TECHNICAL MEMO

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SUBJECT: Summary of Run 11 Predictive Simulation for GMA 8 Joint Planning

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INTRODUCTION

WSP conducted a predictive simulation in support of the Groundwater Management Area (GMA) 8 joint planning effort. The work we conducted was designed to provide the GMA 8 districts with necessary and sufficient information for discussing potential desired future conditions with the other members of GMA 8. Our work involved using the Groundwater Availability Model of the Northern Trinity and Woodbine Aquifers (NTWGAM) (Kelley, Ewing, Jones, Deeds, & Hamlin, 2014) to simulate potential production within the model area and evaluate the simulated response of the aquifers within GMA 8. We will identify the described simulation as "GMA 8 Run 11" or "Run 11" in this report.

MODIFICATION OF MODEL INPUTS

Run 11 used the NTWGAM to simulate potential production and made the following changes to the model from the Run 10 version. The first change was to extend the model run by an additional ten years placing the end model data at the end of 2080. The second was to change all stress periods from actual days in a year (365 or 366 for leap year) to a constant 365.25 days. This change was made to make annual pumpage volumes (and resulting Managed Available Groundwater (MAG) estimates) consistent and to not have any variation due to difference in model stress period lengths. The third change was to move the drought of record recharge rates to the last three years of the model run from 2078 until the end of 2080. The last change involved the vertical distribution of pumping. In the second round of joint planning, there was significant debate about the assumption in Run 10 to move pumping from the surficial layer to

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underlying layers to avoid pumping cutbacks. In Run 11, some shallow pumping was assigned to the surficial layer (Layer 1), similar to how it was distributed in the calibration model.

MODIFICATION OF PUMPING INPUTS

Run 11 pumping used Run 10 pumping (Beach, 2016) as the base pumping rate. Run 11 was modified by extending the pumping of Run 10 by an additional 10 years, as well as making changes in four different groundwater conservation districts (GCD) and in two counties. As with previous pumping inputs all pumping is kept at a constant rate starting in 2010. The exception to this is in Southern Trinity GCD (McLennan County) which requested changes to the first 10 years of pumping (2010-2019). Changes to Clearwater Underground Water Conservation District (CUWCD), Prairielands GCD, Southern Trinity GCD, Upper Trinity GCD, and Travis and Williamson county are shown in the tables below. The adjustment column shows the change from Run 10 pumping rates to Run 11 pumping rates. Negative values indicate a decrease in pumping rate and positive value indicating an increase in pumping rate.

Table 1: Clearwater UWCD updated pumping in Run 11.

Aquifer	Run 10 (AFY)	Adjustment (AFY)	Run 11 (AFY)
Glen Rose	972	-697	275
Hensell	1,097	3	1,100
Hosston	7,179	721	7,900
Total	9,248	27	9,275

Table 2: Prairielands GCD updated pumping in Run 11.

Aquifer	Run 10 (AFY)	Adjustment (AFY)	Run 11 (AFY)
Hensell	3,603	-3,207	397
Pearsall	98	1,848	1,946
Hosston	13,237	1,358	14,596
Total	29,887	0	29,887

Table 3: Travis County updated pumping Run 11.

Aquifer	Run 10 (AFY)	Adjustment (AFY)	Run 11 (AFY)
Glen Rose	973	-873	100
Hensell	1,144	1,156	2,300
Hosston	2,799	1,401	4,200
Total	4,916	1,684	6,600

Table 4: Williamson County updated pumping in Run 11.

Aquifer	Run 10 (AFY)	Adjustment (AFY)	Run 11 (AFY)
Glen Rose	689	-539	150
Hensell	752	848	1,600
Hosston	1,934	-184	1,750
Total	3,375	125	3,500

Table 5: Upper Trinity GCD updated pumping in Run 11.

