GAM Run 10-042 MAG

By Mohammad Masud Hassan, P.E.

Edited and finalized by Ian Jones to reflect statutory changes
effective September 1, 2011

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-3337
November 18, 2011

Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section and Interim Director of the Groundwater Resources Division, is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on November 18, 2011.

This page is intentionally left blank.

EXECUTIVE SUMMARY:

The modeled availability groundwater for the Pecos Valley and Edwards-Trinity (Plateau) aquifers as a result of the desired future conditions adopted by Groundwater Management Area 3 is approximately 407,400 and 3,400 acre-feet per year, respectively. This is shown divided by county, regional water planning area, and river basin in tables 1 and 2 for use in the regional water planning process. Modeled available groundwater is summarized by county, regional water planning area, river basin, and groundwater conservation district in tables 2 through 4. The estimates were extracted from Groundwater Availability Model Run 09-035 (version 2), which Groundwater Management Area 3 used as the basis for developing their desired future condition.

REQUESTOR:

Mr. Paul Weatherby of Middle Pecos Groundwater Conservation District on behalf of Groundwater Management Area 3

DESCRIPTION OF REQUEST:

In a document dated August 31, 2010 and received September 7, 2010, Mr. Paul Weatherby provided the Texas Water Development Board (TWDB) with the desired future condition of the Edwards-Trinity (Plateau) and Pecos Valley aquifers adopted by Groundwater Management Area 3. The desired future condition for the Edwards-Trinity (Plateau) and Pecos Valley aquifers in Groundwater Management Area 3, as shown in Resolution # 08-09-2010-3, is as follows:

> *"The average total net decline in water levels within* [Groundwater Management Area] *3, taken as a whole, at the end of the fifty-year period in 2060, shall not exceed twenty eight (28) feet below water levels in the aquifers in the year 2010, and;*
>
> *The results of Scenario 11 of the Texas Water Development Board* [Groundwater Availability Model] *Run 09-35 version-3*[1] *(single-layer model) used to develop the* [desired future condition] *for the Edwards-Trinity (Plateau)/Pecos Valley Aquifers within* [Groundwater Management Area] *3 are adopted in their entirety."*

[1] The most recent version of this report is version 2, which Groundwater Management Area 3 used when developing the desired future condition. Please see the reference email attached in Appendix A.

In response to receiving the adopted desired future condition, the Texas Water Development Board has estimated the modeled available groundwater for the Edwards-Trinity (Plateau) and Pecos Valley aquifers in Groundwater Management Area 3.

METHODS:

The Texas Water Development Board previously completed several predictive groundwater availability model simulations of the Edwards-Trinity (Plateau) and Pecos Valley aquifers to assist Groundwater Management Area 3 in developing a desired future condition. The locations of Groundwater Management Area 3, the Edwards-Trinity (Plateau) and Pecos Valley aquifers,

and the groundwater availability model cells that represent the aquifers are shown in Figure 1. As described in Resolution # 08-09-2010-3, the management area considered Scenario 11 of Groundwater Availability Modeling (GAM) Run 09-035 (version 2) when developing a desired future condition for the Edwards-Trinity (Plateau) and Pecos Valley aquifers. Since the above desired future condition is met in Scenario 11 of GAM Run 09-035 (version 2), the estimated pumping for Groundwater Management Area 3 presented here was taken directly from that simulation. The pumping was then divided by county, regional water planning area, river basin, and groundwater conservation district (Figure 2).

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the modified groundwater model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers are described below:

- The recently modified and calibrated groundwater flow model of the Edwards Trinity (Plateau) and Pecos Valley aquifers (Hutchison and others, 2011) was used for this simulation. The model was calibrated based on groundwater elevation data from 1930 to 2005.
- The model has one layer which represents the Pecos Valley Aquifer in the northwest portion of the model area, the Edwards-Trinity (Plateau) Aquifer in the southeast portion of the model area, and a lumped representation of both aquifers in the relatively narrow area where the Pecos Valley Aquifer overlies the Edwards-Trinity (Plateau) Aquifer.
- The results presented in this report are taken from Scenario 11 in GAM Run 09-035 (version 2, Hutchison, 2010). See GAM Run 09-035 (version 2) for a full description of the methods, assumptions, and results for the groundwater availability model run.
- Cells were assigned to individual counties, river basins, regional water planning areas, and groundwater conservation districts as shown in the September 27, 2010 version of the file that associates the model grid to political and natural boundaries for the Edwards-Trinity (Plateau) and Pecos Valley aquifers.
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- The model results presented in this report were extracted from all areas of the model representing the units comprising the Edwards-Trinity (Plateau) and Pecos Valley aquifers. This includes some areas outside the “official” boundary of the aquifer shown in the 2007 State Water Plan (TWDB, 2007).

