

Presentation to the Colorado and Lavaca Basin and Bay Stakeholder Committee



Presented by:



September 22, 2015

Outline

- Proposal Background
- Proposal Options 1 and 2
- Shallow Groundwater Flow Systems
- Model Grid Scale and Implications Regarding Modeling GW/SW Interaction in Regional GAMs
- Evidence that Scale Issues Exist in the Current GMA-12 GAM
- Lower-Colorado River Basin (LCRB) Example
- Proposal 1: Improvements to GMA 12 Model for Simulation of GW/SW interaction
- Proposal 2: Field Studies

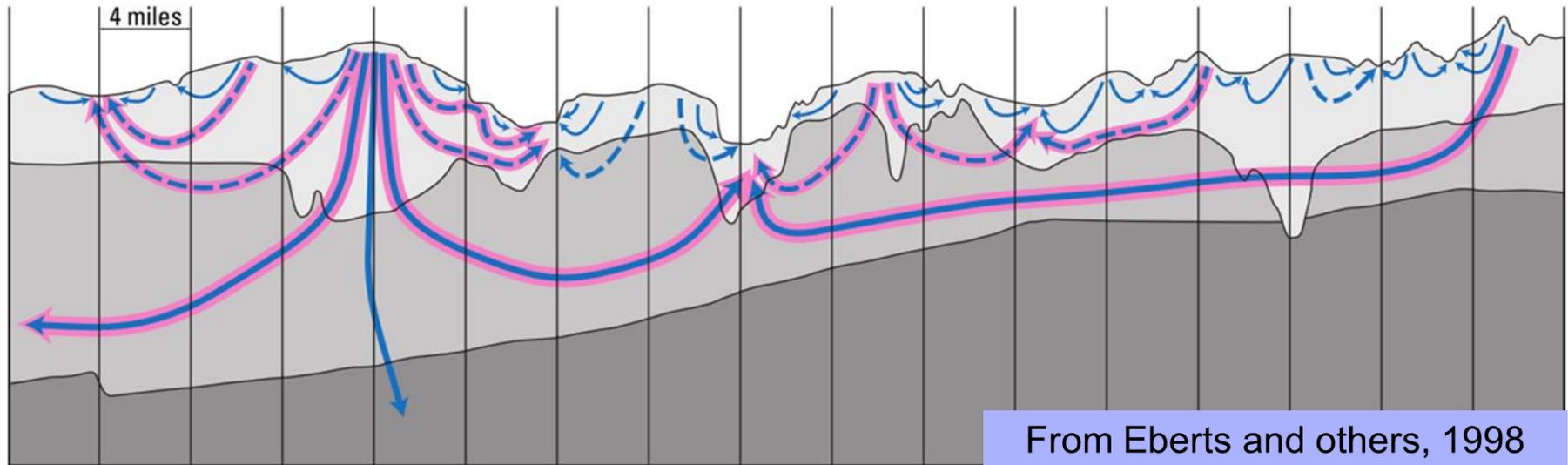
Proposal Background

- \$520,000 from TWDB and GCD to improve modeling of faults & historic pumping for GMA 12 GAM
 - Investigate whether faults are sealing
 - Incorporate numerous large-scale pumping tests
 - Recalibrate model beginning with pre-development
- \$200,000 from GCDs, LCRA, and BRA to improve SW-GW interaction in GMA 12 GAM
 - Reconstruct model from MODFLOW-96 (fixed grid size) to MODFLOW-USG (variable grid sizes)
 - Refine 1-mile grid spacing to 0.5 mile grid spacing for Brazos and LCRA river and tributaries
 - Include one additional shallow vertical layer
- Project Schedule
 - Start: Sept. 2015
 - End: December 2017

Proposal Options

- \$30,000 (Option 1a – original)
 - 0.25 mile grid spacing for Colorado River
 - Characterize the alluvium and model as a separate layer
 - Meet every six months with BBASC
- \$50,000 (Option 1b - expanded)
 - Same as option 1a
 - 0.25 mile grid spacing for Colorado and its tributaries
 - An additional (2 total) model layer for shallow flow system
- \$10K for (Option 2)
 - Work plan regarding data, collection, and analysis to address BBESTs needs in Colorado and Lavaca River Basin

