Groundwater Availability Modeling (GAM) for the West Texas Igneous and Bolson Aquifers

Presented to

Stakeholder Advisory Forum

Sul Ross State University – Alpine, Texas

January 7, 2003

West Texas Igneous and Bolson GAM Team

- LBG-Guyton Associates

- Water Prospecting and Resource Consulting, LLC

- John Shomaker & Associates, Inc.

- Daniel B. Stephens & Associates, Inc.

- Senior Technical Advisors

  - Kevin Urbanczyk, Ph.D., Sul Ross State University

  - Jack Sharp, Ph.D., University of Texas at Austin

GAM Team Responsibilities

- **LBG-Guyton Associates**

  - Project Management

  - TWDB Interaction

  - Stakeholder Interaction

  - Model Development, Calibration, Verification, Prediction

  - Report and Documentation

GAM Team Responsibilities

- Water Prospecting and Resource Consulting, LLC
  - Igneous Aquifer Data Collection and Evaluation

- John Shomaker & Associates, Inc.
  - Bolson Aquifer Data Collection and Evaluation

- Daniel B. Stephens & Associates, Inc.
  - Geographic Information Systems (GIS)

- Senior Technical Advisors
  - Conceptual Model Development and Oversight

Presentation Outline

- Review of GAM Objectives and Expectations

- Groundwater Modeling Concepts

- West Texas Igneous and Bolson Aquifers

- Modeling Approach and Conceptual Model Issues

GAM Objectives

- Provide reliable and timely information on GW availability to ensure adequate supplies or recognize inadequate supplies through 2050

- Develop realistic and scientifically accurate GW flow models representing the physical characteristics of the aquifer and incorporating the relevant processes

- The models are designed as tools to help assess GW availability through 2050 based on current projections of groundwater demands