Aquifer	O/D	County	Run 10 (AFY)	Adjustment (AFY)	Run 11 (AFY)
Glen Rose	Outcrop	Hood	654	138	792
Glen Rose	Downdip	Hood	103	22	125
Paluxy	Outcrop	Hood	159	0	159
Twin Mountains	Outcrop	Hood	3,674	1,351	5,025
Twin Mountains	Downdip	Hood	7,854	2,914	10,768
Antlers	Outcrop	Montague	3,878	2,236	6,114
Antlers	Downdip	Montague			
Antlers	Outcrop	Parker	2,899	6	2,905
Antlers	Downdip	Parker			
Glen Rose	Outcrop	Parker	2,290	1,394	3,684

Aquifer	O/D	County	Run 10 (AFY)	Adjustment (AFY)	Run 11 (AFY)
Glen Rose	Downdip	Parker	874	532	1,406
Paluxy	Outcrop	Parker	2,609	5	2,614
Paluxy	Downdip	Parker	50	0	50
Twin Mountains	Outcrop	Parker	1,074	220	1,294
Twin Mountains	Downdip	Parker	2,083	444	2,527
Antlers	Outcrop	Wise	7,702	1,404	9,106
Antlers	Downdip	Wise	2,058	381	2,439
-	-	Total	37,961	11,048	49,009

Table 6: Southern Trinity GCD updated pumping in Run 11.

Year	Hosston Run 10 (AFY)	Adjustement for Hosston (AFY)	Hosston Run 11 (AFY)
2010	15,937	-4,135	11,802
2011	15,937	-4,635	11,302
2012	15,937	-5,361	10,576
2013	15,937	-6,978	8,959
2014	15,937	-8,424	7,513
2015	15,937	-7,565	8,372
2016	15,937	-7,074	8,863
2017	15,937	-7,929	8,008
2018	15,937	-8,130	7,807
2019	15,937	-8,135	7,802
2020-2070	15,937	0	15,937

METHODOLOGY

WSP used the same methodology as the Beach (2016) report to calculate and report the results from Run 11. A summary of the methodology is included below, and any changes or differences made are included in discussion.

- Simulations were conducted with the Texas Water Development Board (TWDB) approved version of the NTWGAM with modification discussed above.
- Initial water levels remained the same as the January 1st, 2010 water levels taken from the transient calibration of the NTWGAM.
- Instances in which initial water levels were below the bottom of the aquifer at the start of the simulation were omitted from any calculations.
- Instances in which water levels fell below the bottom of the aquifer during the model simulation had their water levels set to the bottom of the aquifer and were still used in the calculations.
- Model cells were assigned spatial location (i.e. County, district, GMA, etc.) based on the TWDB grid shapefiles for the Woodbine and Trinity.
- Model cells were assigned to aquifers based on their model IBND values and were only used for calculations if they were also considered part of the official aquifer boundary which was given as the "AQ_Active" value is equal to 1 from the grid shapefiles.
- Aquifer hydrogeologic regions were also assigned to each model cell based on the aquifer regions developed during the creation of the NTWGAM and documented in Kelley and others (2014).
- All calculations were performed on a cell-by-cell basis. Specifically, for each cell the calculation for water level difference was performed, and then the results were summarized based on the county, GCD, aquifer, etc.
- The transmissivity weighted method remained the same as in Beach (2016) and was used to calculate aquifers that are composed of multiple aquifer layers within the NTWGAM.

MODEL RESULTS

Results for the Run 11 simulation are broken down by GCD and county level and are composed of three different tables. The first table shows the pumping rates for each decade starting in 2010 and ending 2080, the second table shows the average drawdown, and the third table shows the summary of county and GCD water budget summary.

All model results are shown as tables and in order by GCD. After each GCD table summary will follow the individual counties that make up the GCD. For example, Red River GCD results showing pumping rates is immediately followed by Fannin and Grayson county pumping rate tables.

BIBLIOGRAPHY

Beach, J. A, M. Keester, and B. Konetchy, 2016. *Results of Predicitve Simulations in Support of GMA 8 Joint Planning- NTGCD GAM 8 Run 10.* Austin: LBG-Guyton Associates.

Kelley, V., Ewing, J., Jones, T. L., Deeds, N., and Hamlin, S., 2014. *Updated Groundwater Availability Model of the Northern Trinity and Woodbine Aquifers.* Contract Report to TWDB.