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, “modeled available groundwater” is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from “managed available groundwater,” shown in the draft version of this report dated January 25, 2011, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

RESULTS:

The modeled available groundwater for the Pecos Valley Aquifer and the Edwards-Trinity (Plateau) Aquifer as a result of the desired future condition adopted by Groundwater Management Area 3 is approximately 407,400 and 3,400 acre-feet per year, respectively. This has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (tables 1 and 2). Note that, for tables 1 and 2, the pumping from the cells in the model representing both the Pecos Valley and Edwards-Trinity (Plateau) aquifers is shown as coming from the Pecos Valley Aquifer since it is the uppermost unit. The modeled available groundwater for the Edwards-Trinity (Plateau) and Pecos Valley aquifers is also summarized by county and groundwater conservation district as shown in tables 3 and 4. In Table 4, the total pumping both excluding and including areas outside of a groundwater conservation district is shown. Pumping is not summarized by regional water planning area or river basin since all areas are within Region F and the Rio Grande Basin.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. In reviewing the use of models in environmental regulatory decision-making, the National Research Council (2007) noted:

> "Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."

A key aspect of using the groundwater model to develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating

the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition(s).

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G., 2000, MODFLOW-2000, The U.S. Geological Survey modular ground-water model-user guide to modularization concepts and the ground-water flow process: U.S. Geological Survey Open-File Report 00-92, 121 p.

Hutchison, William R., 2010, GAM Run 09-035 Model Run Report (version 2): Texas Water Development Board, GAM Run 09-035 Report, 10 p.

Hutchison, William R., Jones, Ian, and Anaya, Roberto, 2011, Update of the Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers of Texas, Texas Water Development Board, 59 p.

National Research Council, 2007, Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Table 1: Modeled available groundwater for the Pecos Valley Aquifer in Groundwater Management Area 3. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Regional Water Planning Area	River Basin	Year					
			2010	2020	2030	2040	2050	2060
Crane	**F**	Rio Grande	4,972	4,972	4,972	4,972	4,972	4,972
Loving	**F**	Rio Grande	2,984	2,984	2,984	2,984	2,984	2,984
Pecos	**F**	Rio Grande	122,734	122,734	122,734	122,734	122,734	122,734
Reeves	**F**	Rio Grande	186,722	186,722	186,722	186,722	186,722	186,722
Ward	**F**	Rio Grande	50,010	50,010	50,010	50,010	50,010	50,010
Winkler	**F**	Rio Grande	39,984	39,984	39,984	39,984	39,984	39,984
Total			**407,406**	**407,406**	**407,406**	**407,406**	**407,406**	**407,406**

Table 2: Modeled available groundwater for the Edwards-Trinity (Plateau) Aquifer in Groundwater Management Area 3. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Regional Water Planning Area	River Basin	Year					
			2010	2020	2030	2040	2050	2060
Crane	**F**	Rio Grande	26	26	26	26	26	26
Reeves	**F**	Rio Grande	3,389	3,389	3,389	3,389	3,389	3,389
Total			**3,415**	**3,415**	**3,415**	**3,415**	**3,415**	**3,415**

Table 3: Modeled available groundwater for the Edwards-Trinity (Plateau) and Pecos Valley aquifers summarized by county in Groundwater Management Area 3 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Crane	4,998	4,998	4,998	4,998	4,998	4,998
Loving	2,984	2,984	2,984	2,984	2,984	2,984
Pecos	122,734	122,734	122,734	122,734	122,734	122,734
Reeves	190,111	190,111	190,111	190,111	190,111	190,111
Ward	50,010	50,010	50,010	50,010	50,010	50,010
Winkler	39,984	39,984	39,984	39,984	39,984	39,984
Total	**410,821**	**410,821**	**410,821**	**410,821**	**410,821**	**410,821**

Table 4: Modeled available groundwater for the Edwards-Trinity (Plateau) and Pecos Valley aquifers summarized by groundwater conservation district (GCD) in Groundwater Management Area 3 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Middle Pecos GCD	122,734	122,734	122,734	122,734	122,734	122,734
Total (excluding non-district areas)	**122,734**	**122,734**	**122,734**	**122,734**	**122,734**	**122,734**
No District	288,087	288,087	288,087	288,087	288,087	288,087
Total (including non-district areas)	**410,821**	**410,821**	**410,821**	**410,821**	**410,821**	**410,821**