Aquifers in Texas

Major Aquifers of Texas
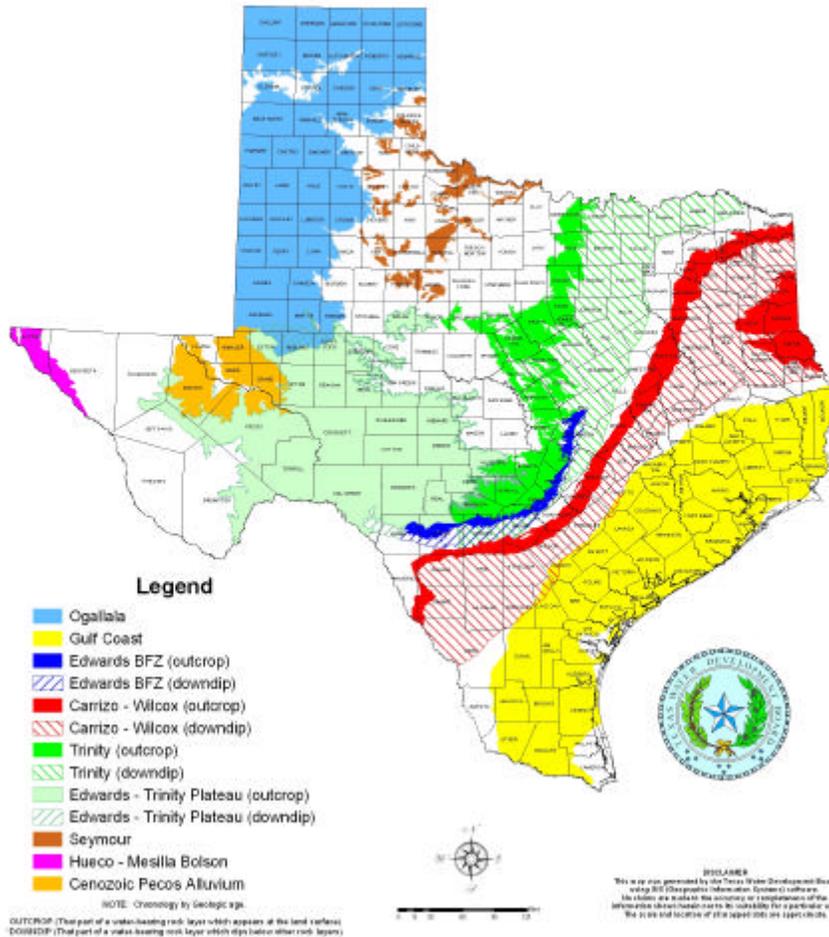
Minor Aquifers of Texas
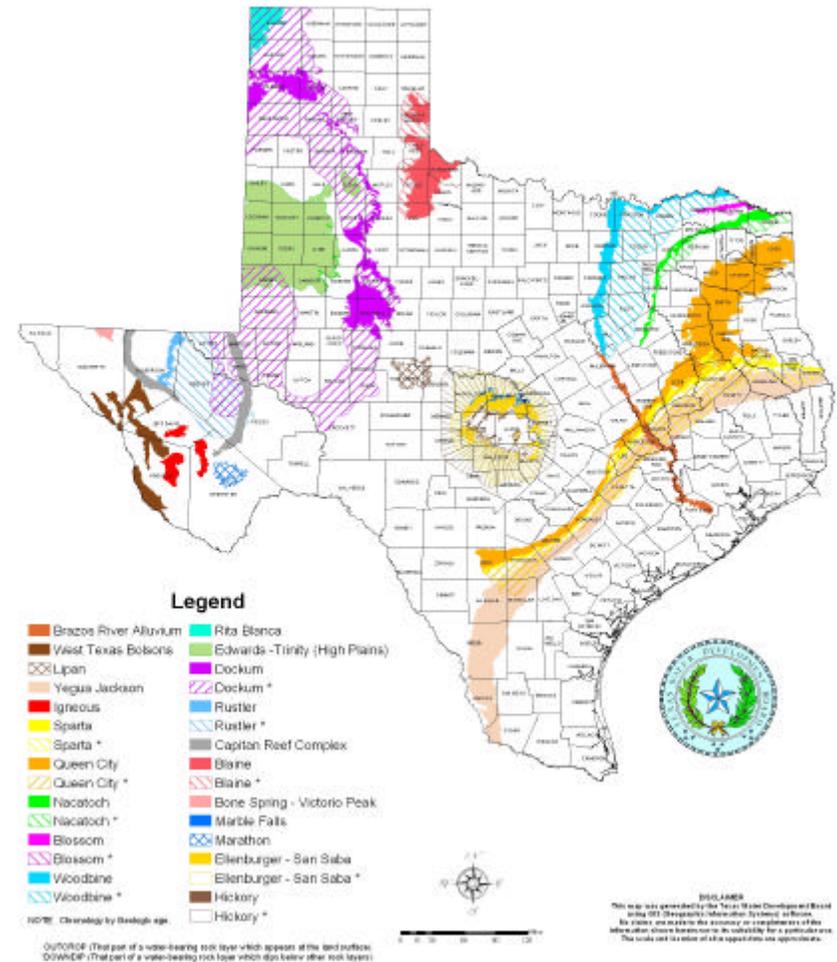
