Disclaimer

The statements contained in this presentation are my professional views and opinions and are not intended to reflect the positions of, or information from, the three member Texas Water Development Board, nor is it an indication of any official policy position of the Board.
Outline

- Introduction
- Overview of Capitan Reef Complex Aquifer
- Conceptual model
- Revised project schedule
INTRODUCTION
Groundwater Availability Modeling Program

- **Aim**: Develop groundwater flow models for the major and minor aquifers of Texas.
- **Purpose**: Tools that can be used to aid in groundwater resources management by stakeholders.
- **Public process**: Stakeholder involvement during model development process.
- **Models**: Freely available, standardized, thoroughly documented. Reports available over the internet.
- **Living tools**: Periodically updated.
Major Aquifers
How we use Groundwater Models?

- Provide groundwater conservation districts with water budget data for their management plans.
- Assisting groundwater management areas in determining desired future conditions.
- Calculating Modeled Available Groundwater.
- Calculating Total Estimated Recoverable Storage.
Stakeholder Advisory Forums

- Keep stakeholders updated about progress of the model
- Inform how the groundwater model can, should, and should not be used
- Provide stakeholders with the opportunity to provide input and data to assist with model development
CAPITAN REEF COMPLEX AQUIFER
Study Area
Aquifer Boundaries

Legend
- State boundaries
- County boundaries
- Capitan Reef Complex outcrop
- Capitan Reef Complex (Standen and others, 2009)
- Capitan Reef Complex (TWDB)

North Arrow

Scale:
- 30 Miles
Minor Aquifers
Climate
Land Surface Elevation

Based on data from Gesch and others (2002)
Average Annual Precipitation

Based on data from Oregon State University (2006)
Average Monthly Precipitation

Based on data from National Climatic Data Center (2011)
Average Monthly Pan Evaporation
Geology
Surface Geology

Based on data from the Bureau of Economic Geology and New Mexico Bureau of Geology and Mineral Resources
### Generalized Stratigraphy

#### Summary of geologic formations and groups forming the Capitan Reef Complex and Delaware Basin

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<td>Dockum Group</td>
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<td>Carlsbad and Capitan Limestones</td>
<td>Gilliam</td>
<td>Bell Canyon</td>
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<td>Delaware Mountain Group</td>
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<td>Upper San Andres</td>
<td>Word Formation (Cherry and Brushy Canyon Equivalent)</td>
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<td>(Brushy Canyon Equivalent)</td>
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<td>Capitan Reef Complex</td>
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<td>Artesia Group</td>
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<td>Cutoff Shale (Member of Bone Spring Limestone)</td>
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<td><strong>Permian/ Leonardian</strong></td>
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<td>Leonard and Hess Member of Leonard Formation</td>
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<td>Bone Spring Limestone</td>
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* Formations overlie Capitan Reef Complex between the Guadalupe and Glass Mountains
Generalized Cross-Section

NORTHWEST SHELF

Artesia Group
- Tansill Formation
- Yates Formation
- Seven Rivers Formation
- Queen Formation
- Grayburg Formation

Capitan Limestone

Castile Formation

DELWARE BASIN

Guadalupe Group
- Cut-off Formation
- Victorio Peak Dolomite
- Brushy Canyon Formation
- Bell Canyon Formation
- Delaware Mountain Group

Bone Spring Limestone

Modified from Standen and others (2009); Melim and Scholle (1999)
Previous Work
Previous Groundwater Models
Hydrostratigraphy/Framework
# Hydrostratigraphy