Hierarchy of Groundwater Flow Systems



NOT TO SCALE

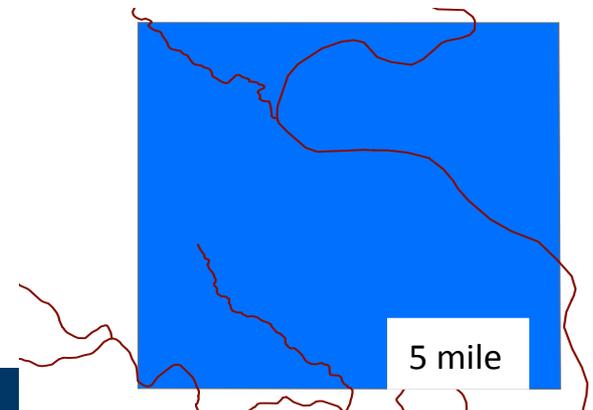
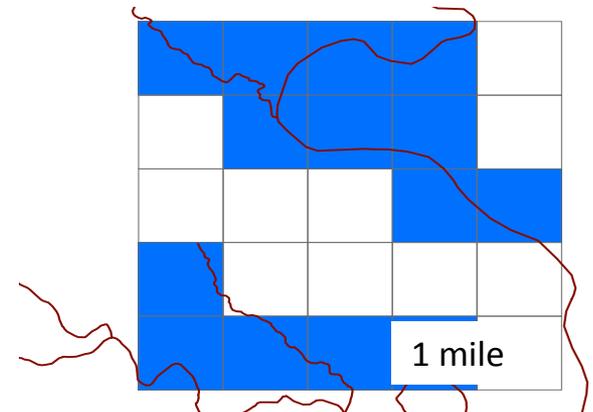
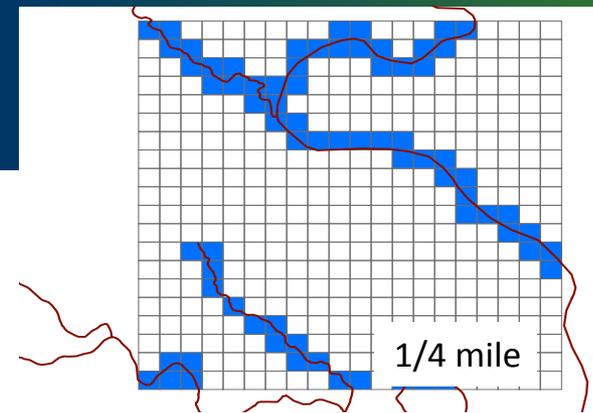
From Eberts and others, 1998

- ← Local ground-water flow path
- ← Intermediate ground-water flow path
- ← Regional ground-water flow path
- ← Indicates flow simulated by the regional ground-water flow model constructed for this investigation

