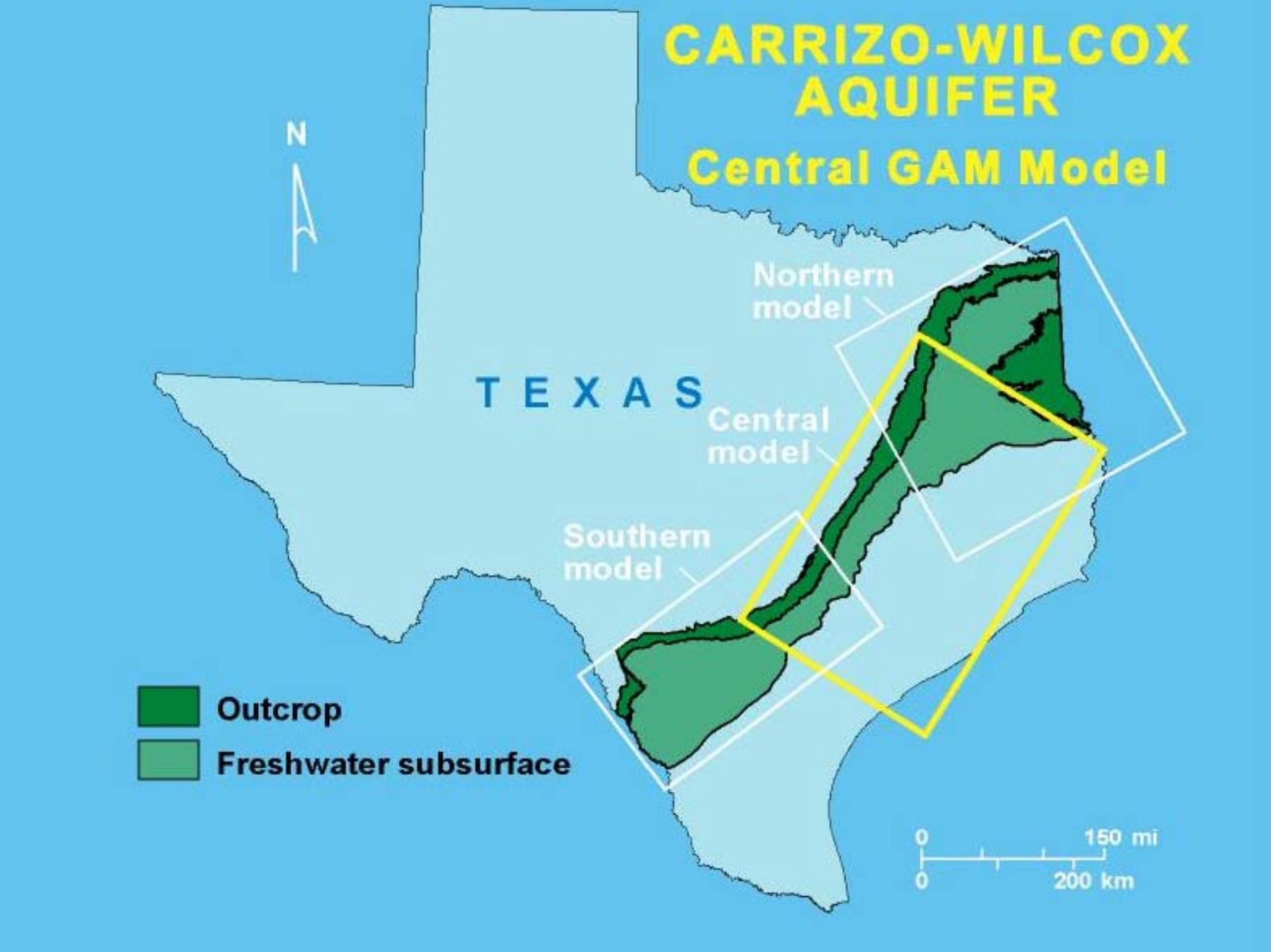
texas water development board

AGENDA
STAKEHOLDER ADVISORY FORUM (SAF) MEETING
February 28, 2002

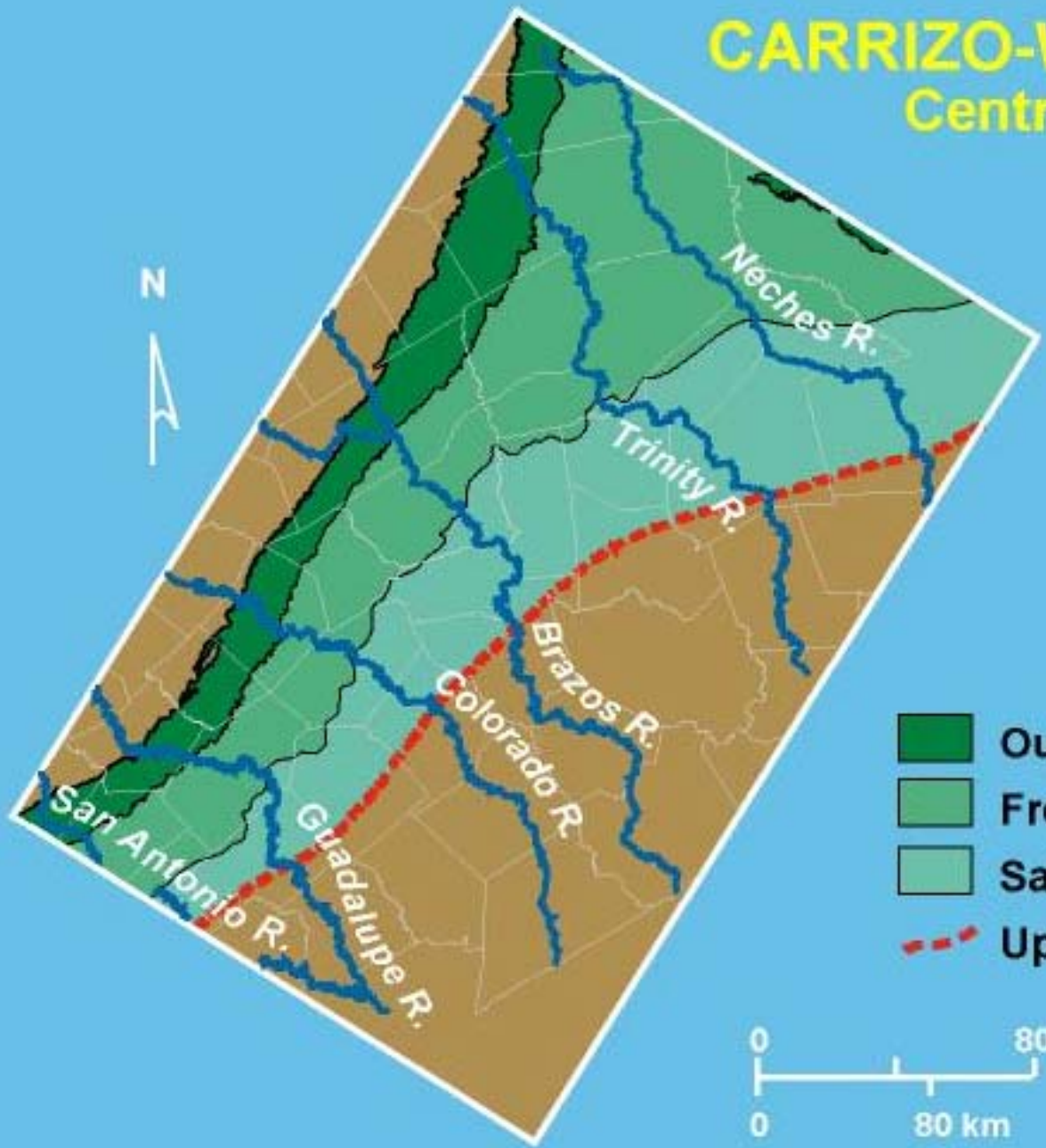
- Steady-state model calibration
- Calibration targets
  - —Water levels and potentiometric surface
  - —Baseflow discharge of groundwater
- Calibration variables
  - —Recharge
  - —Hydraulic conductivities
- Status
- Remaining work
- Schedule

ROLE OF GAM MODEL

- Goal of GAM project is to develop a scientifically accurate and realistic computer model
- Model will represent the aquifer's water budget and groundwater processes such as recharge, discharge, and pumping
- Once the model is developed, it can be used to assess availability of groundwater


CARRIZO-WILCOX AQUIFER
Central GAM Model
N
TEXAS
Northern model
Central model
Southern model
Outcrop
Freshwater subsurface
0
150 mi
0
200 km

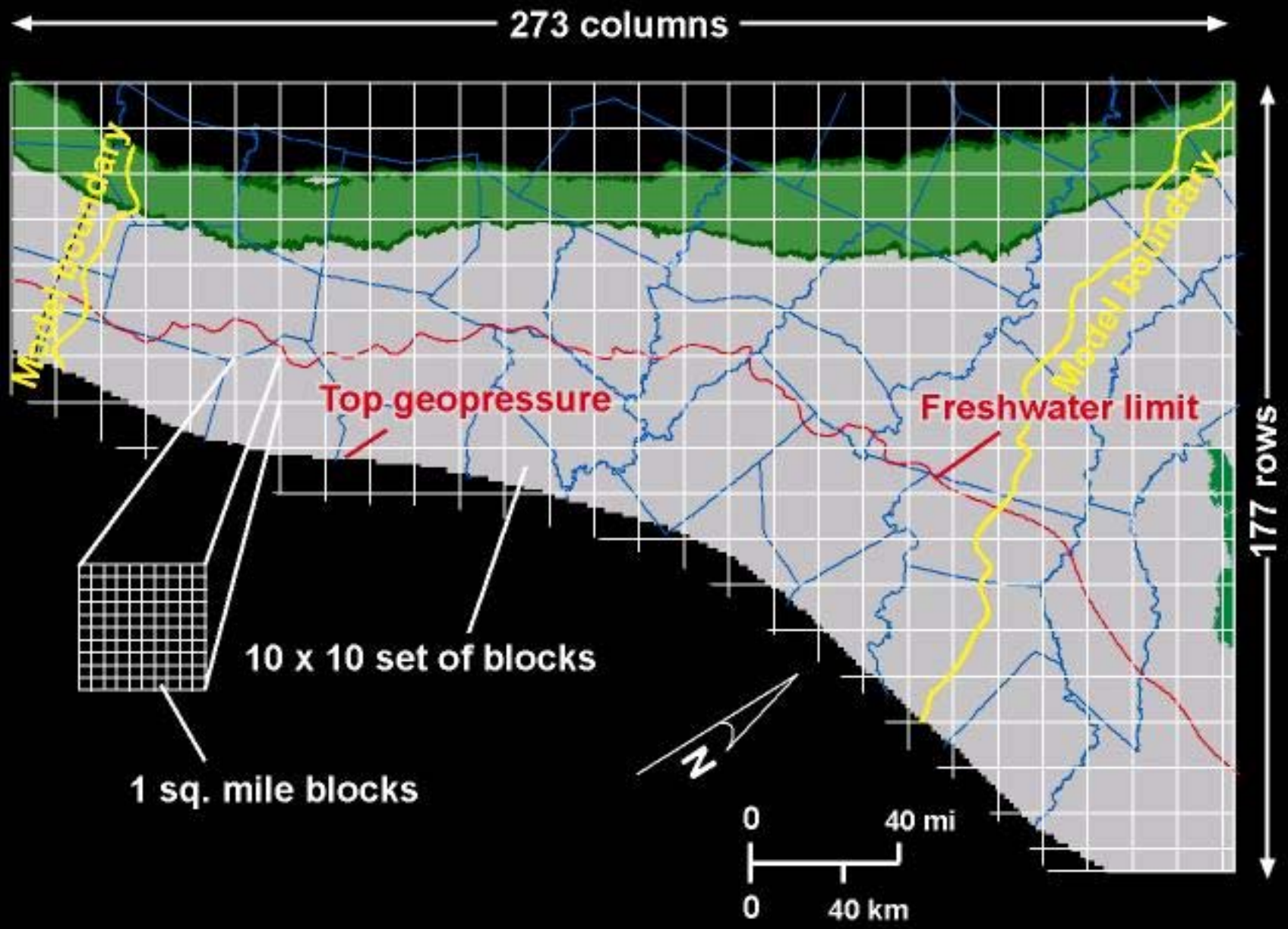
CARRIZO-WILCOX AQUIFER
Central Model Area