<table>
<thead>
<tr>
<th>Aquifer/Formation</th>
<th>Description</th>
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<tbody>
<tr>
<td>Pecos Valley Aquifer</td>
<td>Edwards Group, Trinity Group</td>
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<tr>
<td>Edwards-Trinity (Plateau) Aquifer</td>
<td>Dockum Group, Dewey Lake Formation</td>
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<td>Dockum Aquifer</td>
<td>Rustler Formation</td>
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<td>Rustler Aquifer</td>
<td>Salado Formation, Castile Formation</td>
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<td>Aquitard</td>
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<td>Aresia Group Aquitard</td>
<td>Tansill Formation, Yates Formation, Seven Rivers Formation, Munn/Queen/Grayburg Fms.</td>
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<td>Capitan Reef Complex Aquifer</td>
<td>Carlsbad Limestone, Tessey, Capitan Limestone, Goat Seep Dolomite, Vidrio</td>
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<tr>
<td>Delaware Mountain Group Aquitard</td>
<td>Bell Canyon, Cherry Canyon, Brushy Canyon, Pipeline Shale Member</td>
</tr>
</tbody>
</table>
Capitan Aquifer Top Elevation

Legend
- County boundaries
- State boundaries
- Capitan Reef Complex
  (Standen and others, 2009)

Top Elevation (feet MSL)
- 8,000 - 9,000
- 7,000 - 8,000
- 6,000 - 7,000
- 5,000 - 6,000
- 4,000 - 5,000
- 3,000 - 4,000
- 2,000 - 3,000
- 1,000 - 2,000
- 0 - 1,000
- -1,000 - 0
- -1,500 - -1,000

Modified from Standen and others (2009)
Capitan Aquifer Base Elevation

Modified from Standen and others (2009)
Capitan Aquifer Thickness

Modified from Standen and others (2009)
Water Levels/Regional Groundwater Flow
Conceptual Flow System

Modified from Hiss (1980) and Sharp (2001)
Conceptual Flow System

Arrows are groundwater flow vectors; the thickness of the arrow represents the general magnitude of flow.
Conceptual Flow System

From Hiss (1980)
Water-Level Data

Legend
- County boundaries
- State boundaries
- Capitan Reef Complex Aquifer outcrop
- Capitan Reef Complex (Standen and others, 2009)

Water-level measurement locations
- Well location

[Map showing water-level data with various states and counties marked, including Texas and New Mexico]
Artesian Wells

Legend:
- County boundaries
- State boundaries
- Capitan Reef Complex Aquifer outcrop
- Capitan Reef Complex (Standen and others, 2009)

Water-level measurement locations:
- Artesian
- Nonartesian

[Map showing Artesian Wells in Texas and New Mexico]
Capitan Aquifer Water-Level Data
Rustler Aquifer Water-Level Data
Dockum Aquifer Water-Level Data

Legend
- County boundaries
- State boundaries
- Capitan Reef Complex (Standen and others, 2009)

Water-Level Elevation (feet MSL)
- 3,000 - 3,500
- 2,500 - 3,000
- 2,366 - 2,500

Map showing the Dockum Aquifer in Texas and New Mexico with water-level data markers.
Edwards-Trinity/Pecos Valley Aquifer Water-Level Data

Legend
- County boundaries
- State boundaries
- Capitan Reef Complex (Standen and others, 2009)

Water-Level Elevation (feet MSL)
- 3,500 - 4,000
- 3,000 - 3,500
- 2,500 - 3,000
- 2,194 - 2,500
Water-Level Data
Water-Level Data
Water-Level Data
Water-Level Data

Ward County (North)

- Pecos Valley Aquifer (46-32-912)
- Dockum Aquifer (45-25-713)
- Capitan Reef Complex Aquifer (46-32-309)

Graph showing water-level elevation from 1940 to 2016.
Water-Level Data
Water-Level Data
Recharge
Oil and Gas Wells

Legend

- Oil/Gas wells
- Major faults
- County boundaries
- State boundaries
- Capitan Reef Complex (Standen and others, 2009)

Data from Railroad Commission of Texas and New Mexico Energy, Minerals and Natural Resources Department
Oil and Gas Wells

Data from Railroad Commission of Texas and New Mexico Energy, Minerals and Natural Resources Department
Irrigated Farmland
Grassland and Scrubland