Major Aquifer GAMs
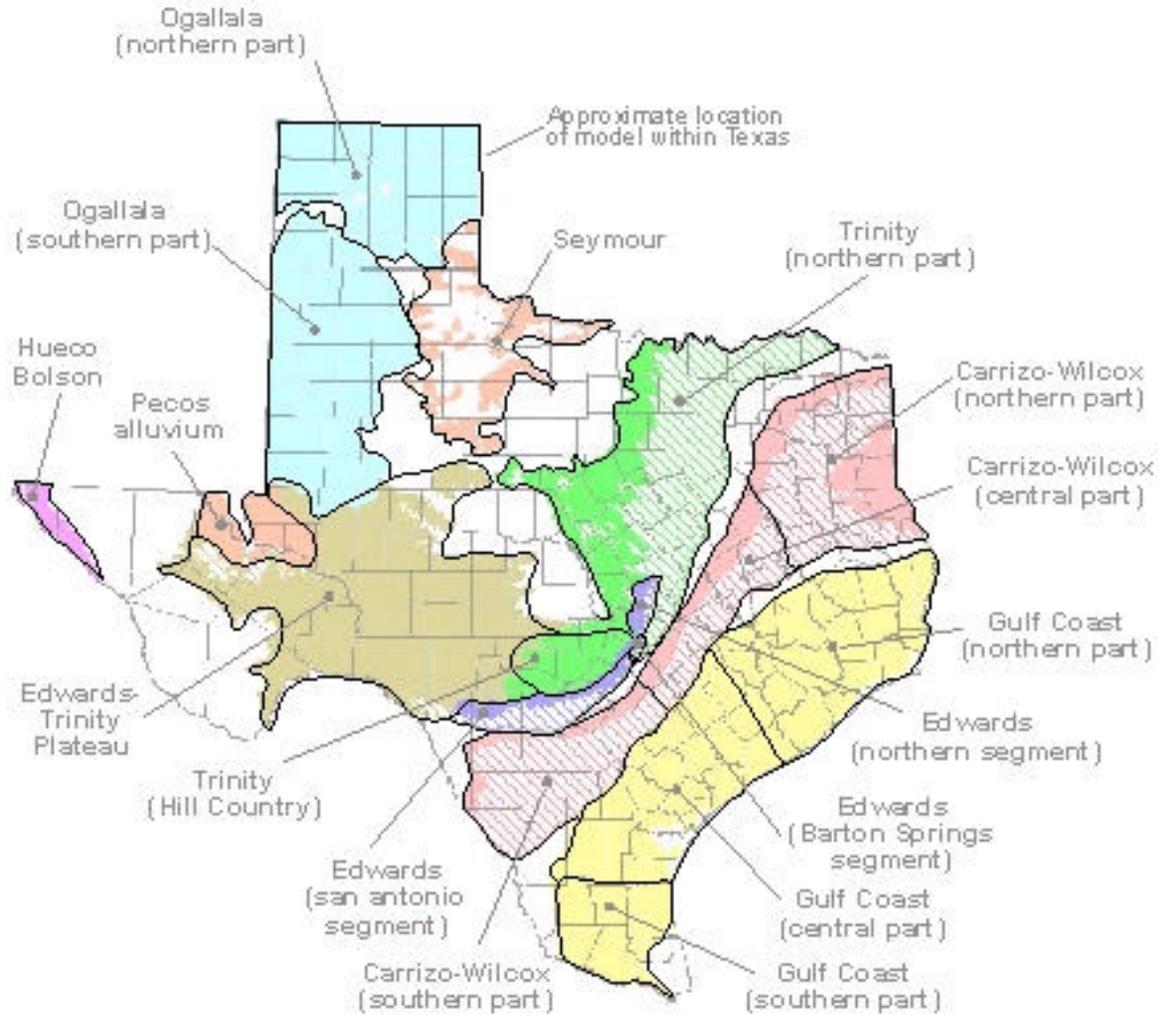
Minor Aquifer GAMs
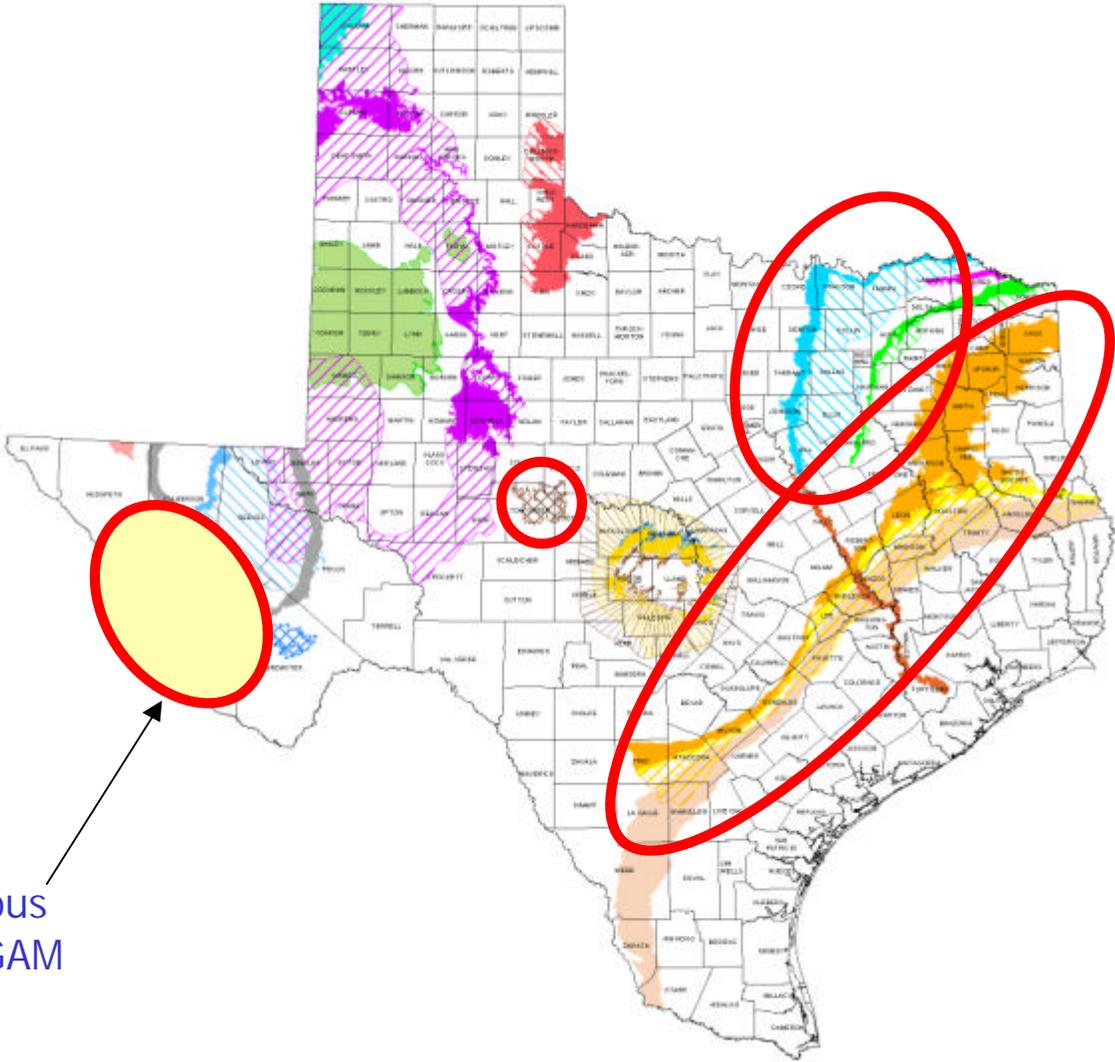
West Texas Igneous
and Bolson GAM