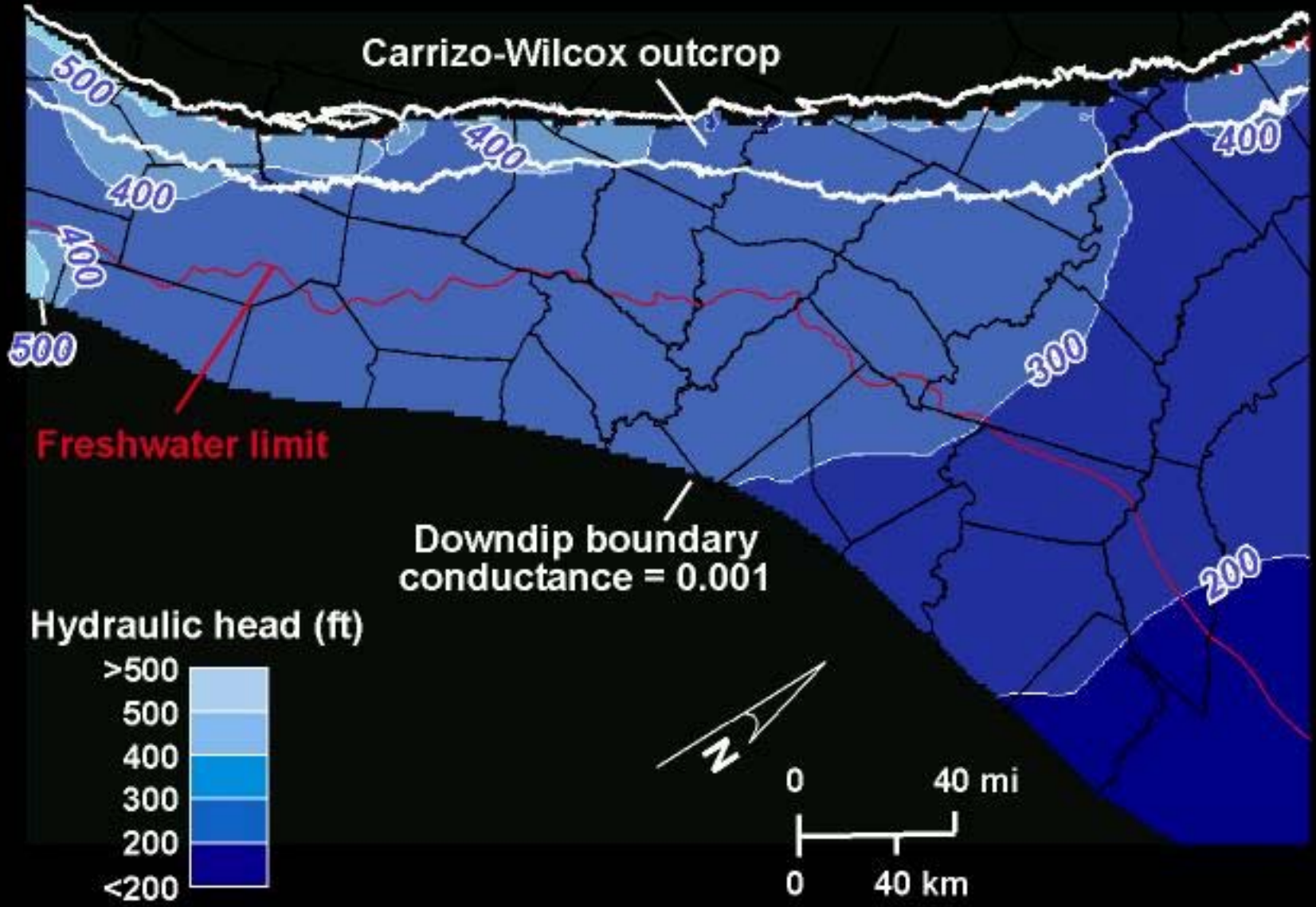
Outcrop
Freshwater subsurface
Saline subsurface
Updip limit of geopressure

0 80 mi
0 80 km

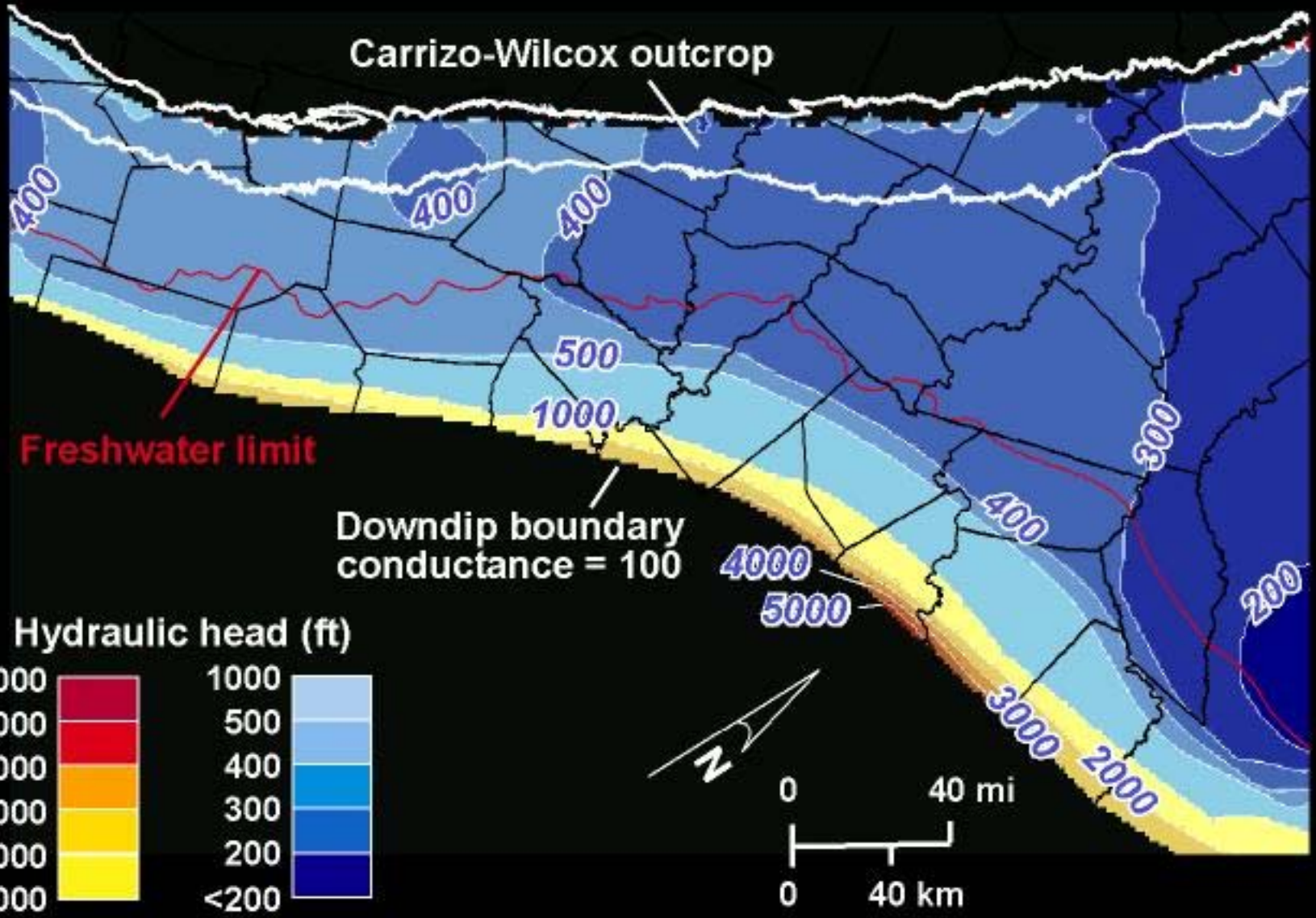
MODEL GRID


273 columns
177 rows
Model boundary
Model boundary
Top geopressure
Freshwater limit
10 x 10 set of blocks
1 sq. mile blocks
N
0
40 mi
0
40 km