Data from National Land Cover Dataset
Hydraulic Properties
Hydraulic Properties
Hydraulic Properties
## Hydraulic Properties

<table>
<thead>
<tr>
<th>Aquifer</th>
<th>Minimum (feet/day)</th>
<th>Maximum (feet/day)</th>
<th>Median (feet/day)</th>
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<td>Artesia Group</td>
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<td>Delaware Mountain Group</td>
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<td>0.00000007</td>
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<tr>
<td>Castile Formation</td>
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<td>0.05</td>
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<tr>
<td>Rustler Aquifer</td>
<td>0.001</td>
<td>100</td>
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<td>Dockum Aquifer</td>
<td>0.3</td>
<td>300</td>
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<tr>
<td>Edwards-Trinity (Plateau) Aquifer</td>
<td>0.25</td>
<td>45</td>
<td>6.7</td>
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<tr>
<td>Pecos Valley Aquifer</td>
<td>4</td>
<td>25</td>
<td>8.6</td>
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Water Quality
Groundwater Quality
Groundwater Quality
Groundwater Isotopes

- **Carbon-14** ($^{14}\text{C}$)
  - Relative age of groundwater
  - Indicates recent recharge
- **Carbon-13** ($^{13}\text{C}$)
  - Progressively changes from soil to rock compositions along flow paths
- **Tritium** ($^{3}\text{H}$)
  - Relative age of groundwater
  - Indicates recent recharge
- **Stable Hydrogen** ($^{2}\text{H}$) and **Oxygen** ($^{18}\text{O}$)
  - Seasonal and/or spatial distribution of recharge
  - Source of recharge water
Groundwater Isotopes

Conclusions

- Most recharge occurred in or near the aquifer outcrops
  - Guadalupe and Glass Mountains,
  - near southern margin of Delaware Mountains
- Little recharge associated Apache Mountains
- Most recharge during Pleistocene (10,000+ years ago)
  - Most recent recharge near the Delaware Mountains
- Eastern arm of aquifer has relatively simple flow system
  - Single recharge zone in the Glass Mountains
- Western arm of aquifer more complex
  - Range of recharge conditions
Conceptual Model

Diagram showing the conceptual model of groundwater flow in the Pecos River basin. The model includes various aquifers such as the Edwards-Trinity (Plateau) Aquifer, Rustler Aquifer, Dockum Aquifer, and Capitan Reef Complex Aquifer, with arrows indicating the direction of groundwater flow. The map also highlights key geographical features like Glass Mountains and the Pecos River.
REVISED PROJECT SCHEDULE
# Project Tasks and Proposed Schedule

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<tr>
<th>Milestone</th>
<th>Completion Date</th>
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<tr>
<td>Stakeholder Advisory Forum #1</td>
<td>October 2012</td>
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<tr>
<td>Draft Conceptual Model Report</td>
<td>April 2014</td>
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<tr>
<td>Stakeholder Advisory Forum #2</td>
<td>May 2014</td>
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<tr>
<td>Final Conceptual Model Report</td>
<td>June 2014</td>
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<tr>
<td>Model construction &amp; calibration/draft model report</td>
<td>May 2015</td>
</tr>
<tr>
<td>Stakeholder Advisory Forum # 3</td>
<td>June 2015</td>
</tr>
<tr>
<td>Final Report</td>
<td>August 2015</td>
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Contact Information

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ian.jones@twdb.texas.gov
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Texas Water Development Board
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Austin, Texas 78711-3231

Web information:
www.twdb.texas.gov/groundwater
Groundwater Model
What is Groundwater Availability?