GAM Expectations

- Result in standardized, thoroughly documented, and publicly available numerical groundwater flow models and supporting data

- Include substantial stakeholder input to insure the models address the relevant water-resources issues of each aquifer

- Provide an integrated tool for the assessment of water management strategies for GCDs, RWPGs, and state planners

Why GAMs?

- A groundwater model provides a good way to integrate geologic information and measured data to predict groundwater flow.

- Best available technology.

What a GAM IS.

- Tool to meet the TWDB GAM objectives as specified by Texas Legislature.

- Tool to perform regional evaluation for long-term water supply.

- Tool developed from an assimilation and interpretation of significant research and different types of data.

What a GAM is NOT.

- Something that can tell you the water level in your backyard well to the nearest hundredth of a foot every minute of the day.

- Icon on a desktop computer that can be easily used and correctly interpreted by anyone.

- The definition of groundwater availability.

Numerical GW Flow Modeling

- A numerical groundwater flow model is the mathematical representation of the physical aquifer

- A numerical model calculates the water level at specific locations based on aquifer characteristics, pumping, recharge, etc.

- Calculated water levels can be compared to measured water levels in wells

Previous Investigations of
West Texas Igneous and Bolson Aquifers

- ## Igneous Aquifer Studies
  - Site-Specific
    - McDonald Observatory
    - Cities
  - Semi-regional
    - Lang (1949), Alpine Area
    - Davis (1961), Marfa Area
  - University Thesis
    - Hart (1992)
    - Palczynsky (2001)
  - Regional
    - LBG-Guyton (2001)

- ## Bolson Studies
  - Site-Specific
    - Cliet (1991), Antelope Valley Farm
  - Regional
    - Gates, White, & Stanley (1980)
    - White, Gates, Smith, & Fry (1980)
  - Models
    - Shomaker (2001), Wild Horse Flat
    - Hunt Corp, Ryan Flat

Igneous Aquifer Geology

Data Source : Texas Bureau of Economic Geology
& Sul Ross State University
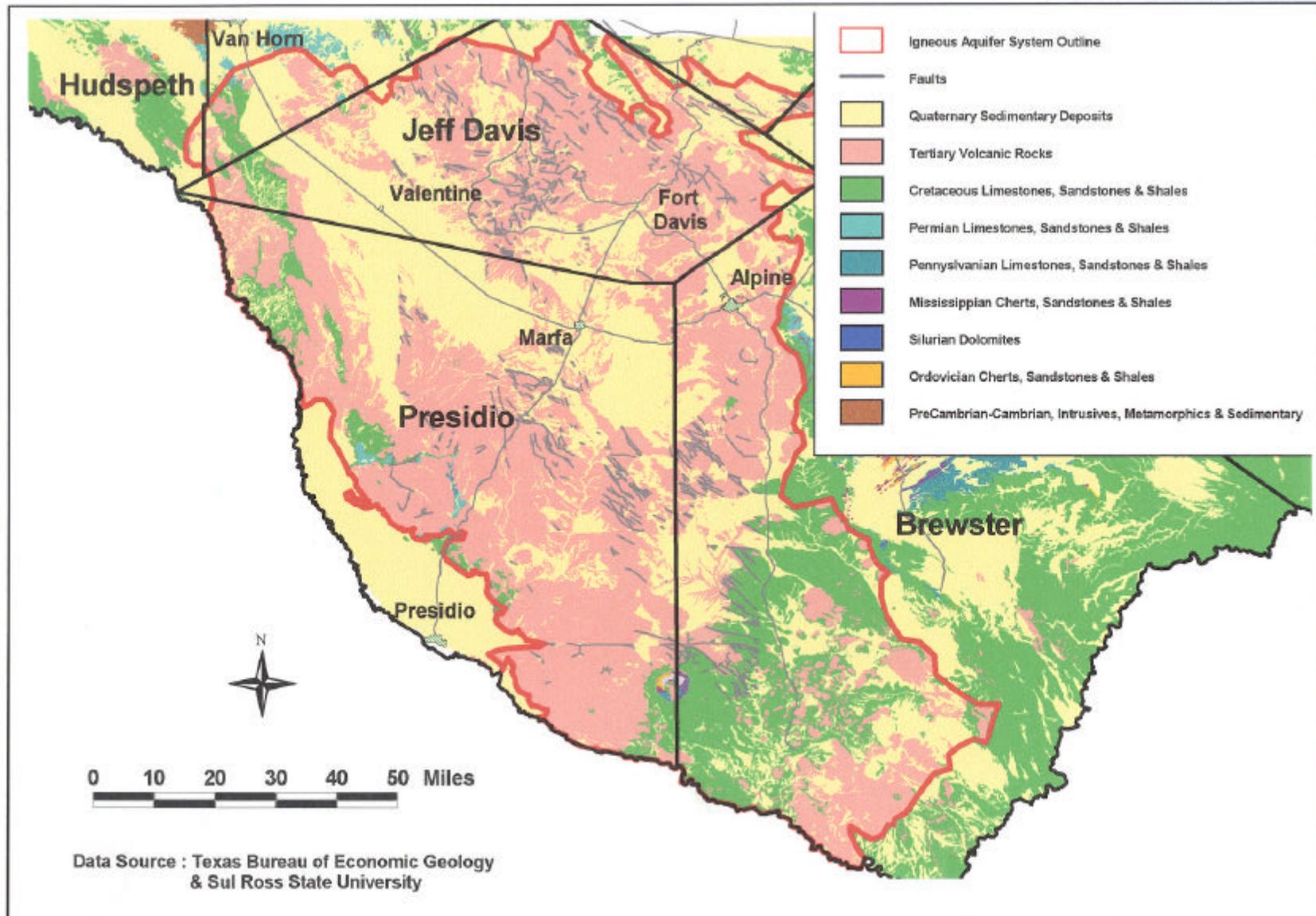
Igneous Aquifer Wells