TEST SIMULATION
Simsboro Potentiometric Surface



TEST SIMULATION
Simsboro Potentiometric Surface

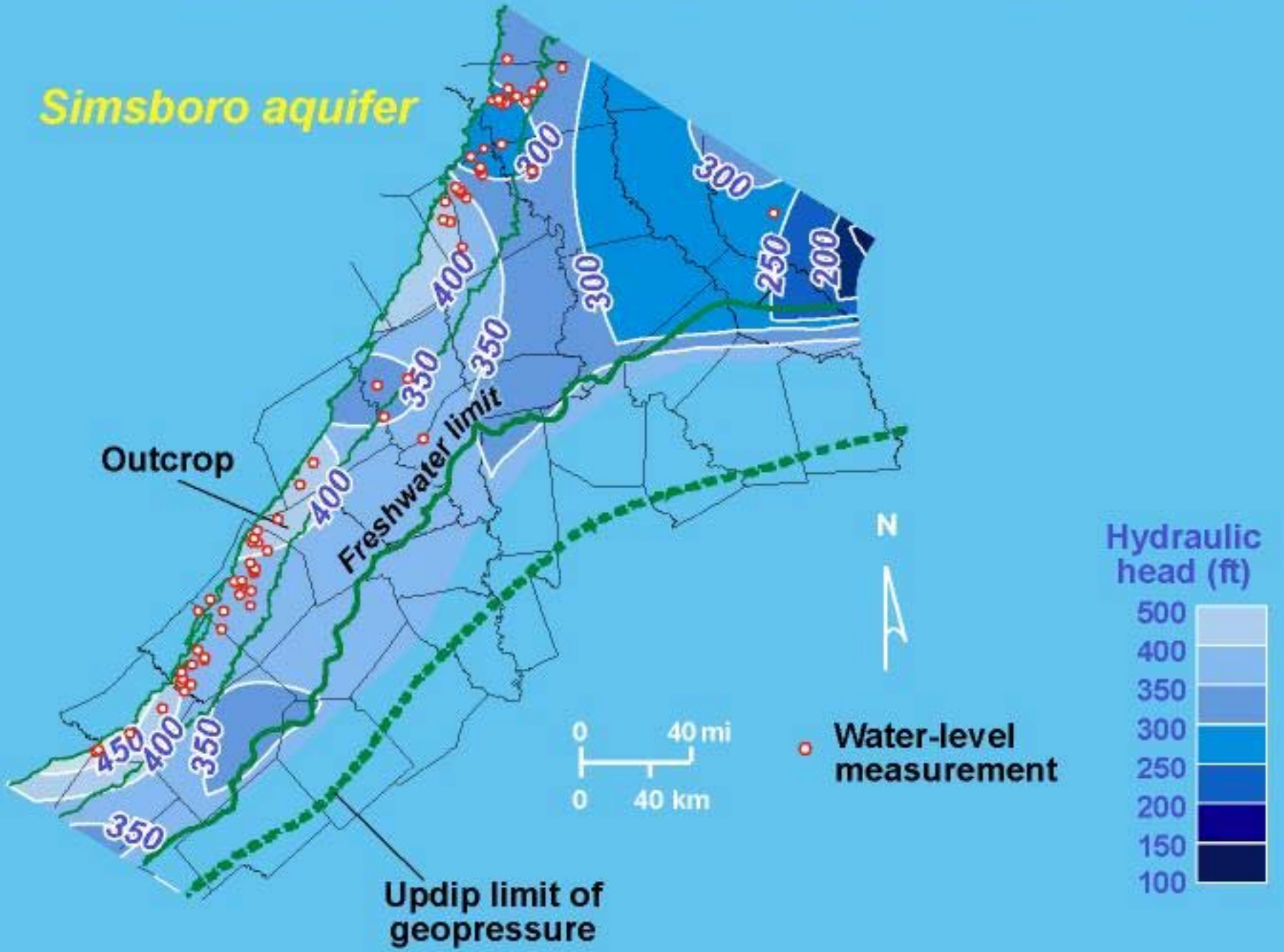


STEADY-STATE MODEL CALIBRATION

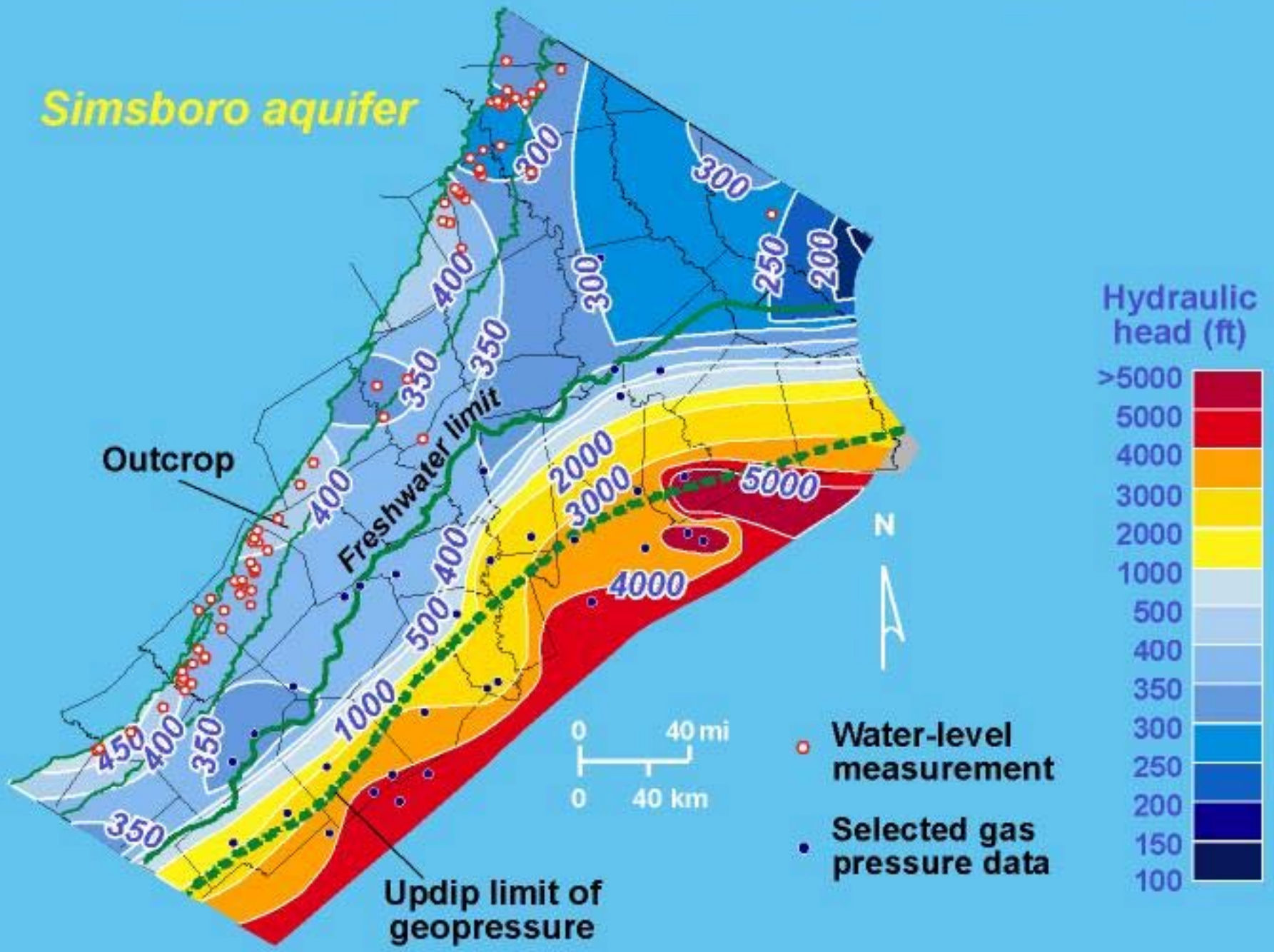
Calibration targets:

- **Water levels**
- **Stream baseflow discharge from groundwater**

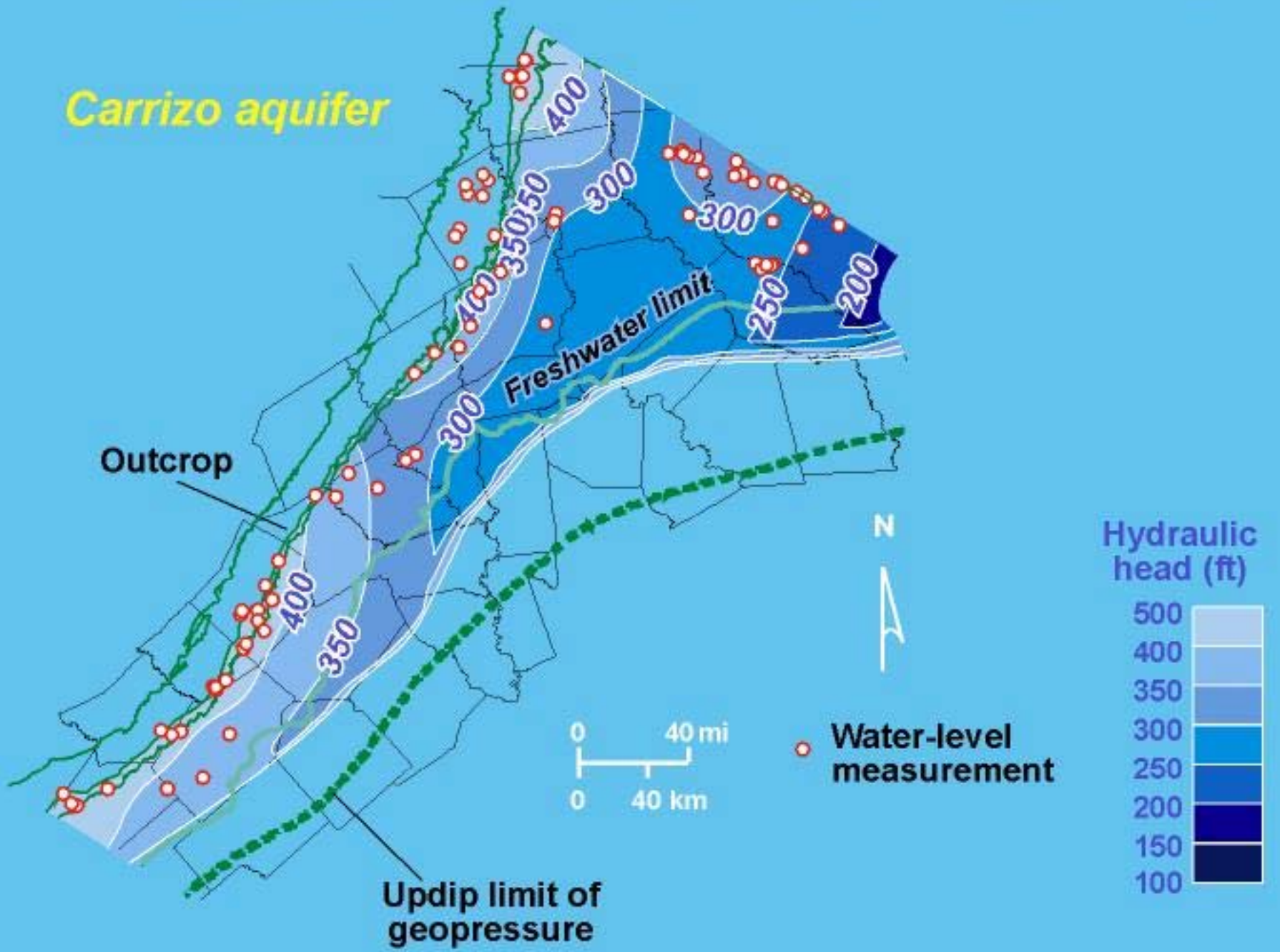
PREDEVELOPMENT POTENTIOMETRIC SURFACE



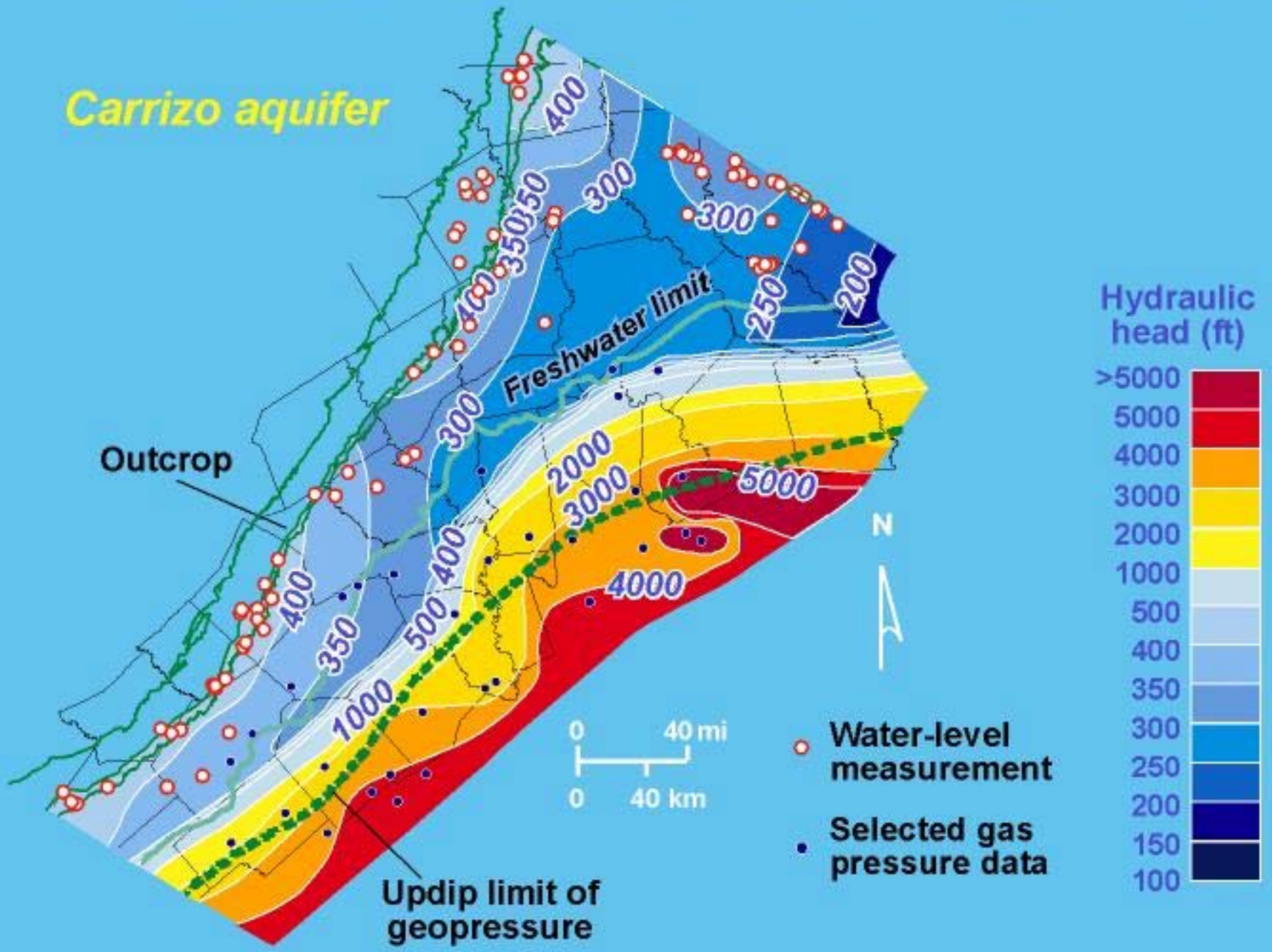
PREDEVELOPMENT POTENTIOMETRIC SURFACE



PREDEVELOPMENT POTENTIOMETRIC SURFACE

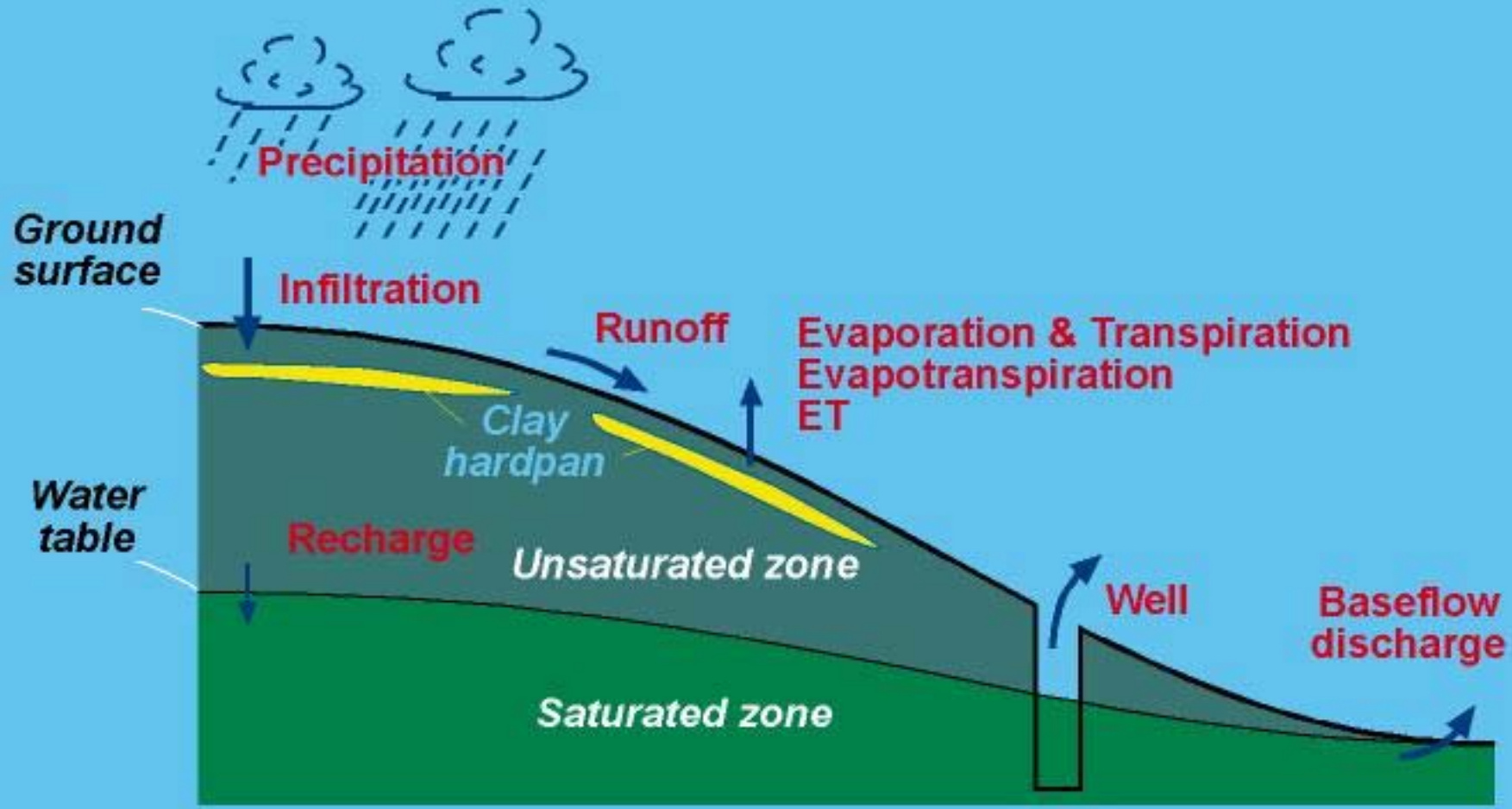


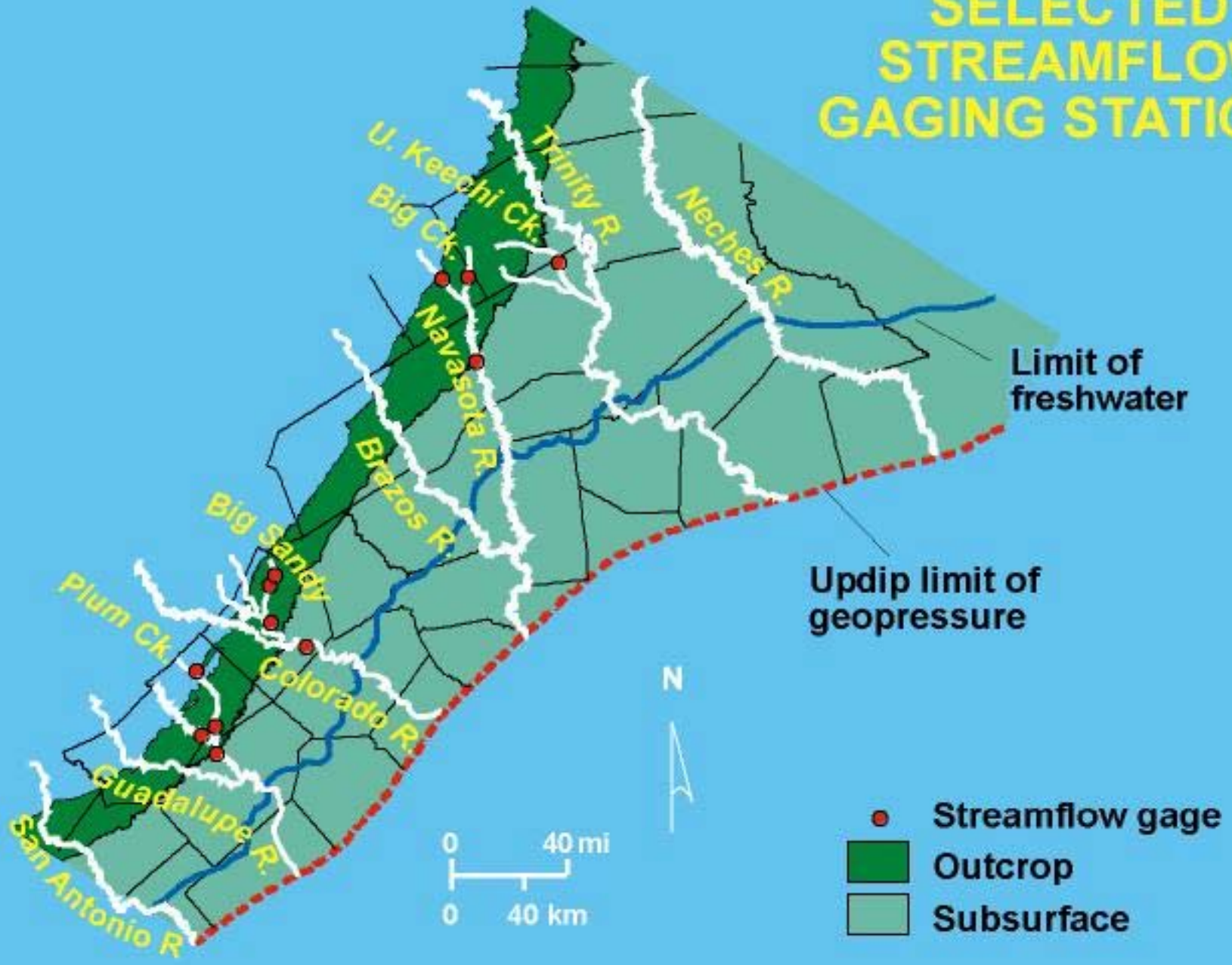
PREDEVELOPMENT POTENTIOMETRIC SURFACE