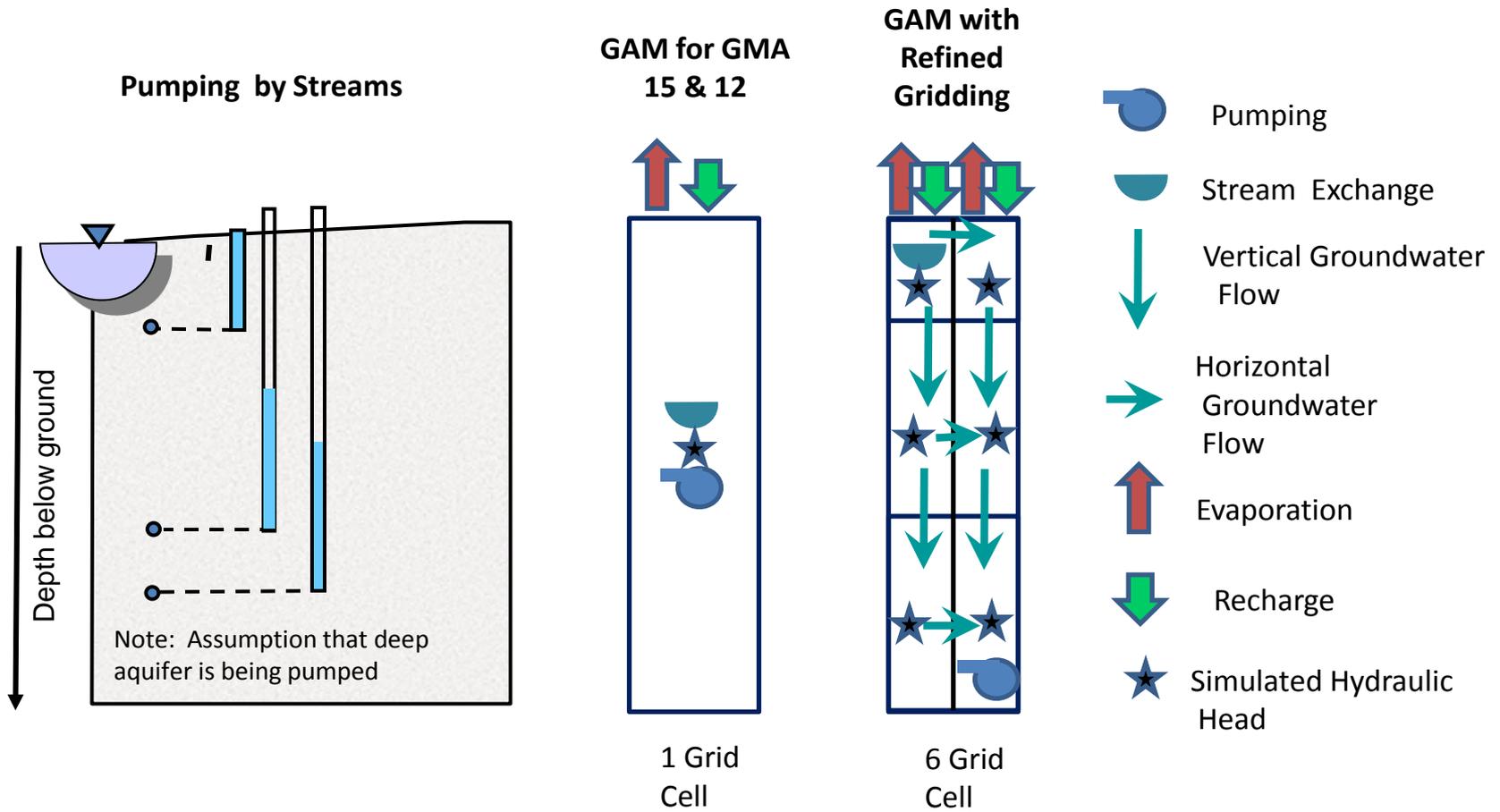
Note: Most GAMs and regional groundwater flow models do not have the vertical resolution in their layering to represent local flow paths.

Implications of Horizontal Grid Scale

- Refinement Provides
 - Better representation of topographic gradients
 - Better definition of topographic lows
 - Better representation of surface-groundwater interaction
- The smaller the grid, the more local the flow system that can be modeled
- Generally, the smaller the grid, the more amount of discharge (recharge) can be modeled

