Trinity-Hill Country Groundwater Availability Model: Update

Ian C. Jones, Ph.D., P.G.
Stakeholder Advisory Forum
June 7, 2005
OUTLINE

- Update issues
- Introduction to groundwater modeling
- Overview of Trinity-Hill Country Aquifer
- GAM schedule
  - SAF meetings
  - Project milestones
UPDATE ISSUES

- Meeting GAM standards
  - Map projection
  - Stress periods
- Adding Lower Trinity
  - Simulating Hammett Shale
- Adjust structure
- Redistribution of pumping
- Recharge distribution
INTRODUCTION TO GROUNDWATER FLOW MODELING
WHAT IS AN AQUIFER?

- Rock or sediment from which usable amounts of water can be extracted
HYDROLOGIC CYCLE

- Precipitation
- Evaporation
- Transpiration
- Water Table
- Recharge
- Runoff
- Discharge
WHY ARE GROUNDWATER FLOW MODELS NEEDED?

- Groundwater flow is difficult to observe
- Aquifers are typically complex in terms of spatial extent and hydrogeological characteristics
- Means of integrating available data for prediction of groundwater flow
GROUNDWATER FLOW MODELING

- Mathematical representation of an aquifer
- Uses basic laws of physics that govern groundwater flow
- Calculates the hydraulic head at discrete locations (grid)
- Calculated model heads can be compared to hydraulic heads measured in wells
MODEL INPUT DATA

- Geology
  - Stratigraphy
  - Structure
- Water levels
- Surface water
  - Spring discharge
  - Stream discharge
- Aquifer properties
- Water use
Hydraulic head calculated by balancing water inflows and outflows

Pumpage
Evapotranspiration
Springflow

Recharge

Aquifer properties:
Hydraulic conductivity
Storativity
Aquifer thickness

Groundwater flow between cells

MODEL CELL
MODELING PROCESS

- Define model objectives
- Develop conceptual model
- Design model
- Calibration and verification modeling
  - Comparison with observed data
- Predictive modeling
  - Predict impacts of projected pumping
    - 2000 - 2050
MODEL PERIODS

Pre-Development
(Steady-state)

Calibration

Verification

Predictive

- Observed water levels
- Simulated water levels
MODEL LIMITATIONS

- Approximation of the real system
  - Regional scale
- Uncertainty in the input data
  - Grid resolution
  - Incomplete data
PURPOSE OF THE TRINITY MODEL

- A tool to evaluate water-management strategies.
- Predict water-level declines under drought-of-record conditions.
INTRODUCTION TO THE TRINITY-HILL COUNTRY GROUNDWATER AVAILABILITY MODEL
THE MODEL AT A GLANCE

- Hill Country area.
- Includes: (1) Edwards Group in plateau, (2) Upper Trinity aquifer, (3) Middle Trinity aquifer, (4) Lower Trinity aquifer.
- Considers geology, recharge, rivers, and pumping.
STUDY AREA
Sediments younger than Edwards Group
Edwards Group (BFZ)
Edwards Group (Plateau)
Upper member of the Glen Rose Limestone
Lower member of the Glen Rose Limestone
Hensel Sand
Sediments older than the Hensel Sand
1997 PUMPING BY USE CATEGORIES

- Domestic: 73%
- Municipal and Industrial: 14%
- Irrigation: 8%
- Stock: 5%

Legend:
- Municipal+Industrial
- Domestic
- Stock
- Irrigation
ADDITIONAL PARAMETERS

- Structural geology
- Hydraulic conductivity
- Specific storage/Specific yield
- Streams (Drains)
- General Head Boundary
- Stress periods
- Recharge distribution
GAM SCHEDULE
TENTATIVE SCHEDULE

Jun. — Conceptual model

Jul. — Model design

Aug. — Calibrate steady-state model

Sep. — Calibrate transient model

Oct. — Complete model predictions

Nov. — Prepare draft report

Dec. — Present SAF Model Seminar

Deliver Final Product
SAF INPUT NEEDED

- **Data**
  - Pump test results
  - Water-level
  - Spring flow
  - Structural

- **Insights**
  - How the aquifer works
  - Model assumptions
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The first Stakeholder Advisory Forum (SAF) for the updated Trinity-Hill Country Groundwater Availability Model (GAM) was held at the Kendall County Historic Courthouse in Boerne, Texas, on June 7, 2005. Topics covered during the meeting were the work to be done to update the model, an overview of groundwater modeling, the hydrogeology of the Trinity-Hill Country aquifer, and the tentative work schedule. We plan to update the model to meet GAM standards, add the Lower Trinity aquifer to the model, make adjustments to the structure of the existing layers, and redistribute recharge and pumping. According to the present tentative work schedule, work to update the model, including the report, may be completed by the end of 2005.

During the meeting, stakeholders asked several questions pertaining to various aspects of the model. The following is a synopsis of stakeholder questions and comments (bold) and our responses (italics).

- **How will the Hammett Shale be simulated?** We will simulate the Hammett Shale using the vertical hydraulic conductivity for groundwater flow between the Middle and Lower Trinity aquifers. Vertical hydraulic conductivity values will be determined through the model calibration process.

- **Would model efforts by groundwater conservation districts (GCDs) duplicate work done on GAM?** Modeling efforts by GCDs will likely supplement work done on GAM. The GAMs developed by the TWDB are regional-scale models designed to give a “big picture” view of aquifer responses to projected pumping and drought. Sometimes GCDs need to address local-scale issues within their boundaries that would be better addressed using local-scale models.

- **How well does the model simulate Jacob's well spring?** We will check on that.
• A stakeholder noted that Bexar Met Water District is looking at pumping 15,000 acre-feet per year in northern Bexar County. We will check to see whether that pumping is included in the projected pumping in the model.

• A stakeholder has observed groundwater flow to the north near the Haby Crossing Fault. When we run the model we will try to simulate this but there is the possibility that northward groundwater flow in that part of the aquifer may be a local-scale issue that can not be replicated in a regional-scale model.

• New pumping test information. We are interested in incorporating into the model any pumping test data that GCDs or other entities have collected.

• Stakeholder had questions related to how well the model predicted future aquifer responses. Model uncertainty is related to uncertainty in input parameters, pumping projections, and climate assumptions. The uncertainties increase into the future. We plan to study model uncertainty in the future.

• LBG-Guyton Associates did a Lower Trinity aquifer study for regional water planning groups in the model area. We will review these study reports and incorporate applicable data.

• Need to look for recharge data related to Cibolo Creek in the Trinity Glen Rose GCD groundwater management plan. We will attempt to acquire a copy of this report and incorporate the applicable data.

• What are the sources of structural geology data. We obtain structural geology data from different sources including previous studies, geophysical logs, and drillers’ logs.
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