from LBG-Guyton (2001)
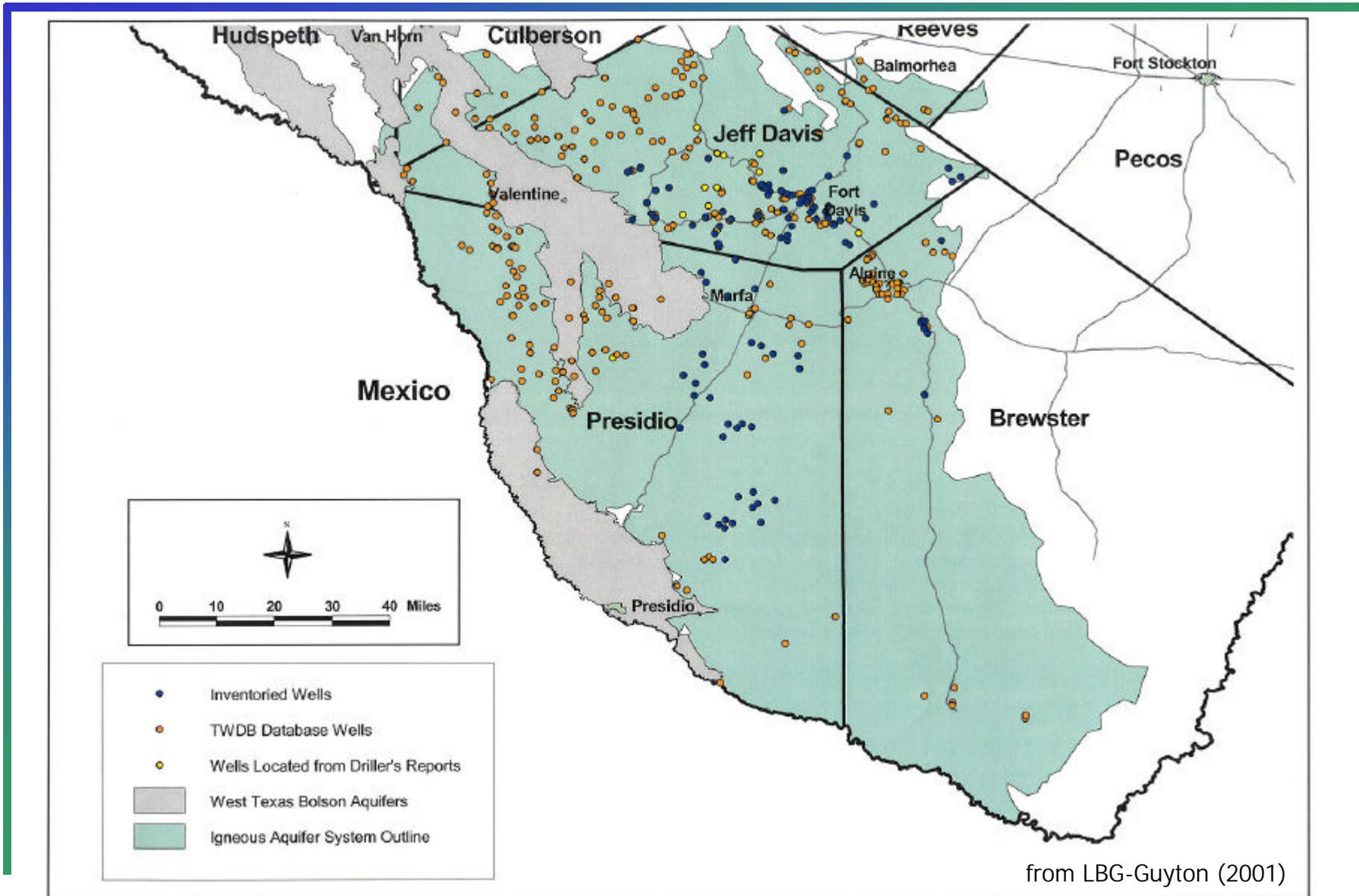
Igneous Aquifer Water Levels
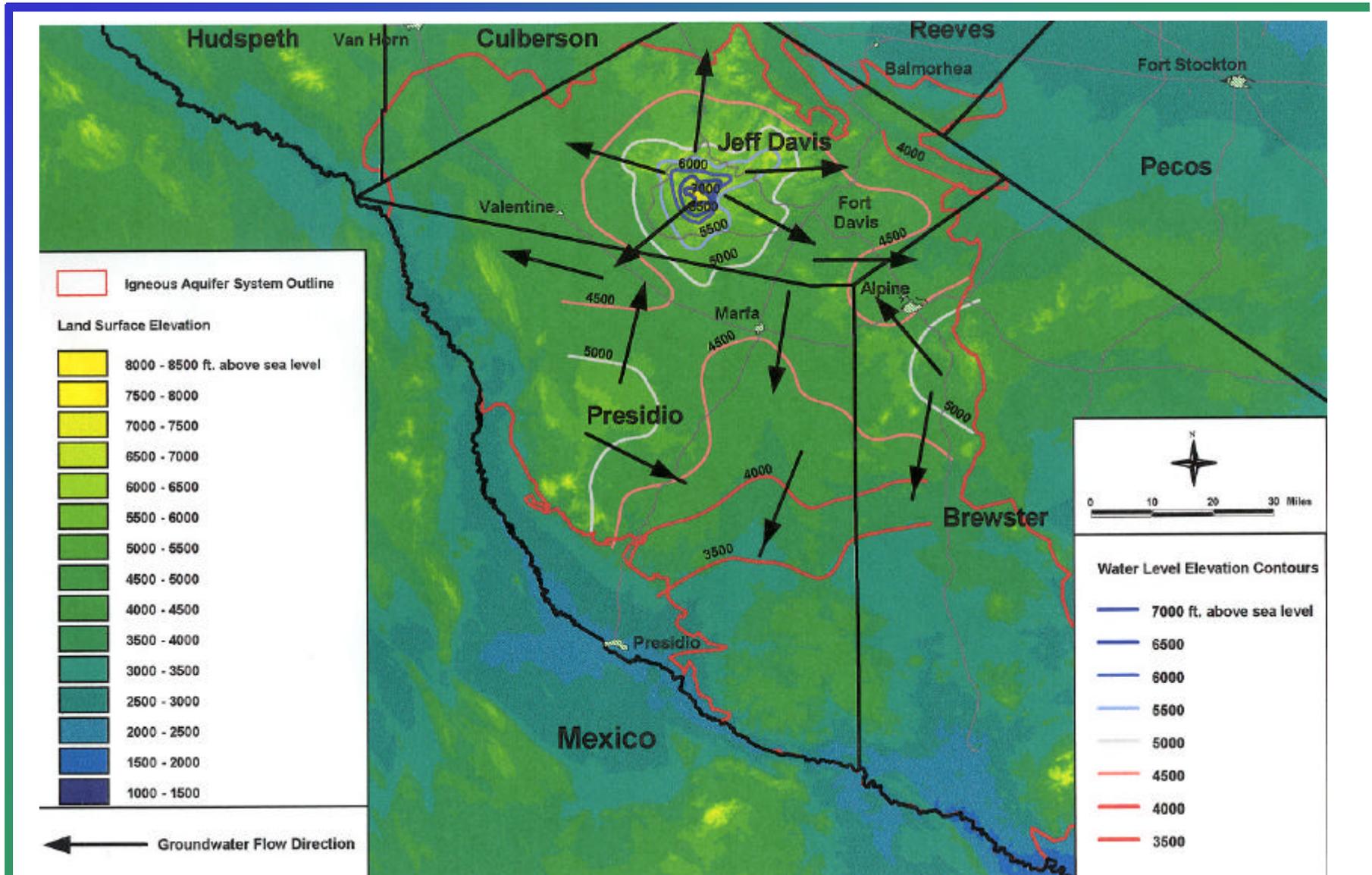
from LBG-Guyton (2001)