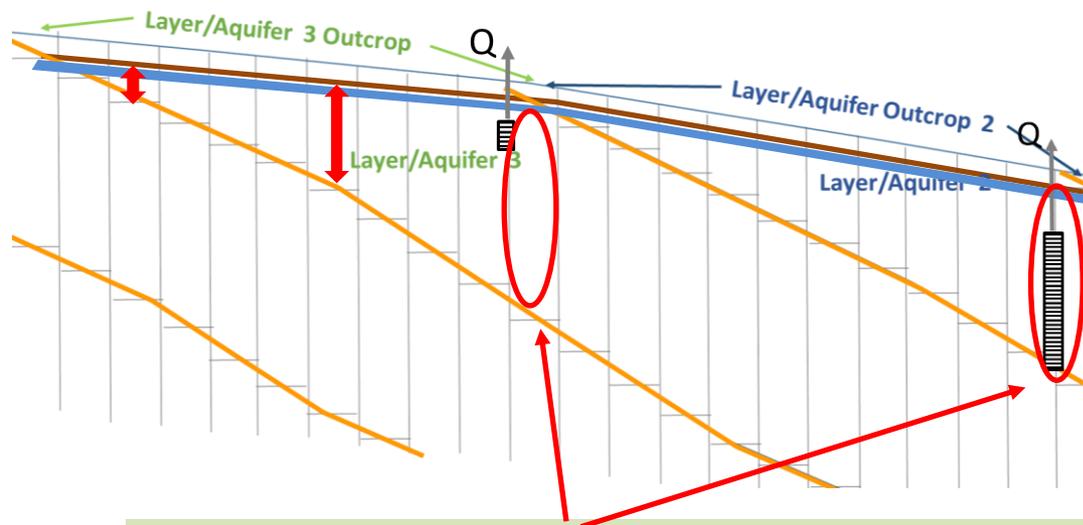
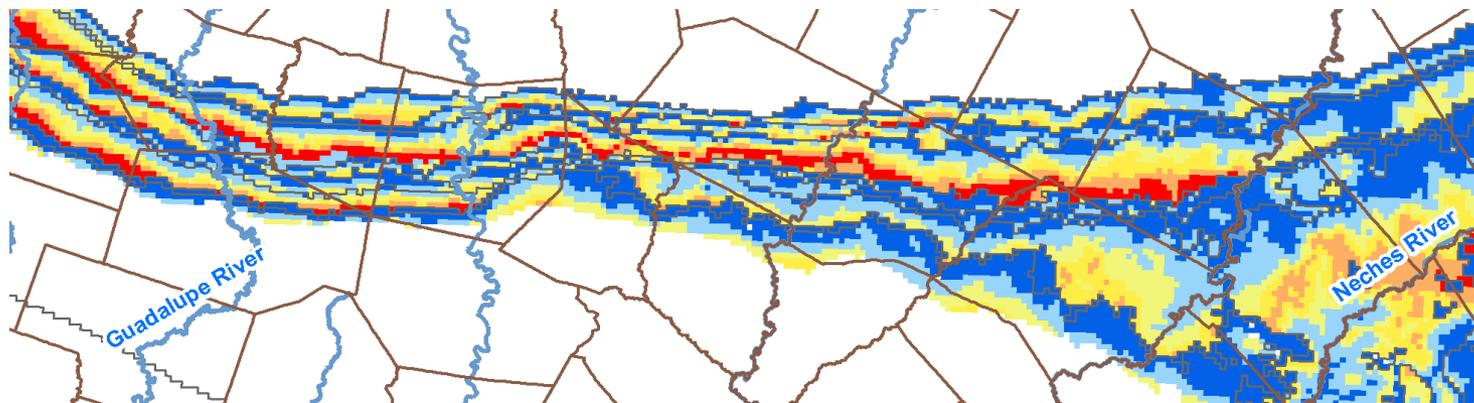


Implications of Vertical Grid Scale



Evidence that Problem Exists with GAM 12 GAM Representing Shallow Flow System

Outcrop Cell Thickness (ft)