Science + Policy = Groundwater Availability

GAM or other tool + Desired Future Conditions = Managed Available Groundwater

Goal: informed decision-making
BASICS OF GROUNDWATER FLOW
Groundwater Flow: Definitions

- **Aquifer** — Geologic unit that can transmit useable amounts of water to a well
  - **Unconfined** — water table forms the upper boundary
  - **Confined** — upper boundary is low permeability layer
- **Water table** — boundary between saturated and unsaturated zones
- **Hydraulic head** — water level in a well expressed as an elevation
Groundwater Flow: Definitions

- **Hydraulic conductivity** — A measurement of the ability of material to transmit groundwater

- **Specific yield** — The volume of water that an unconfined aquifer releases from storage per unit surface area of aquifer per unit decline in water table elevation

- **Storativity** — The volume of water that a confined aquifer releases from storage per unit surface area of aquifer per unit decline of head
Groundwater Flow: Definitions

- **Recharge** — The processes involved in the addition of water to the saturated zone
- **Discharge** – The processes involved in water leaving an aquifer
- **Cross-formational flow** – Groundwater flow between geologic formations (aquifers)
- **Stream loss or gains** – The water that is lost or gained through the base of a stream due to interaction with an aquifer
Basic Principles of Groundwater Flow

- The primary observable quantity describing groundwater flow is the hydraulic head as measured in a well.
- The difference in hydraulic head between adjacent wells determines the direction of groundwater flow:
  - From higher heads towards lower heads.
- The water table is typically a subdued replica of the topography.
- The thickness and hydraulic conductivity of the aquifer define volumetric flow rates:
  - The larger the hydraulic conductivity and thickness, the greater the flow.
Schematic Cross Section of Groundwater Flow
Confined/Unconfined Aquifer

Unconfined Outcrop

Confined Aquifer
GROUNDWATER MODELING
Definition

- A mathematical device that represents an approximation of an aquifer (*The Compendium of Hydrogeology*)
- Simulation of groundwater flow by means of a governing equation used to represent the physical processes that occur in the aquifer, together with equations that describe heads or flows along the boundaries of the model (*Anderson and Woessner, 2002*)
Why Groundwater Flow Models?

- In contrast to surface water, groundwater flow is difficult to observe.
- Aquifers are typically complex in terms of spatial extent and hydrogeological characteristics.
- A groundwater model provides the only means for integrating available data for the prediction of groundwater flow at the scale of interest.
Numerical Flow Model

- A numerical groundwater flow model is the mathematical representation of an aquifer.
- It uses basic laws of physics that govern groundwater flow.
- In the model domain, the numerical model calculates the hydraulic head at discrete locations (determined by the grid).
- The calculated model heads can be compared to hydraulic heads measured in wells.
Modeling Process

1. Define model objectives
2. Data compilation and analysis
3. Conceptual model
4. Model design
5. Calibration
   - Steady State*
   - Transient*
6. Verification
7. Reporting
8. Future Water Strategies
9. Prediction
10. Comparison with field data

* Includes sensitivity analysis
Model Specifications

- Three dimensional (MODFLOW-2005 or later)
- Regional scale (1000’s of square miles)
  - Eastern arm of the Capitan Reef Complex Aquifer
- Grid spacing
  - Uniform grid – ¼ miles proposed
- Implement
  - recharge
  - groundwater/surface water interaction
  - pumping
- Calibration to observed water levels/fluxes
MODFLOW

- Code developed by the U.S. Geological Survey (USGS)
- Selected by TWDB for all GAMs
- Handles the relevant processes
- Comprehensive documentation
- Public domain – non-proprietary
- Most widely used groundwater model
  - USGS had 12,261 downloads of MODFLOW computer code in 2000
- Supporting interface programs available
  - Groundwater Vistas to be used in all GAMs
DATA COLLECTION
Data Collection

- Heads, Discharge & Water Quality Data
  - County Reports (predevelopment)
    - Evidence of artesian wells
    - Evidence of flowing springs
  - TWDB groundwater database
  - GCDs
  - Thesis work
  - Other literature
Data Collection