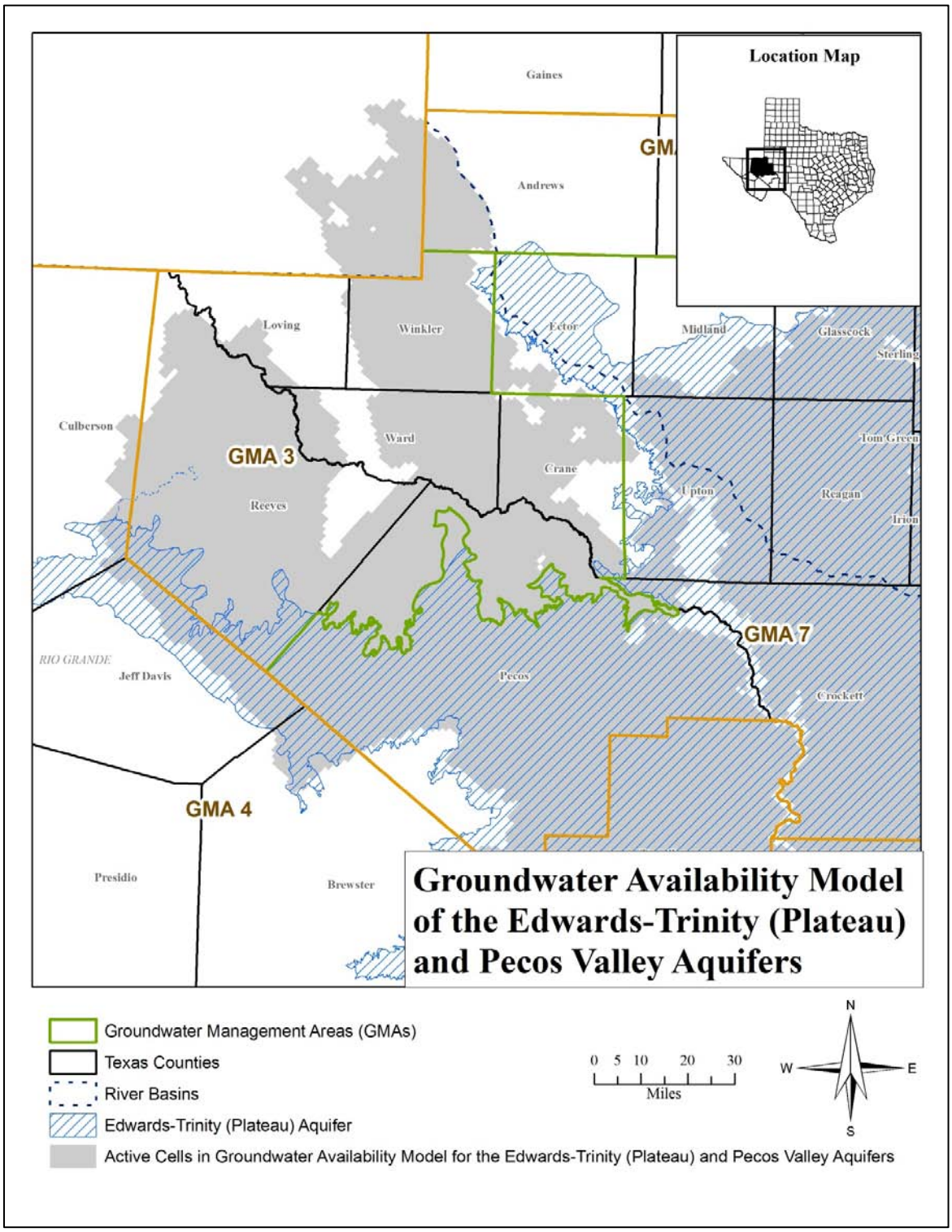

Figure 1: Map showing the areas covered by the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers.