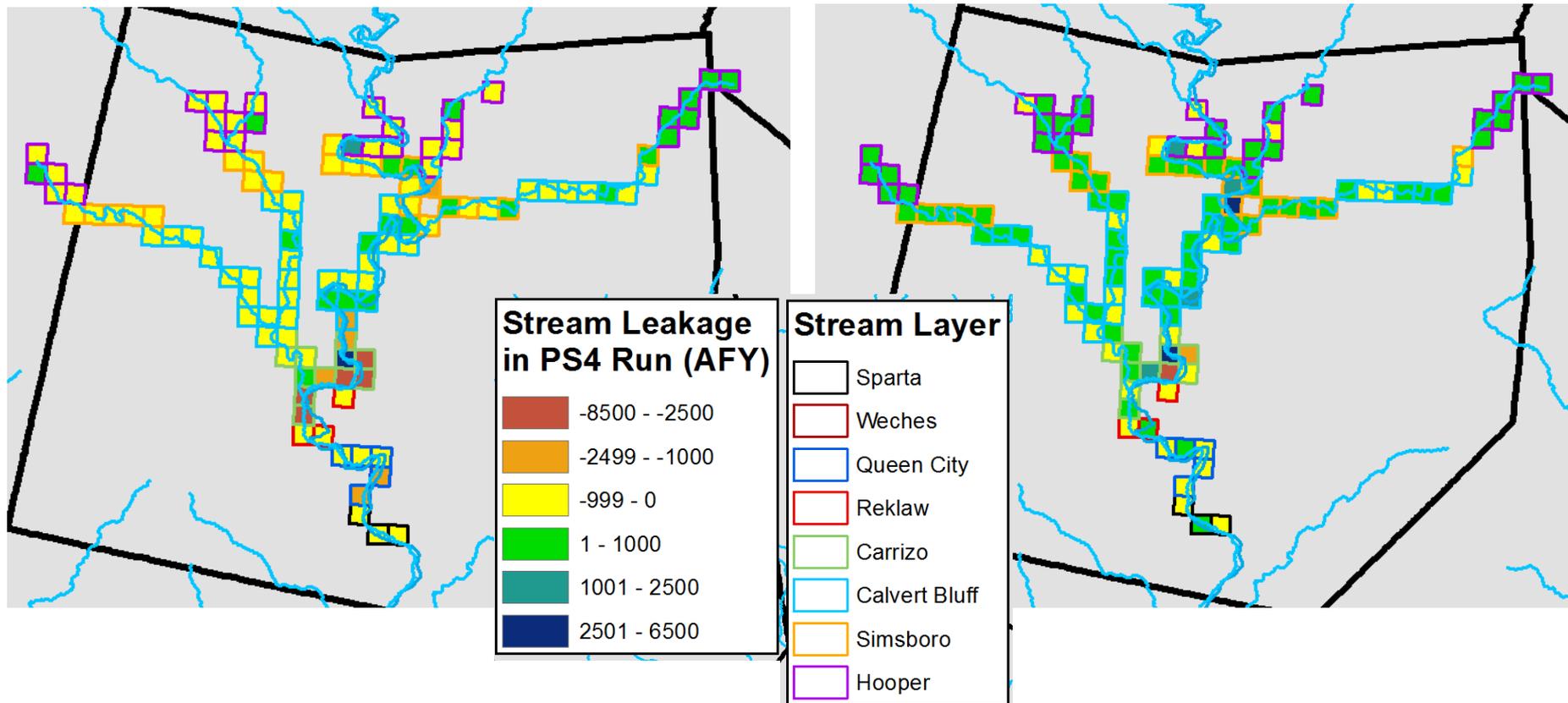


Potential Problem: Large grid eliminates shallow flow system and directly connects deep flow system to river