- Hydraulic Properties
  - County reports
  - Meyers
  - TCEQ Surface Casing Database
    - Typically specific capacity tests
  - GCD
  - Literature/Thesis
  - Stakeholders
Data Request

Request:
- Unpublished data to support the model
  - Water levels
  - Pump test results

Deadline:
- February 2013
Surface Hydrology

Legend

Streams
- Intermittent
- Perennial

State boundaries

County boundaries

Capitan Reef Complex outcrop

Capitan Reef Complex (Standen and others, 2009)
Climate Regions

Modified from Larkin and Bomar (1983)
Average Annual Maximum Temperature

Legend
- County boundaries
- State boundaries
- Capitan Reef Complex (Standen and others, 2009)

Average Annual Maximum Temperature (°F)
- 40 - 42
- 42 - 44
- 44 - 46
- 46 - 48
- 48 - 50
- 50 - 52
- 52 - 54
- 54 - 56
- 56 - 58
- 58 - 60
- 60 - 62
- 62 - 64

Based on data from Oregon State University (2006)
Fault System

Legend

- Faults
- Major faults
- County boundaries
- State boundaries
- Capitan Reef Complex outcrop
- Capitan Reef Complex (Standen and others, 2009)

Based on data from the Bureau of Economic Geology and New Mexico Bureau of Geology and Mineral Resources
Rustler Aquifer Top Elevation

Based on data from Ewing and others (2012)
Rustler Aquifer Base Elevation

Based on data from Ewing and others (2012)
Rustler Aquifer Thickness

Based on data from Ewing and others (2012)
Dockum Aquifer Top Elevation

Based on data from Ewing and others (2008)
Dockum Aquifer Base Elevation

Based on data from Ewing and others (2008)
Dockum Aquifer Thickness

Based on data from Ewing and others (2008)
Edwards-Trinity/Pecos Valley Aquifer Top Elevation

Based on data from Hutchison and others (2011)
Edwards-Trinity/Pecos Valley Aquifer Thickness

Based on data from Hutchison and others (2011)
Surface Water Hydrology
Surface Water

08401500 PECOS RIVER BELOW BRANTLEY DAM NEAR CARLSBAD, NM

08401500 CARLSBAD MAIN CANAL AT HEAD NEAR CARLSBAD, NM

08401500 ROCKY ARROYO NEAR CARLSBAD, NM

08404000 PECOS RIVER BELOW AVA/ON DAM, NM

08405105 DARK CANYON DRAW NEAR WHITES CITY, NM

08405105 DARK CANYON DRAW AT CARLSBAD, NM

08405200 PECOS RIVER AT DAMITE 3 NEAR CARLSBAD, NM

08405200 PECOS RIVER AT CARLSBAD, NM

08405200 PECOS RIVER BELOW DARK CANYON AT CARLSBAD, NM

Data from U.S. Geological Survey
Springs

Legend
- Water bodies
- Perennial streams
- Capitan Reef Complex
  (Standen and others, 2009)
Hydraulic Properties

Frequency

Hydraulic Conductivity (feet per day)

Artesia Group

Capitan Reef Complex
Groundwater Isotopes
Groundwater Isotopes
Groundwater Isotopes
Groundwater Isotopes
Groundwater Isotopes

(A) Groundwater near southern margin of the Delaware Mountains

(B) Additional data points from different locations and meteoric water line
Groundwater Isotopes

Modified from Hiss (1980) and Sharp (2001)
Edwards-Trinity/Pecos Valley Aquifer Base Elevation

Based on data from Hutchison and others (2011)
MEETING MINUTES FOR THE SECOND CAPITAN REEF COMPLEX
AQUIFER GROUNDWATER AVAILABILITY MODEL STAKEHOLDER
ADVISORY FORUM

May 27, 2014

Pecos County Courthouse, Fort Stockton, Texas

The second Stakeholder Advisory Forum (SAF) for the Capitan Reef Complex Aquifer Groundwater Availability Model (GAM) was held on Tuesday, May 27, 2014 at 11:00 AM at the Pecos County Courthouse located at 103 West Callaghan Street in Fort Stockton. A list of meeting participants is provided at the end of this meeting note.

