Hydrologic Models in the Courtroom

Working Paper

Dividing the Waters Model Assessment Committee
Hydrologic Models in the Courtroom

Models: Their Uses, Development, & Assessment
WORKING OUTLINE

• The Model Building Process
• Opinions of Model Builders
• Criteria for Judging Adequacy of Models
• Case Examples of the Use of Models in Complex Adversarial Proceedings
• Judging/Assessing Models and Model Based Expert Testimony
FLOW CHART

DATA COLLECTION

CONCEPTUAL MODEL

SUFFICIENT DATA?

MODEL CONSTRUCTION & PARAMETER ESTIMATION

CALIBRATION & SENSITIVITY ANALYSIS

ADEQUATE?

CODE SELECTION

PREDICTIVE SIMULATIONS
Comments on Modeling

Bredehoeft and Konikow (1993):

• The very words *calibrate* and *validate* are misleading because they imply veracity.

• Any test of a model can only be used to invalidate it.
Comments on Modeling

Oreskes (1994):

- **Verification, validation, and confirmation** really only apply to closed systems, a condition never met in models of natural systems.
- In natural systems parameters are incompletely known, variables are burdened with inferences and assumptions, and **model results are always non-unique.**
Comments on Modeling

Woessner and Anderson (1996):

• All models are uncertain.
• Acceptability of a specific model is, ultimately, a subjective assessment made in the context of the model’s stated purpose.
ASTM MODEL DOCUMENTATION

ELEMENTS

• MODEL FUNCTION
• GENERAL SETTING
• CONCEPTUAL MODEL
• COMPUTER CODE DESCRIPTION
• MODEL CONSTRUCTION
• PREDICTIVE SIMULATION
• SUMMARY & CONCLUSIONS
• REFERENCES
DAUBERT CRITERIA

• Have theories and techniques been tested.
• Have they have been subjected to peer review and publication.
• Do techniques employed have a known error rate.
• Are techniques subject to standards governing their application.
• Do the theories and techniques enjoy widespread acceptance.
CASE STUDIES

REPUBLICAN RIVER COMPACT CASE (RRCA MODEL)

ARKANSAS RIVER COMPACT CASE (HIM MODEL)
Republican River Basin
Well Development in Republican
Judging/Assessing Models and Model Based Expert Testimony

ARE THERE ALTERNATIVES TO CROSS-EXAMINATION?