Evidence that Problem Exists with GAM 12 GAM Representing Shallow Flow System

2000

2070

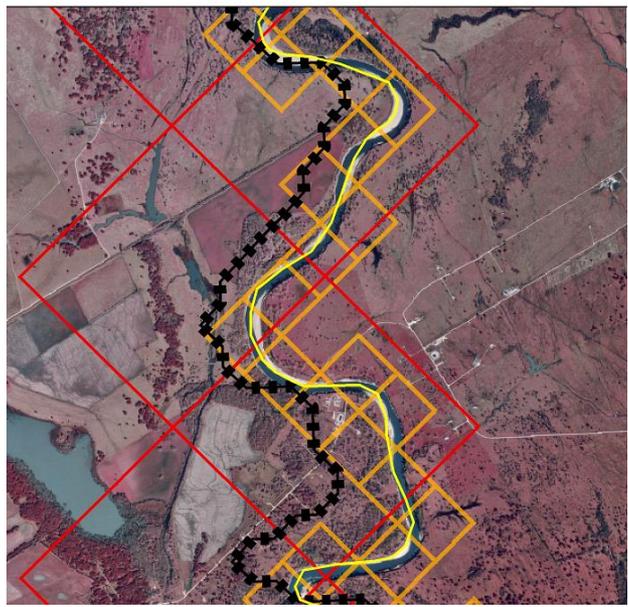
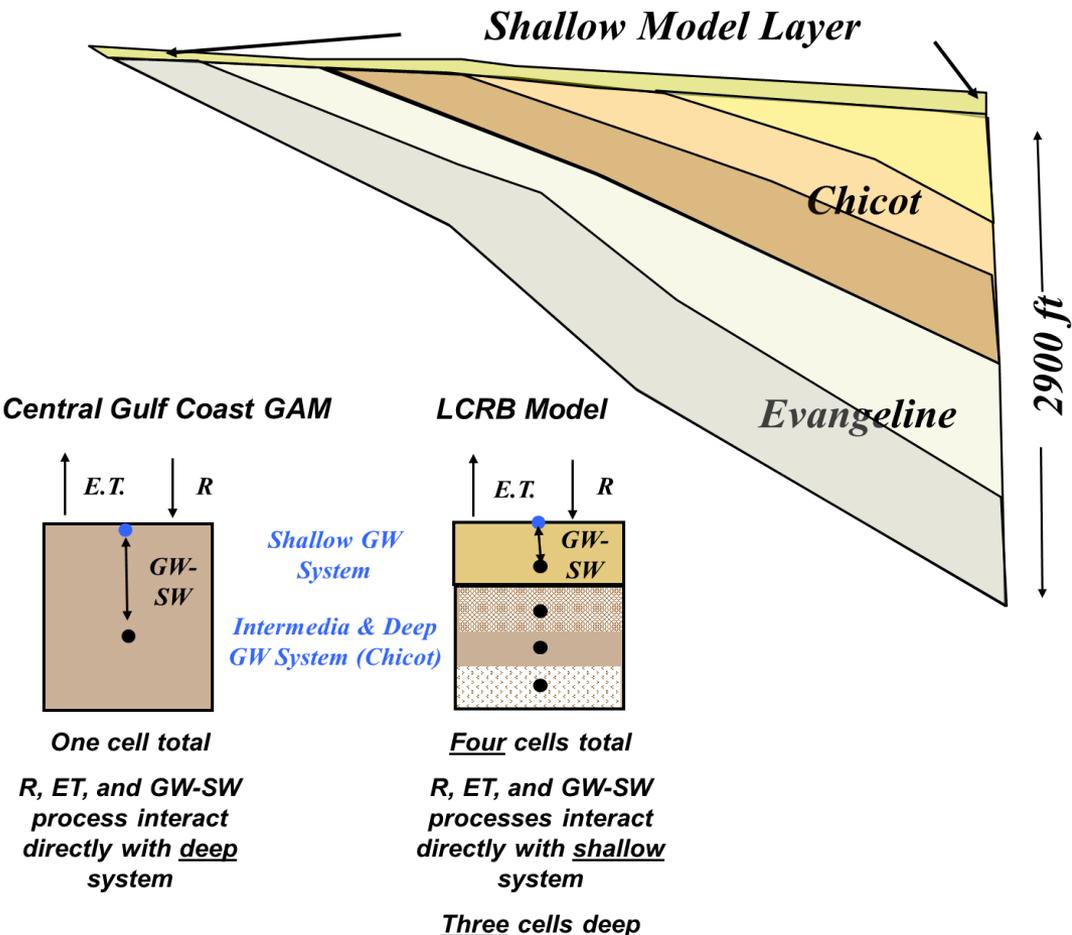


Note: Negative flows (red, orange, yellow) means the aquifer is providing groundwater to the stream – so stream is gaining. Positive flows (greens and blues) means the aquifer if receiving water from the stream – so stream is losing.

LCRB Model: Decrease Areal and Vertical Grid Cell Size

Add Additional Model Layers

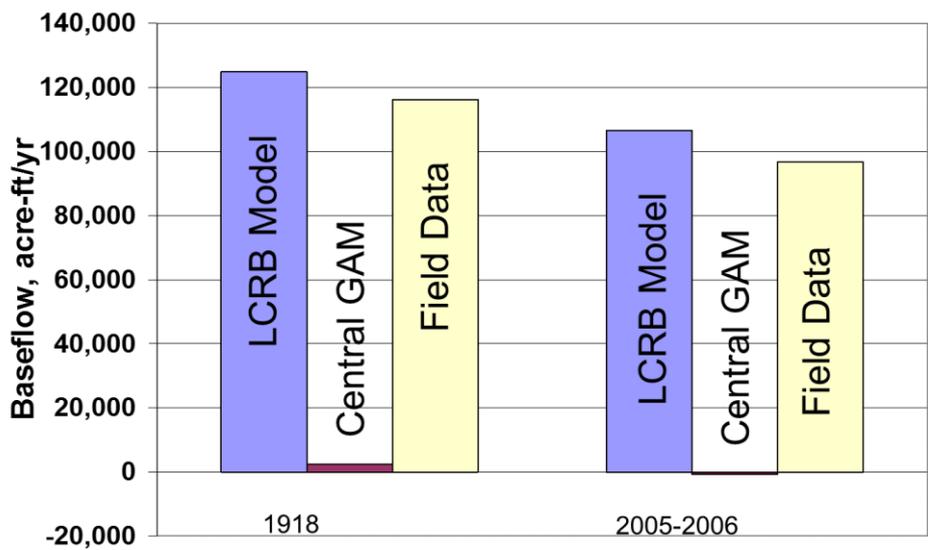
1 mile grids to 0.25 grids



- GAM 1 mile by 1 mile grid
- LSWP 0.25 mile by 0.25 mile grid
- EPA RF1
- National Hydrography Database