The purpose of the second SAF was to discuss the recently developed conceptual model which will be the basis for construction of the groundwater availability model. The meeting also provided a forum for discussing the revised project schedule and provided an opportunity for feedback from stakeholders.

SAF Presentation: Ian Jones, Ph.D., P.G., TWDB

Dr. Jones presented a prepared presentation structured according to the following outline:

1. Introduction
2. Overview of the Capitan Reef Complex Aquifer
3. Conceptual model
4. Revised project schedule

Questions and Answers:

Question: What do you think causes the fluctuations in the Capitan Reef Complex Aquifer water levels?
Answer: Possibly fluctuations in pumping -- industrial pumping was important in the 1970s.

Question: Does the Pecos River interact with the Capitan Reef Complex Aquifer in locations other than that near Carlsbad, New Mexico?
Answer: No, there [the Capitan] is thousands of feet below land surface. It has an effect, but not a direct effect, because there are lots of aquifers in between.

Question: Are these total number of [oil] wells?
Answer: Total number of wells per year.

Question: Wells that were drilled in the Capitan Reef Complex?
Answer: Wells that are actually penetrating the Capitan Reef Complex. These wells are specific to the footprint of the Capitan Reef Complex.

Question: But [they are] not producing from it?
Answer: Right, [the wells] just went through it.
Question: What do [the numeric labels on the hydraulic properties slide] mean?
Answer: In the report there’s a table and these numbers help in matching up each point [on the map] with the data in the table.

Question: Why is not the western arm of the Capitan Reef Complex Aquifer included in this groundwater availability model?
Answer: Part of the western arm is already included in the Bone Spring–Victorio Peak Aquifer groundwater flow model, which we will be adopting as a groundwater availability model later this year.

Question: Is the Capitan Reef Complex Aquifer discharging into the other aquifers?
Answer: Yes, it’s going all the way through overlying aquifers including the Rustler, Dockum, Pecos Valley, and Edwards-Trinity (Plateau) aquifers.

Question: Are you also considering cross-formational flow between the Capitan and the San Andres – shelf margin discharge.
Answer: We are including this as a buffer zone along the side of the Capitan Reef Complex Aquifer itself, and we assume there’s no flow between the Capitan Reef Complex and anything underlying it.

Question: Will you continue with no-flow boundaries on the eastern side of the model?
Answer: We’re not, at least for the beginning, assuming no flow between the Capitan Reef and the Delaware Mountain Group. Considering there is a huge difference in hydraulic conductive, there will be very limited flow between them.

Question: One thing I found while doing work on the Escalera Ranch, which is on the North side of Glass Mountains – the work that Hiss did, the hydrologic framework, did not include the Tessey Limestone, nor did the work by Allan Standen for Daniel B. Stephens & Associates. The Tessey Limestone is not part of the structure as presented here, so I think it would be appropriate to add in that formation, because it’s a significant piece of the aquifer system south of [Ft. Stockton]. The vertical cross-formational flow bothers me, because you can’t see any water quality in Winkler County that would imply vertical flow of that quality from the Capitan Reef Complex Aquifer. I can provide data on that.
Answer: In terms of isotopic groundwater composition, there is very little difference between the Capitan Reef Complex and overlying aquifers— the Rustler, Dockum and Pecos Valley aquifers.

Comment: I have, and will share with you, all the data on pumping that’s been compiled by Hiss from the 1970s with the water-level data, which is the most robust thing to calibrate to.

Question: Water levels reconstructed starting water levels. Looks like you’re looking at 1980, which are not really steady-state…
Answer: I haven’t made a final decision yet. 1980s are the typical starting point for groundwater availability models, but we’re not wedded to that.

