this real scenario, the flow of the Colorado River due to groundwater outflow from the Carrizo-Wilcox and associated aquifers in the Bastrop segment of the river on September 14 was between 21% and 35% of total flow in the river and between 25% and 42% of the TCEQ requirement. **If this trend continues, the contribution of flow to the river during periods of drought will be *significantly less* over time.**

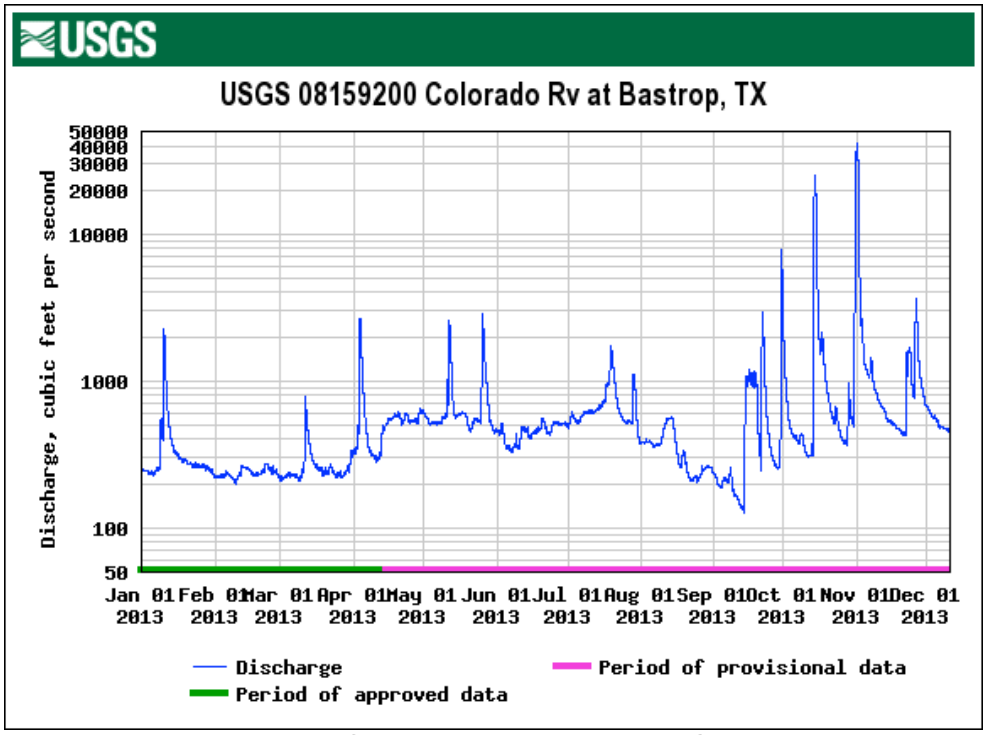


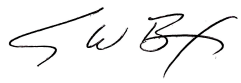
Figure 2: Colorado River at Bastrop Gage.
USGS Hydrograph of Flow Rates (cfs), January 1 – December 13, 2013.

It is clear that ANY additional pumping that decreases flow of groundwater to the Colorado River further exacerbates an already serious negative trend.

[12] Colorado River at Bastrop Gage. USGS Hydrograph of Flow Rates (cfs), January 1 – December 13, 2013 (Attachment C).
[13] LCRA hydromet data for the flow of the Colorado River at the Bastrop Gage on September 14, 2013, at 6:11 am was 144 cubic feet per second. The standing low flow at the same location going back to 2007 is 143 cubic feet per second set on November 21, 2008 at 3:14 am per USGS graph of flow records 2007-present (as far back as the online data are available).
[14] TCEQ Environmental Flow Standards for the Colorado River were adopted in 2012: Proposed Rules 37 TexReg 2521, April 13, 2012. http://www.tceq.texas.gov/permitting/water_rights/eflows/colorado-lavaca-bbsc
[15] Rice Report, Table 3.

We respectfully request that these comments be included in the final report required under Section 36.108 of the Texas Water Code, as we will be summarizing our comments and the GMA's responses in our final comments during the 90-day public comment period.

Respectfully submitted,



Steve Box
Executive Director
Environmental Stewardship

Attachments:

Attachment. George Rice, Affidavit and Report: Proposal to Pump Groundwater from the Simsboro Aquifer (Rice Report). December 11, 2013.

Environmental Stewardship is a charitable nonprofit organization whose purposes are to meet current and future needs of the environment and its inhabitants by protecting and enhancing the earth's natural resources; to restore and sustain ecological services using scientific information; and to encourage public stewardship through environmental education and outreach. We are a Texas nonprofit 501(c) (3) charitable organization headquartered in Bastrop, Texas. For more information visit our website at http://www.environstewardship.org/.