Comparison of SW-GW Interaction: LCRB Model and GMA 15 GAM

Comparison of Groundwater Contribution to Baseflow



Comparison of Pumping Impact on GW-SW Interaction

	Sources of Groundwater For Pumping for Wharton, Colorado, & Matagorda Counties from 1980 to 1999			
	Recharge	Storage	Inflow from Adjacent Counties	Leakage from Surface Water
Central GAM	0%	13%	12%	75%
LCRB Model	66%	28%	7%	0%

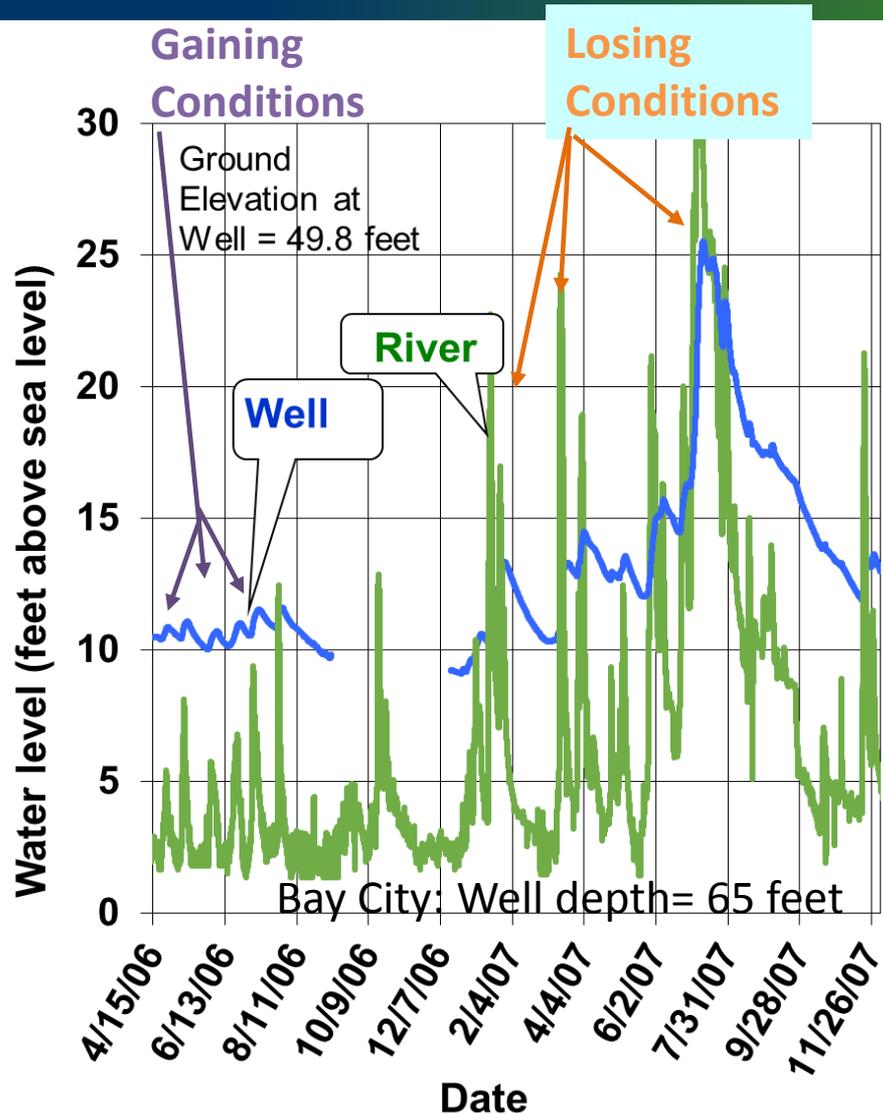
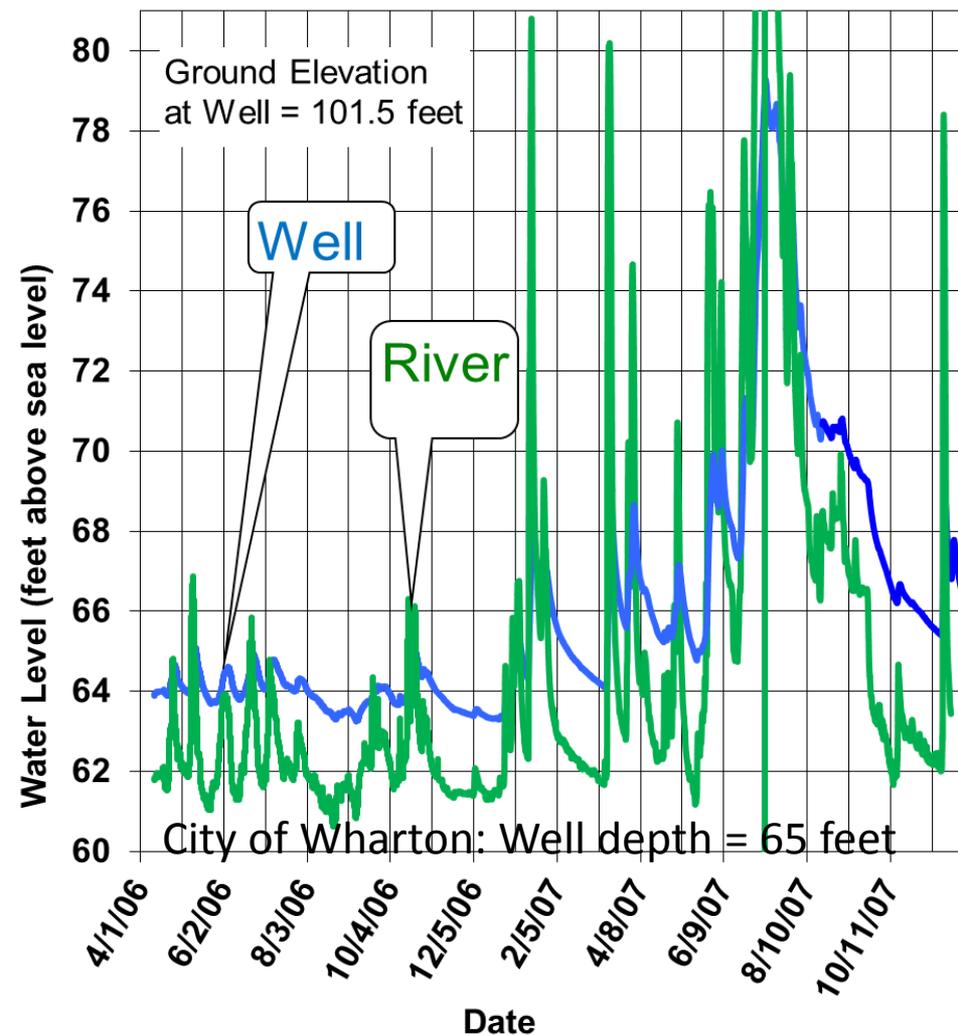
Proposal Option 1 for Improved GW-SW Simulations in GMA 12 GAM

- \$200,000 from GCD, LCRA, and BRA to improve SW-GW interaction in GMA 12 GAM
 - Redo complete model from MODFLOW-96 (fixed grid size) to MODFLOW-USG (variable grid sizes)
 - Refine 1-mile grid spacing to 0.5 mile grid spacing for Brazos and LCRA river and tributaries
 - Add an additional shallow model layer
- Proposal Option 1b (\$50,000)
 - Include an additional model layer
 - 0.25-mile grid spacing for Colorado and its tributaries
 - Alluvium modeled as a separate hydrogeologic unit

Proposal Option 2 for Collecting Data on GW-SW Interaction

- Proposal Option 2 (\$10,000)
 - Use paired surface water gages and groundwater wells (stage, temperature and TDS)
 - Evaluate approaches for using hydrographs to estimate groundwater-surface water exchange and evaluate the biases/errors with the methods
 - Expansion of work started with LCRA-SAWS Water Project
 - Select four sites and evaluate costs of using existing or new wells

Example of the Type of Field Data Needed: (From LCRB Study)



Questions ?