Bolson Aquifers
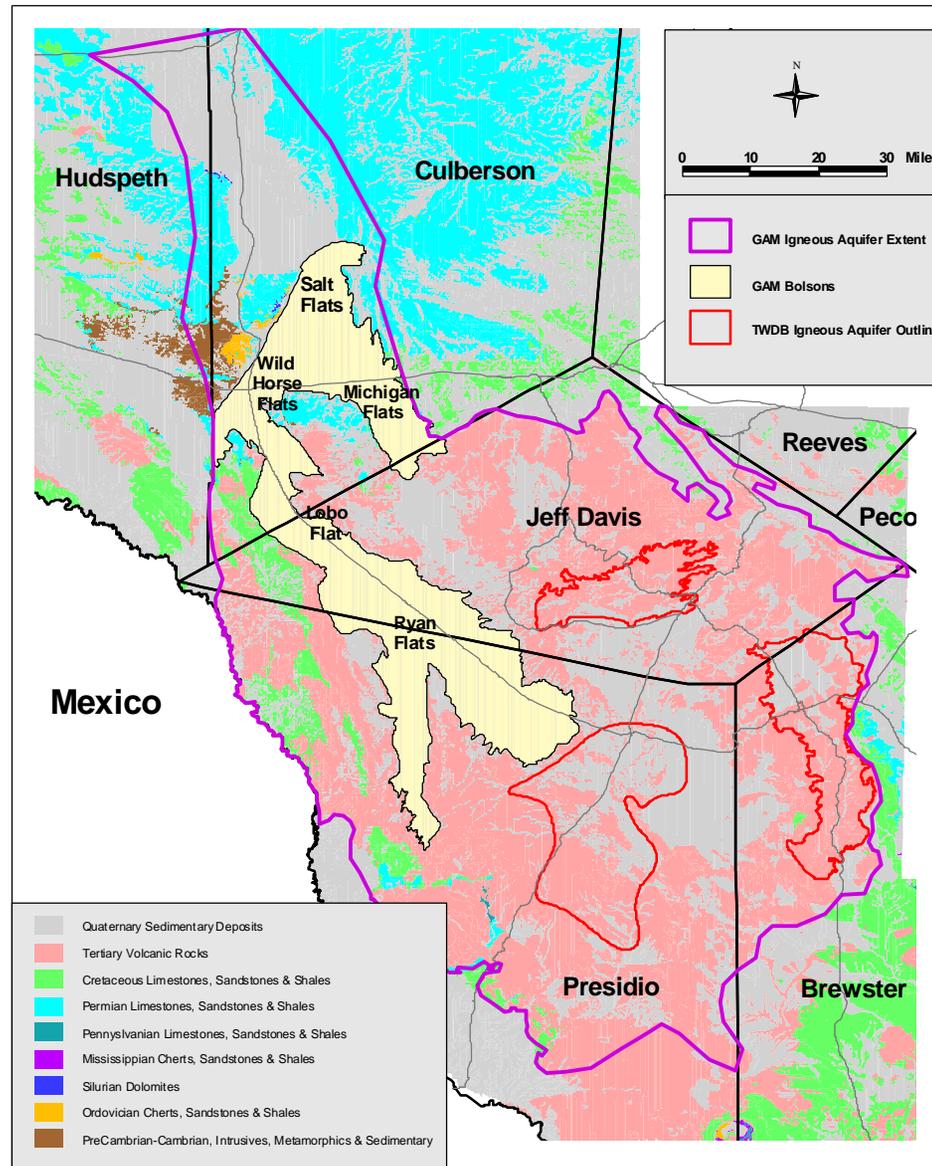
Schematic Igneous-Bolson Cross-Section
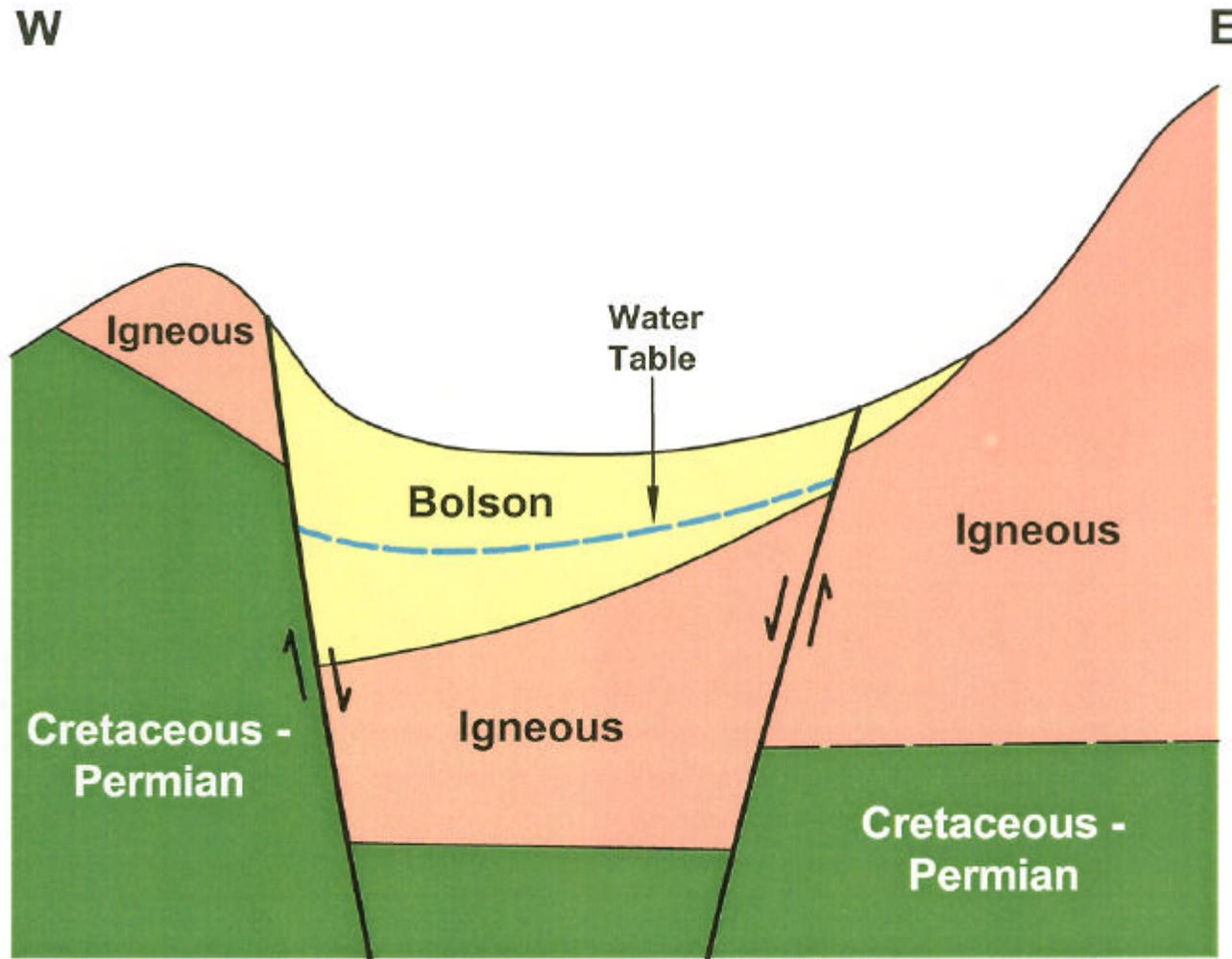
Conceptual Model Issues