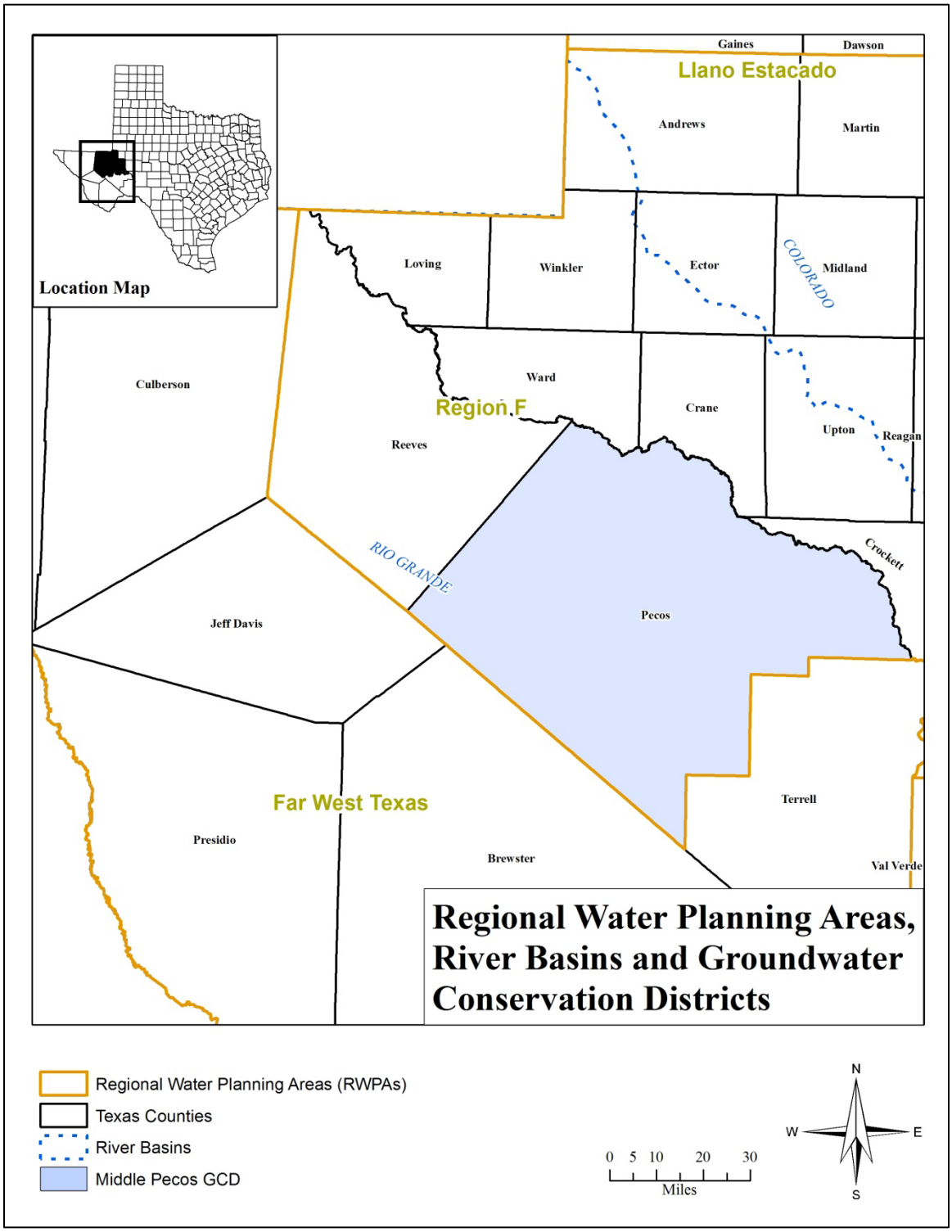

Figure 2: Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in Groundwater Management Area 3.

APPENDIX A

Masud Hassan - Fwd: Draft Model Run Report 09-035 (version 2)

From: Bill Hutchison
To: Hassan, Masud
Date: 1/24/2011 9:10 AM
Subject: Fwd: Draft Model Run Report 09-035 (version 2)
Attachments: draft run 09-035v2.pdf

>>> Bill Hutchison 8/7/2010 7:12 PM >>>
Paul,

Neil Blandford had some comments on the above referenced report, and we have made an additional model run as a result. I have attached a revised version of the report for you.

See you on Monday.

Bill

>>> Bill Hutchison 08/04/10 9:04 AM >>>
Paul,

I have attached the model run report for the Edwards-Trinity (Plateau) and Pecos Valley model that was covered at the GMA 7 meeting last week. It includes the ten scenarios from GMA 7 and reports results for GMA 3 also.

I have already emailed this report to Neil Bladford because he has been reviewing the model and has already provided comments.

See you on Monday!

Bill