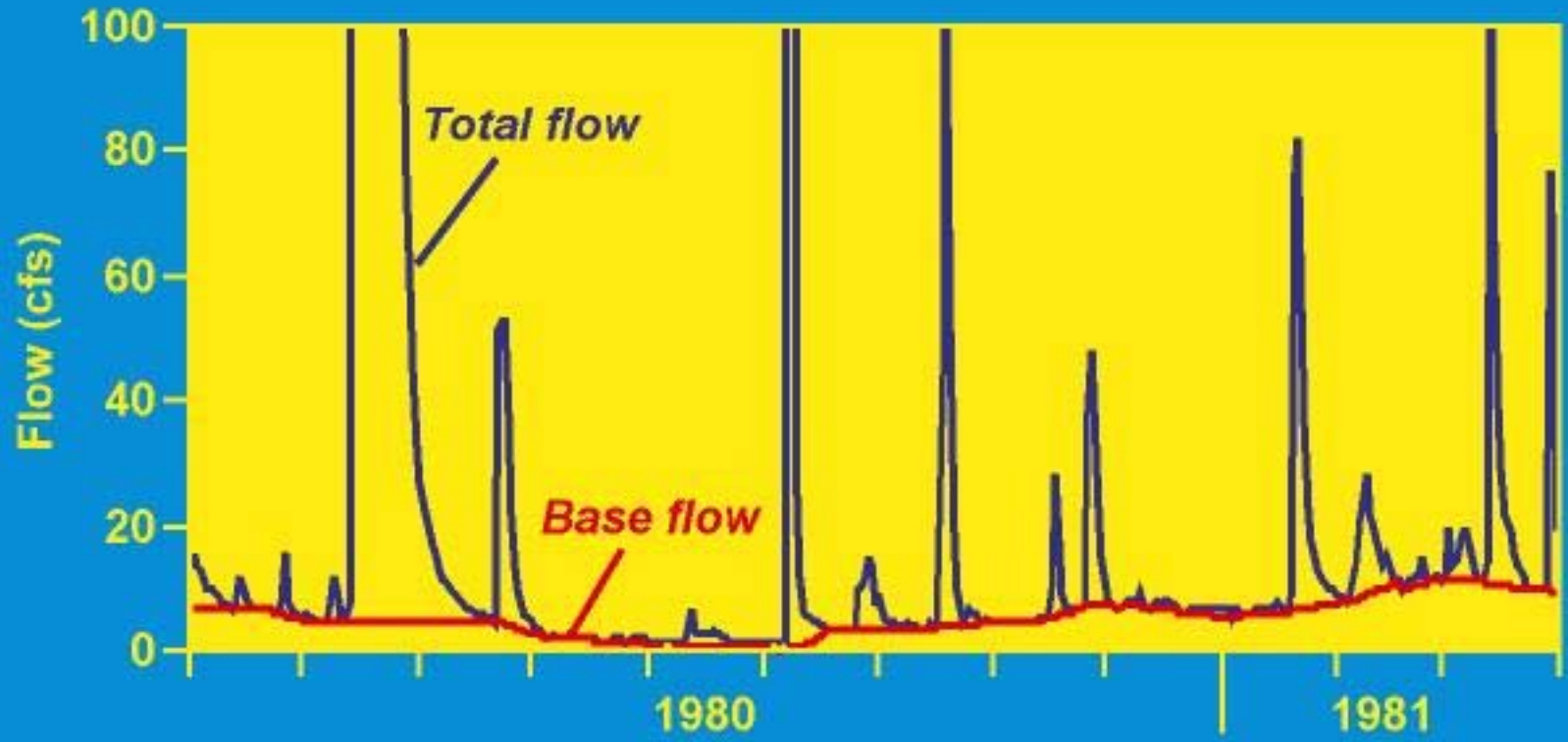
BASEFLOW DISCHARGE OF GROUNDWATER

WATER MOVEMENT
WATER BUDGET

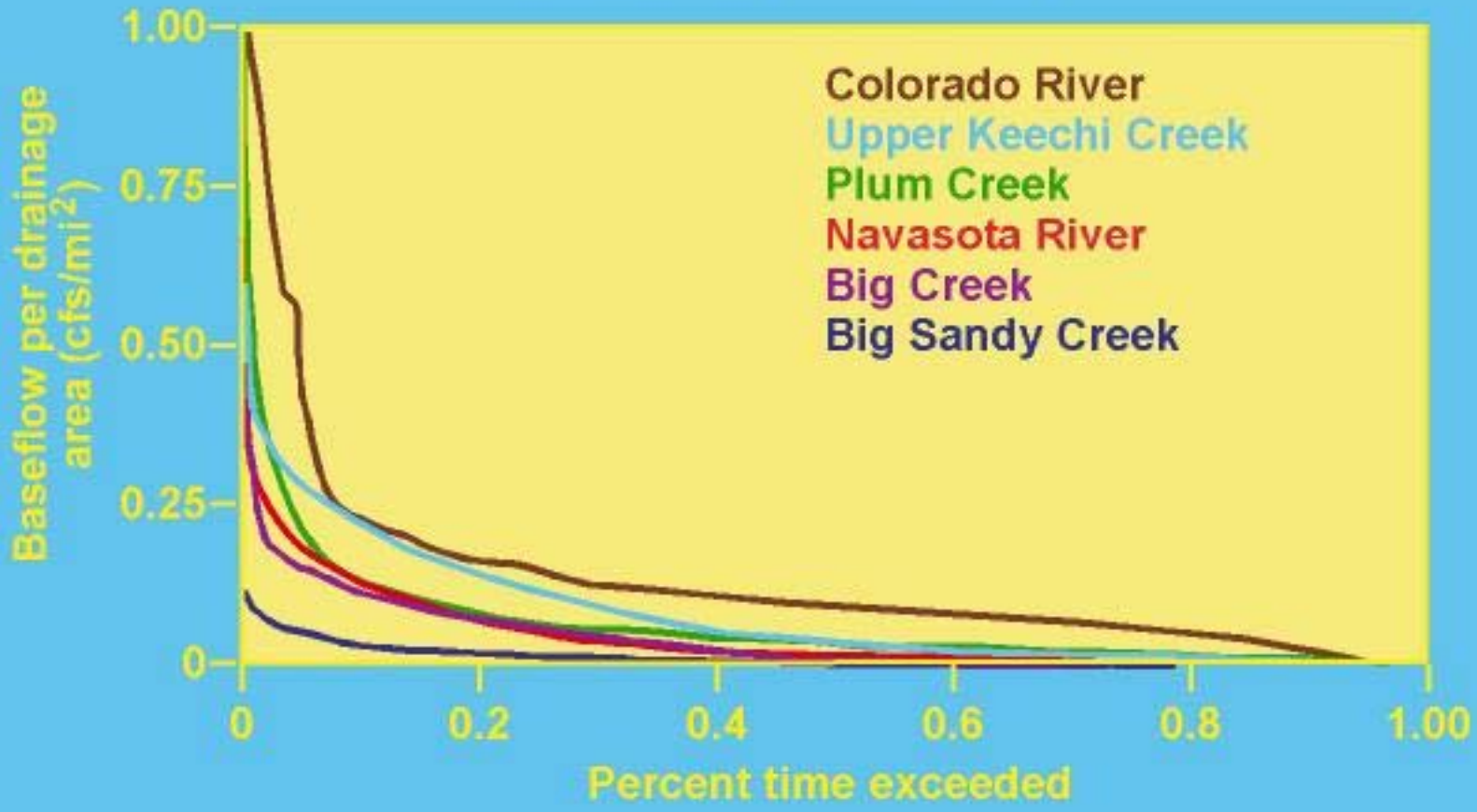



SELECTED STREAMFLOW GAGING STATIONS
U. Keechi Ck.
Big Ck.
Trinity R.
Neches R.
Navasota R.
Brazos R.
Big Sandy
Plum Ck.
Colorado R.
Guadalupe R.
San Antonio R.
Limit of freshwater
Updip limit of geopressure
N
0 40 mi
0 40 km
Streamflow gage
Outcrop
Subsurface