- Aquifer Characteristics

- Hydrostratigraphic layers

- Lateral boundaries

- Recharge

Project Schedule

Task	Date and Project Month																					
	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	Apr-04	May-04	Jun-04
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Stakeholder Input																						
TWDB Review Meetings				√			√			√				√				√		√		
SAF Meetings					√			√			√				√				√			
Conceptual Model Development																						
Data Collection																						
a) Physiography																						
b) Geology																						
c) Water Levels																						
d) Recharge																						
e) Surface Water																						
f) Aquifer Characteristics																						
g) Discharge																						
Model Development																						
a) Architecture																						
b) Steady-State Calibration																						
c) Transient Calibration																						
d) Verification																						
e) Sensitivity Analysis																						
Predictions																						
Documentation												Draft							Draft			Final

SAF Schedule

SAF Meeting	Date	Topics
1	Jan 7, '03	Introduction & Modeling Approach
2	April, '03	Data Evaluation & Conceptual Model
3	July, '03	Model Architecture & Steady-State Calibration
4	Nov, '03	Transient Calibration & Sensitivity
5	March, '04	Predictions and Final Presentation
Model Training	June, '04	Hands-on Stakeholder Training Seminar
Final Report	June 30, '04	Final Report Due to TWDB

IGNEOUS WEST TEXAS BOLSONS SIGN-IN SHEET
January 7, 2003 - SAF 1

<u>Name</u>
Kerr Mitchell
Zhuping Sheng
Bill Hutchison
Janet Adams
Scott Adams
Jeff Bennett
Curtis Schrader
Daniel O'Melia
John Karges
Bill Jenkins
Katheryn Steen
Gordon Bell
Patti Bell
Mike Mecke
Kevin Urbanczyk
James W. Ward
Lalae Battista
James Beach
John Ashworth