Question: So, with the dataset available, will you be willing to go back in time a little bit?
Answer: Yes.
**Question:** There’s not much discussion about recharge in [this presentation], but how do you plan on dealing with this? You have very limited hydraulic conductivity data, and no recharge analysis, just ranges of recharge of 1,000 to 16,000 acre-feet…

**Answer:** Typically we would calibrate to the recharge.

**Comment:** On the framework, there’s a USGS report by Wilshire (Professional Paper 599H) that has the Tessey Limestone – I can provide that, too.

**Question:** There’s mention of this being a karst aquifer, but no mention of this in the conceptual model. Seems kind of confusing.

**Answer:** There’s a certain amount of karst effects on it.

**Comment:** Maybe [should give] consideration there, on how you’d treat the hydraulic conductivity there as opposed to the other areas.

**Answer:** Yes, in fact just the shape of the model, the aquifer itself, will restrict flow particular parallel to the reef trend.

**Question:** Are you going to post the presentation on the website?

**Answer:** Yes, with the comments, too.

**Question:** The slide of the hydrographs in the central Pecos County… Is it correct that water levels in the Rustler Aquifer are higher by 100 feet or so than the rest? So you would not expect the Capitan water to overcome that amount of head and move upward.

**Answer:** The general trend would seem to suggest, if anything, the Capitan Reef Complex Aquifer may receive water from the Rustler Aquifer at that location. Based on those three wells.

**Question:** Are you actively modeling all five layers, or are you using General-Head Boundaries to represent some of those layers?

**Answer:** The primary aim would be to model the Capitan Reef Complex Aquifer layer. The other layers will be based on data incorporated from existing groundwater availability models.

**Question:** The simulated layers will be General-Head Boundaries?

**Answer:** The question is, to what degree will I be recalibrating those layers? The emphasis will be on the Capitan Reef Complex Aquifer itself and its relationship to what’s [adjacent] to it.

**Question:** Any idea on the thickness of Artesia Group between the Rustler and the Capitan? Somebody said there’s a lot of communication between the Rustler and the Capitan Reef Complex aquifers, and then the USGS – there’s communication between the Rustler and the Edwards-Trinity (Plateau) aquifers.

**Answer:** It varies, in some areas the Salado Formation may not be there at all.

**Question:** The water districts when they did their Desired Future Conditions, they include 11,000 acre-feet permitted water from the Capitan Reef Complex Aquifer, they did not have a lot of data. Will you be making recommendations for different sections of the aquifers when they redo the Desired Future Conditions in 2016, to either raise it or lower the Desired Future Conditions.
**Answer:** We calculate Modeled Available Groundwater based on Desired Future Conditions that are provided by the local planning group. In some instances a Desired Future Condition may not be possible, in terms of what the model shows.

**Question:** We did receive Total Estimated Recoverable Storage, and the numbers in Groundwater Management Area 7 are different than previously determined. They kind of increased.

**Answer:** Yes, the probably could be. A whole new process.
### Attendance

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<tr>
<th>NAME</th>
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<tbody>
<tr>
<td>Steve Finch</td>
<td>John Shoemaker &amp; Associates</td>
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<td>Jeff Williams</td>
<td>Williams Ranch</td>
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<td>Darrell Peckham</td>
<td>Water Quest, Inc.</td>
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<td>Gil Van Deventer</td>
<td>Trident Environmental</td>
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<td>Gerry Grisak</td>
<td>INTERA Inc.</td>
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<td>Alyson McDonald</td>
<td>TAMU Extension</td>
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<td>M.R. Gonzalez</td>
<td>Middle Pecos GCD</td>
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<td>Gerald D. Lyda</td>
<td>La Escaleta Ranch</td>
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<td>Greg Stanton</td>
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<td>Weldon Blackwelder</td>
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<td>Radu Boghici</td>
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