BASEFLOW AND TOTAL FLOW
Plum Creek at Luling



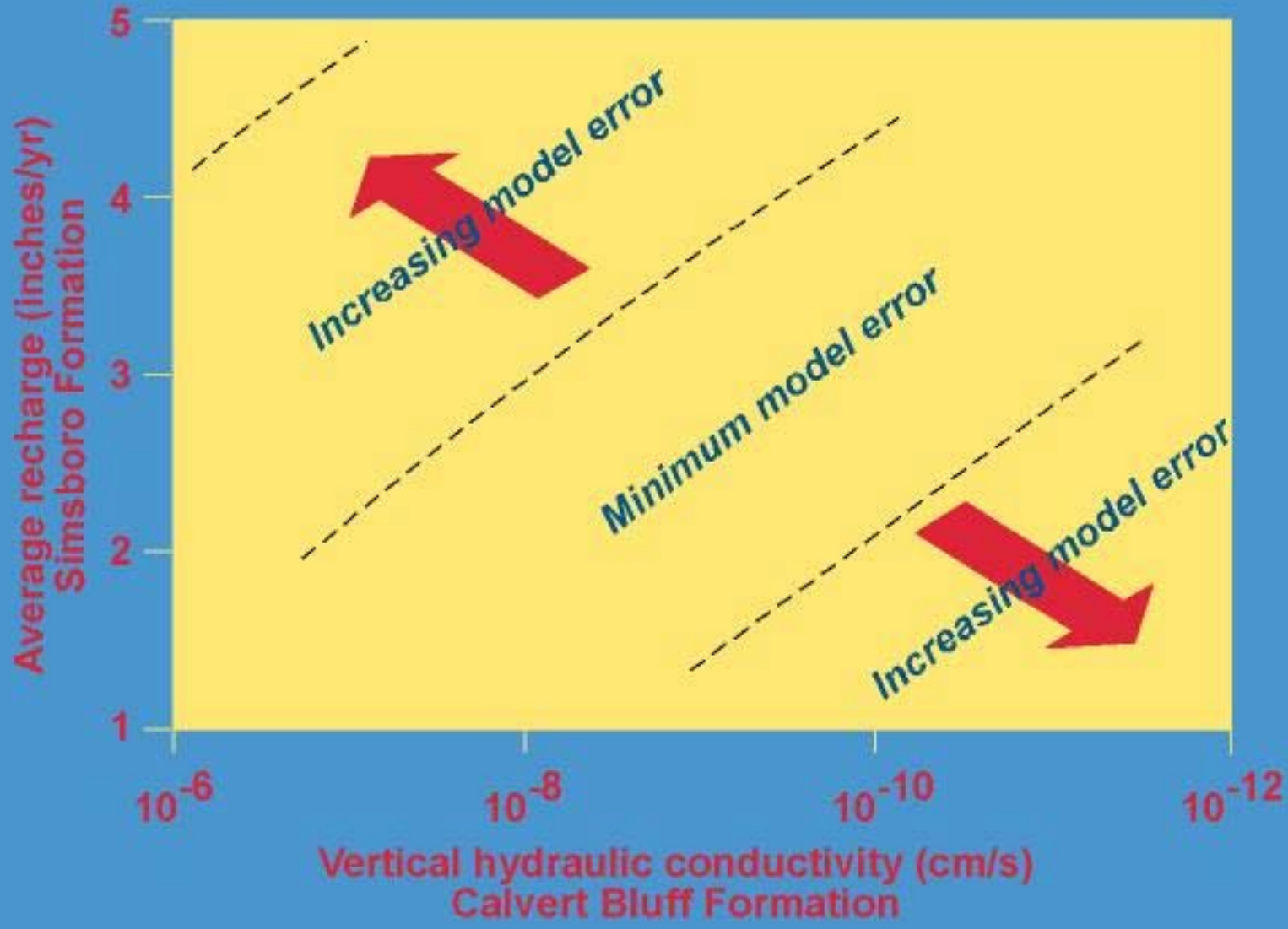
BASEFLOW STATISTICS



CALIBRATION VARIABLES:
Hydraulic conductivity and Recharge

CALIBRATION VARIABLES

R and K_v



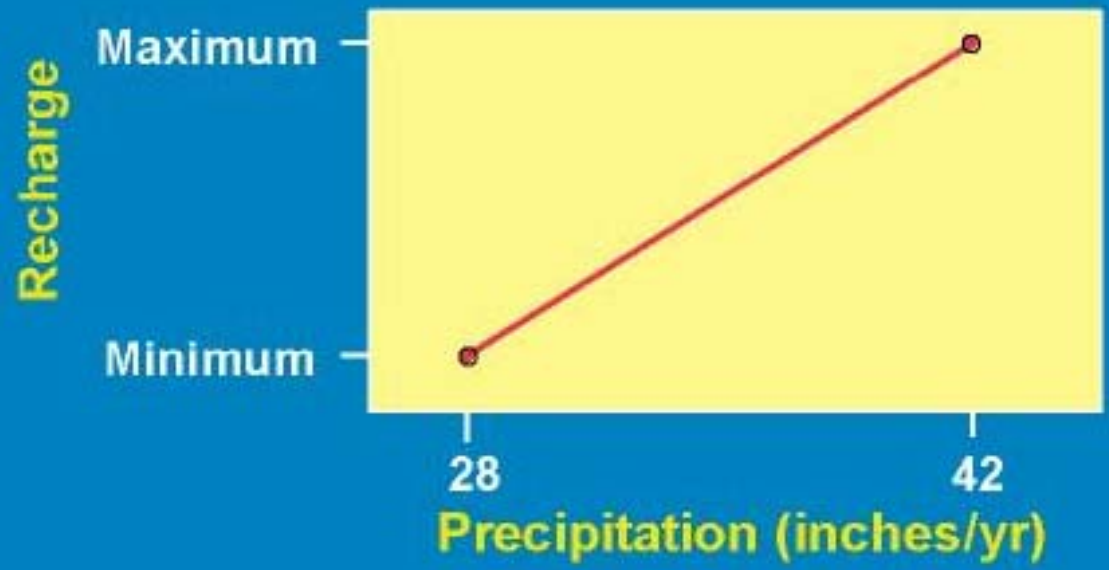
HYDRAULIC CONDUCTIVITY
Mean values (feet/day)

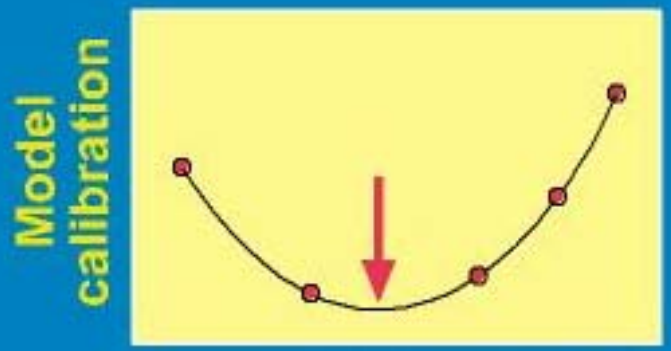
	Horizontal		Vertical
	Test data	Model layer*	Model layer*
Carrizo	20.0	13.2	1.0E-2
Calvert Bluff	0.9	0.05	4.5E-6
Simsboro	21.3	7.6	1.2E-2
Hooper	5.7	0.9	3.9E-6

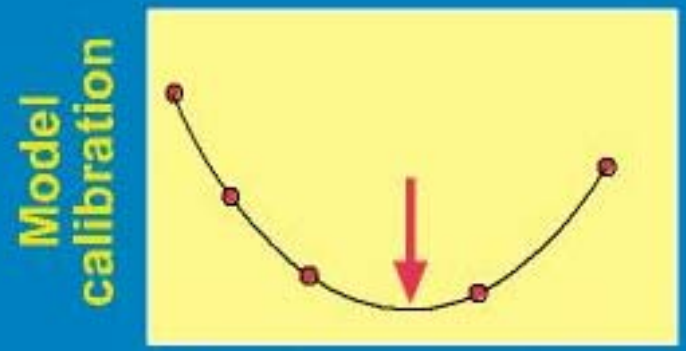
* *Model layer values are weighted by the thicknesses of sand and clay beds, assumed hydraulic conductivity of clay beds (1E-9 cm/s), and vertical anisotropy (Kv/Kh = 0.1)*