First Stakeholder Advisory Forum (SAF) Meeting

January 7, 2003
Sul Ross University, Alpine, Texas

Meeting Summary

The first Stakeholder Advisory Forum (SAF) meeting for the West Texas Bolsons and Igneous Aquifers Groundwater Availability Model (GAM) was held on January 7th from 6:00 to 8:00 PM at the Pete P. Gallego Center on the campus of Sul Ross University in Alpine. Edward "Ted" Angle of the TWDB introduced the consulting team that is contracted to perform the modeling project:

- ?? LBG-Guyton Associates (James Beach – Project Manager)
- ?? Water Prospecting and Resource Consulting
- ?? John Shoemaker and Associates
- ?? Daniel B. Stephens and Associates
- ?? Dr. Jack Sharp – Univ. of Texas at Austin
- ?? Dr. Kevin Urbanczyk – Sul Ross Univ.

James Beach and John Ashworth of LBG-Guyton made a presentation to an audience of approximately 20. The presentation, along with a list of participants who signed up at the meeting, is available at the TWDB GAM website (www.twdb.state.tx.us/gam). The presentation was structured according to the following outline:

- ?? Review of GAM objectives and expectations
- ?? Groundwater modeling concepts
- ?? Bolson and Igneous aquifer hydrogeology
- ?? Modeling approach and conceptual model issues
- ?? GAM and SAF schedule

Much of the meeting was occupied with addressing questions presented by the audience. These questions and answers are presented below.

Questions and Answers

Q: *Will the additional funding being provided by the El Paso Water Utilities through the Far West Texas Regional Planning Group be used to obtain new data for the project and when will the funding be available?*

A: The funding will be available soon. The contract is currently with the Rio Grande COG. It is anticipated that fieldwork will be started within two weeks.

Q: *How is the team going to treat the Igneous and Bolson units and their interconnection?*
A: This has not yet been fully decided; discussion between the TWDB and the project Team will address this issue.

Q: *What are the groundwater flow directions?*
A: A review of the recent LBG Guyton report on the Igneous Aquifers shows that groundwater flow is directly related to topographic elevation change. The flow in the bolson is generally towards the salt basin to the north.

Q: *What is the reasoning for the orientation and size of the grid?*
A: The grid orientation is generally parallel to the long axis of the bolson valley. One of the key hydrogeologic features is the interaction along the graben structure. There also appears to be a scarcity of data in this area. It was suggested that it is likely that the 1-mile by 1-mile model grid will be too large for the interpretive model and that a 2,000-foot model grid may be more appropriate in the areas of greatest concern as this would follow the boundaries better and should help with the interpretive model.

Q: *What new data will be collected in the next 4 months?*
A: At least 5 new pumping tests of some form (these may be specific capacity, step or constant rate tests), and 20 new water levels in areas of concern.

Q: *Will there be water quality sampling and data in the model?*
A: The GAM is not modeling water quality at this stage. However, a basic descriptive analysis will be presented in the report. The next phase of GAM modeling will possibly incorporate a water quality component.

Q: *Will the public have access to the data?*
A: All the data presented at the SAF's will be available at least 1 week in advance on the GAM website. The model data will be available after completion of the project.

Q: *What GIS data standards will be used?*
A: The data standards have all been mandated by the TWDB and are described in http://www.twdb.state.tx.us/publications/requestforproposals/gam-rfq2/GAM-attach.pdf.

Q: *What modeling interface will be used?*
A: As described in http://www.twdb.state.tx.us/publications/requestforproposals/gam-rfq2/GAM-attach.pdf, the model files will be PMWIN format.

Q: *Will the Team be using MODFLOW-96? This will create anisotropy problems that MODFLOW 2000 could address. This could be a major problem with this GAM if MODFLOW-96 is used?*
A: MODFLOW-96 is mandated by the TWDB but the consulting team recognizes the limitations of using a single horizontal anisotropy value for a model layer, as is required in the standard MODFLOW-96.

Q: *Will Dr. Sharp's groundwater flow theories be considered?*
A: Dr. Sharp is a senior technical advisor to the project, and his views are considered valuable and will be incorporated.

Q: *There is sparse data in much of the model area and most of the data will be from municipalities. What data will the municipalities be able to get out of the project? Will the model be able to assist municipalities in evaluating existing well fields and potential new sites for water wells? Model cells should be located such that they split the 3 Marfa wells into different model blocks, as well as placing Village Farms pumping center into a separate cell.*

A: The model will use county and city demands as developed in the Regional Water Plan to predict long-term impacts from pumping. Based on these demands, municipalities may be able to see what effect pumping will have on their well fields. However, the model is regional in nature and not intended to perform detailed analysis of individual well-fields.

Q: *When will the TWDB model the Dell Valley aquifer and will the western side of the Guadalupe National Park be included? Suggested that the Board should extend modeling into New Mexico.*

A: The TWDB intends to include the Dell Valley area in the next round of modeling minor aquifers. Currently there is no mandate to model into New Mexico. This has been considered, but there are other considerations such as which unit is most appropriate and where the recharge comes into play. Therefore it may extend significantly into New Mexico. This is outside the scope of this model effort.