Recharge

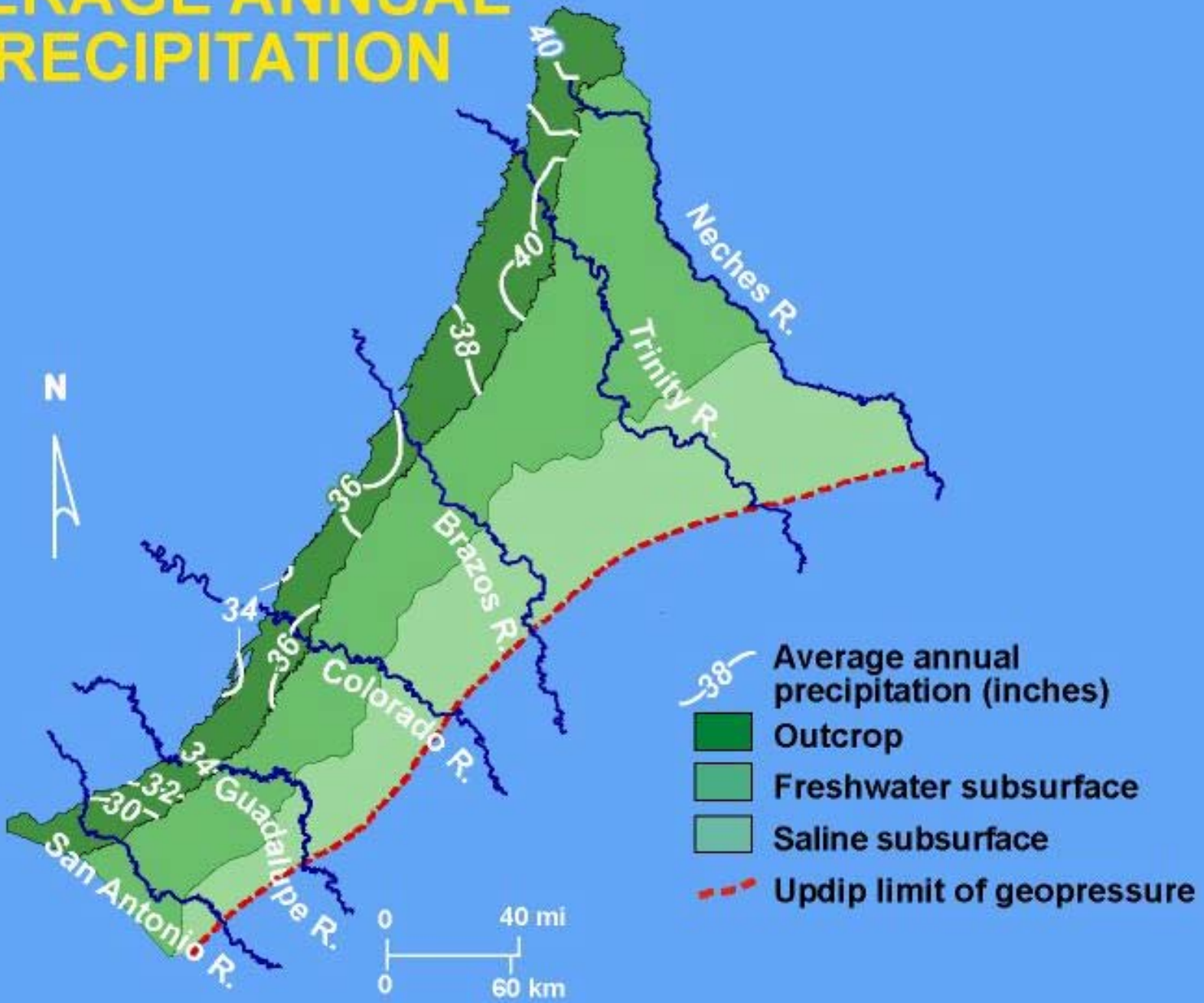
RECHARGE MODELED FROM PRECIPITATION

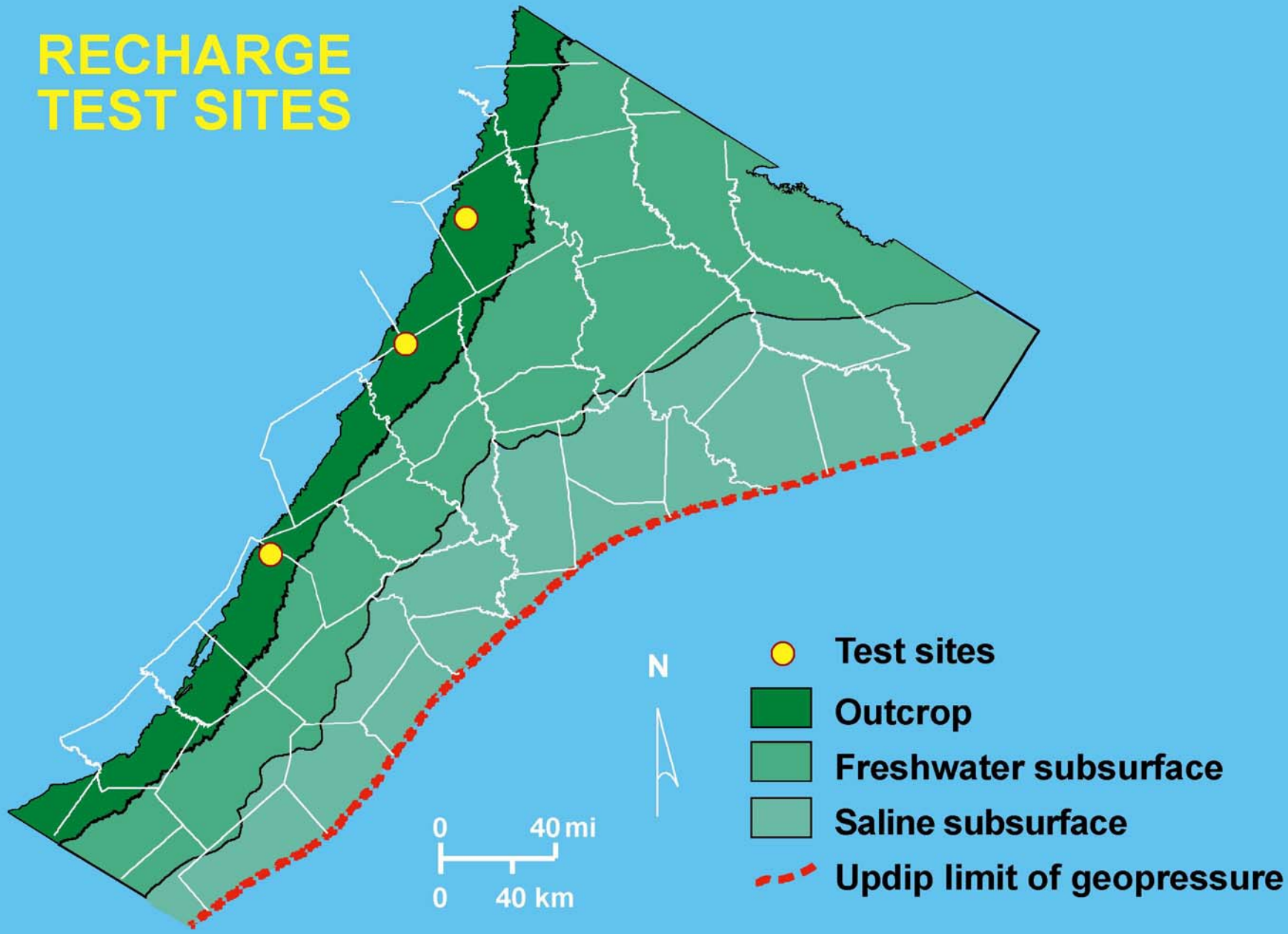






AVERAGE ANNUAL PRECIPITATION

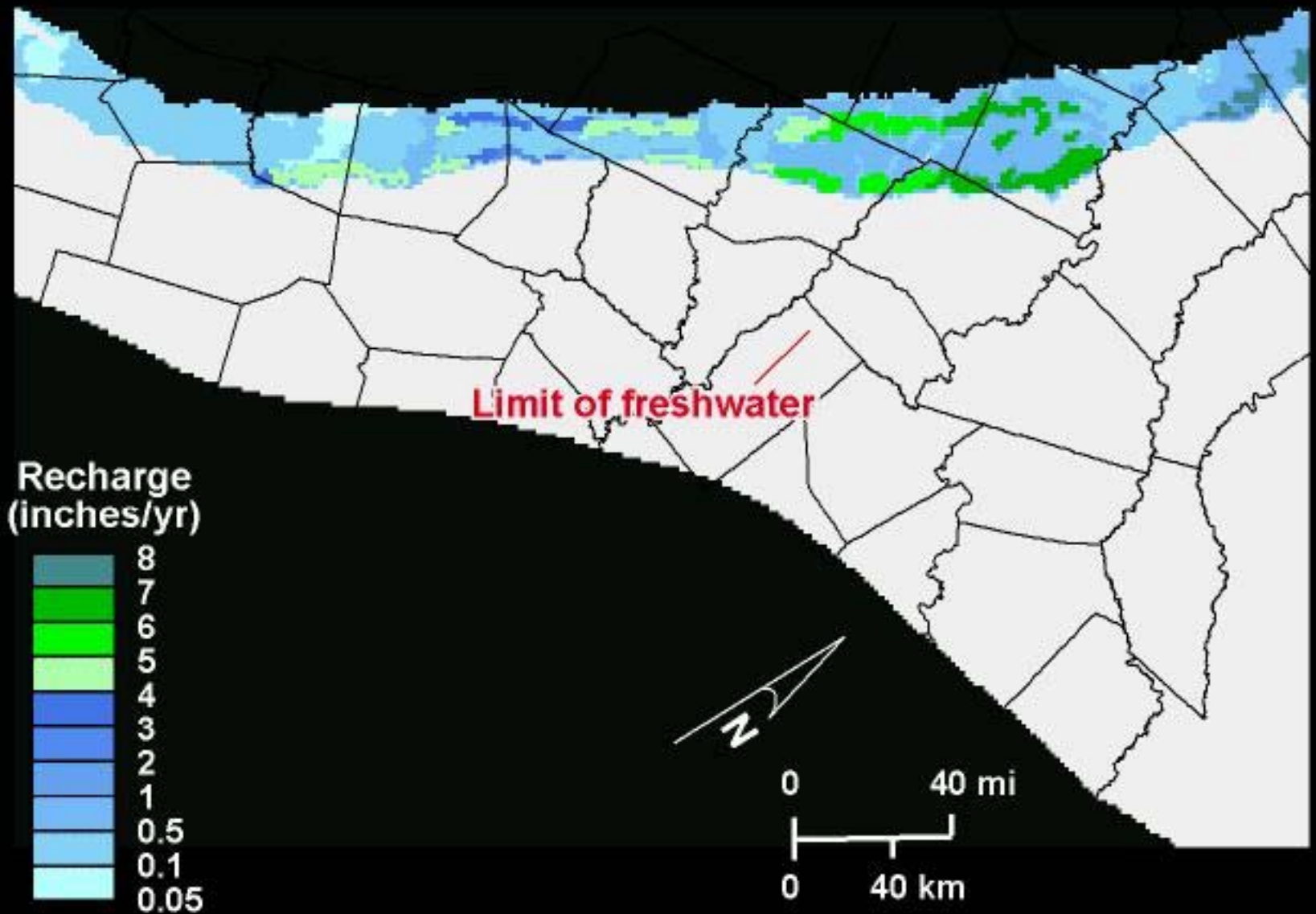



RECHARGE
TEST SITES
N
0
40 mi
0
40 km
Test sites
Outcrop
Freshwater subsurface
Saline subsurface
Updip limit of geopressure

SOIL TYPES
Estimation of Recharge Factors

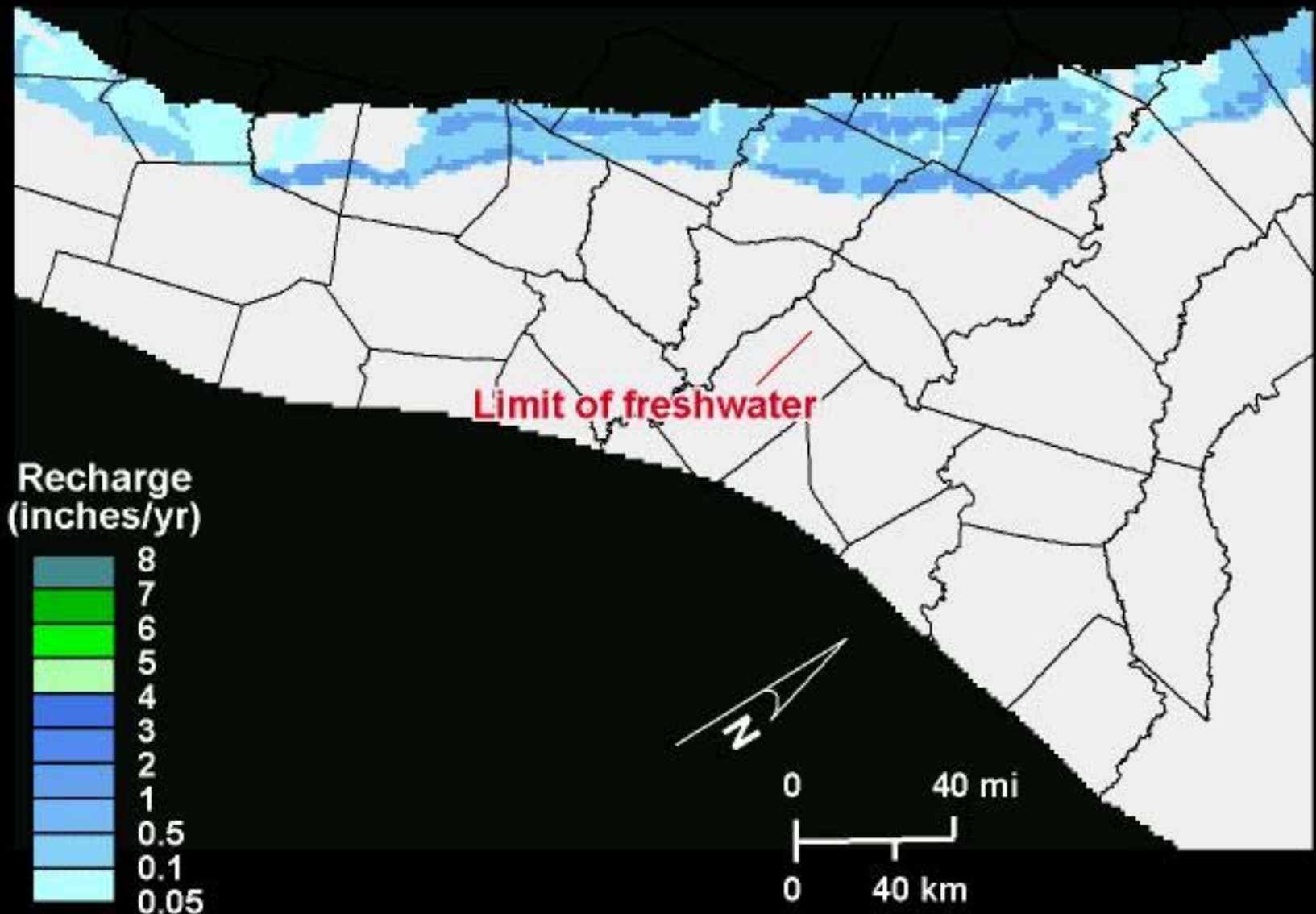
MODEL INPUT - RECHARGE

Scenario of 1 to 8 inches/year



MODEL INPUT - RECHARGE

Scenario of 1 to 2 inches/year



SUMMARY OF STATUS

- Model construction complete
- Calibration data sets complete
- Steady-state calibration in progress
  Trial-and-error adjustment of recharge rates and vertical hydraulic conductivities

REMAINING WORK

- Steady state calibration
  - Select “best” version
  - Sensitivity analyses
- Transient history calibration
  - Finish pumping history input files
  - Model adjustments to “best” match hydrographs and baseflow
- Verification runs
- Predictive models
- Report preparation

SCHEDULE

PROJECT SCHEDULE

Construct model	Jan 2001	to	Jan 2002
Steady-state calibration	Jan 2002	to	Apr 2002
Transient calibration & verification	Apr 2002	to	June 2002
Predictive simulations	July 2002	to	July 2002
Report preparation	May 2002	to	Sept 2002
Draft report due	Sept 2002		
Final report due	Jan 2003		

PROJECT SCHEDULE

First SAF meeting — **April 2001**
- Introduction

Second SAF meeting — **July 2001**
- Conceptual model

Third SAF meeting — **Oct 2001**
- Steady-state calibration

Fourth SAF meeting — ***Feb 2002***
- Steady-state calibration

Fifth SAF meeting — **April 2002**
- Steady-state calibration complete
- Transient calibration

Sixth SAF meeting — **July 2002**
- Transient calibration complete
- Predictive models

Seventh SAF meeting — **Oct 2002**
- Comments on draft report

Final report due — **Jan 2003**

Stakeholder Advisory Forum (SAF)
Central Carrizo-Wilcox Aquifer Groundwater Availability Model

Forum Meeting No. 4
Thursday, February 28, 2002, 2 p.m.
LCRA McKinney Rough Conference Center

List of Attendees

Name	Affiliation
Nathan Ausley	Post Oak Savannah GWCD
James Bene	RW Harden & Assoc
Ralph Boelcer, Jr	TWDB
Peggy Campion	LPGCD
Gary Cooke	City of Elgin
Joe Cooper	LPGCD
Louis Fleischhaver	Trinity Engineering
Larry French	URS
Robert Gresham	Brazos Valley Council of Gov.
Bob Harden	RW Harden & Assoc
Thomas D. Hill	GBRA
Ian Jones	TWDB
Bob Kier	Robert S Kier Consulting
Dan Kowalski	Walnut Creek Mining Co.
Glenn Marburger	LPGCD
David Meesey	TWDB
Ann Mesrobian	Lost Pines GCD
Barry Miller	GCUWCD
Kevin Morrison	SAWS
Jean-Philippe Nicot	Duke Engineering
Dave ORourke	HDR Engineering
Joe Peters	TNRCC
Phil Savoy	Murfee Engineering Co, Inc
Keith Shansberger	LPGCD
Sheril Smith	Bastrop County resident/ Sierra Club
Kathy Snider	Neighbors for Neighbors
Bo Spoonts	TDA
Wayne Tschirhart	GBRA
Eddy Young	TNP-One

Stakeholder Advisory Forum (SAF)
Central Carrizo-Wilcox Aquifer Groundwater Availability Model

Forum Meeting No. 4
Thursday, February 28, 2002, 2 p.m.
LCRA McKinney Rough Conference Center

The fourth Stakeholder Advisory Forum (SAF) for the Central Carrizo-Wilcox Aquifer Groundwater Availability Model (GAM) was held on February 28, 2002, from 2:00 to 3:45 p.m. at the LCRA McKinney Rough Conference Center on Highway 71 northwest of Bastrop, Texas.

The purpose of the fourth SAF Forum was to discuss the calibration of the steady-state model including its calibration targets (water levels and baseflow discharge of groundwater to creeks and rivers), adjustment of calibration variables (recharge rate and hydraulic conductivity), and the status of work and schedule for project completion. The presentation material is available at the TWDB's GAM website (www.twdb.state.tx.us/GAM/czwx_c/czwx_c.htm).

Meeting Introduction

Alan Dutton (UT Bureau of Economic Geology) opened the Forum, who introduced Dr. Ian Jones, representing Dr. Robert Mace (TWDB). Alan Dutton also introduced members of the Central Carrizo-Wilcox Aquifer GAM project team–Bob Harden and James Bene (R. W. Harden and Associates, Inc.), David O'Rourke (HDR Engineering Associates), and Jean-Philippe Nicot (will join Bureau of Economic Geology in April 2002).

Forum Presentation by Alan Dutton

After the introductions, Alan Dutton reviewed the project and made the presentation on the steady-state model, its status of completion, and the project schedule. During and following the presentation, questions were asked by the stakeholders, which are summarized as follows.

Questions and Answers: Open Forum

1. Potentiometric surfaces of the Simsboro and Carrizo

Q: How did you quantify the potentiometric surface in the confined part of the Simsboro aquifer?

A: BEG used water-level data from the TWDB web site for the confined freshwater aquifer and pressure data from gas wells for the saline subsurface downdip of the aquifer. Data are sparse in the deep confined part of the aquifer and some geologic interpretation, consistent with the conceptual model, is included in the contouring of the data.

2. Baseflow discharge of groundwater to creeks and rivers

Q: Why aren't gaging stations used for streamflow analysis on the Brazos River?

A: There were no gage pairs for the Brazos River located completely on the Carrizo-Wilcox outcrop. We wanted pairs that were entirely on the outcrop to avoid having to account for flows that were not specific to the outcrop. Our plan is to use results from other large rivers (for example, the Colorado and San Marcos Rivers) to estimate the groundwater-surface water interaction for the Brazos River.

Q: How far back in time do you look at for baseflow? Does baseflow differ by basin?

A: We have looked as far back in the data as allowed by data with common periods of record between upstream and downstream gaging stations in order to get a complete idea of the influences of the Carrizo-Wilcox outcrop. The flow exceedence curves (unitized by drainage area) show much similarity between rivers.

Q: Was evapotranspiration (ET) used as a modifier in determining baseflow?

A: Only stream-gage data were used to define the groundwater discharge. ET is being estimated as part of the approach to specify recharge and captured recharge.

2. Baseflow discharge of groundwater to creeks and rivers (continued)

Q: What if discharge of the aquifer within small drainage basins actually represents discharge due to groundwater hitting clay hardpans and not groundwater discharging from the aquifer?

A: Details of recharge may include both ET and interflow of soil water within the "A" or other soil horizon. The approach being taken in the calibration of this model is to estimate the "net" recharge that reaches the water table. The baseflow calculation would not distinguish whether the subsurface-water discharge were groundwater that had reached the water table and was being recycled out of the aquifer or soil water that had issued from springs and seeps where a hard pan intersected ground surface.

Q: With constant control releases from the Colorado River, how does that affect baseflow?

A: For the Colorado River, we studied a 20-year time period and selected records of daily flow amounts when there was no interference from dam releases. So, the data may not be continuous through time because times of water release from the river were not used. We can use that information to look at the statistics of how often baseflow exceeds a certain amount.

3. Recharge

Q: How deep are the soil estimations going? Aren't recharges varied by the amount of clay in a soil?

A: The on-line STATSGO data include information on soil properties classified by multiple (usually three) soil layers. Average depth of the third soil layer is approximately 60 inches (5 feet) but as much as 96 inches (8 feet). The hydraulic conductivity and thickness of soils were used to determine a weighted average of soil hydraulic conductivity, which was used as a factor in adjusting the amount of precipitation that becomes recharge for each cell of the model in the aquifer outcrop.

Q: What if the "A" soil horizon (uppermost, usually organic-rich soil zone) is 60 or more inches thick and there is a clay hardpan ("B" second soil horizon in study area may have illuviated clay that impedes the downward movement of soil water) deeper than that?

A: Review of the data files after the meeting shows that the maximum reported thickness of the "A" soil horizon is approximately 36 inches in the study area, and all soil blocks in the area have information for "A," "B," and "C" soil horizons. So the possible affect of a clay hardpan would be included if it appears to be present.

Q: Is BEG going to put in more test areas for recharge?

A: We allowed for as many as ten core holes to be drilled, but we will probably only drill seven. The chloride mass-balance approach previously has not been used in this area of Texas, so we were not sure how successful it would be. So far, on the basis of the first core, the method seems to be working well. If results from the next six cores confirm this, future studies beyond this project may want to consider additional tests to estimate recharge using this method.