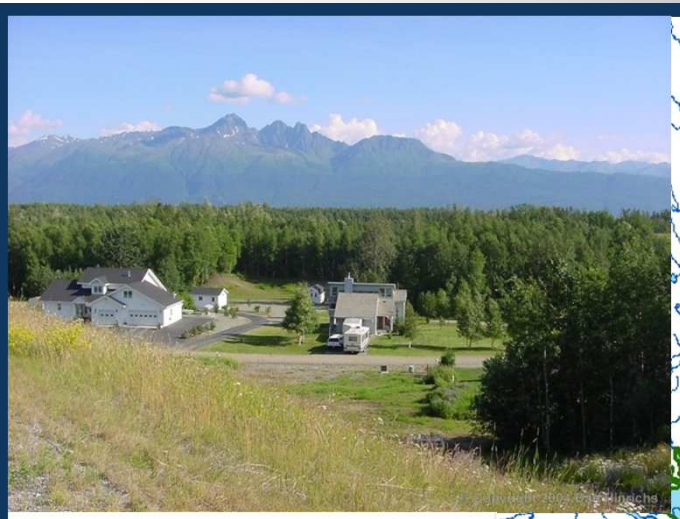
Shallow Groundwater in the Matanuska-Susitna Valley, Alaska: Spring 2011 Update

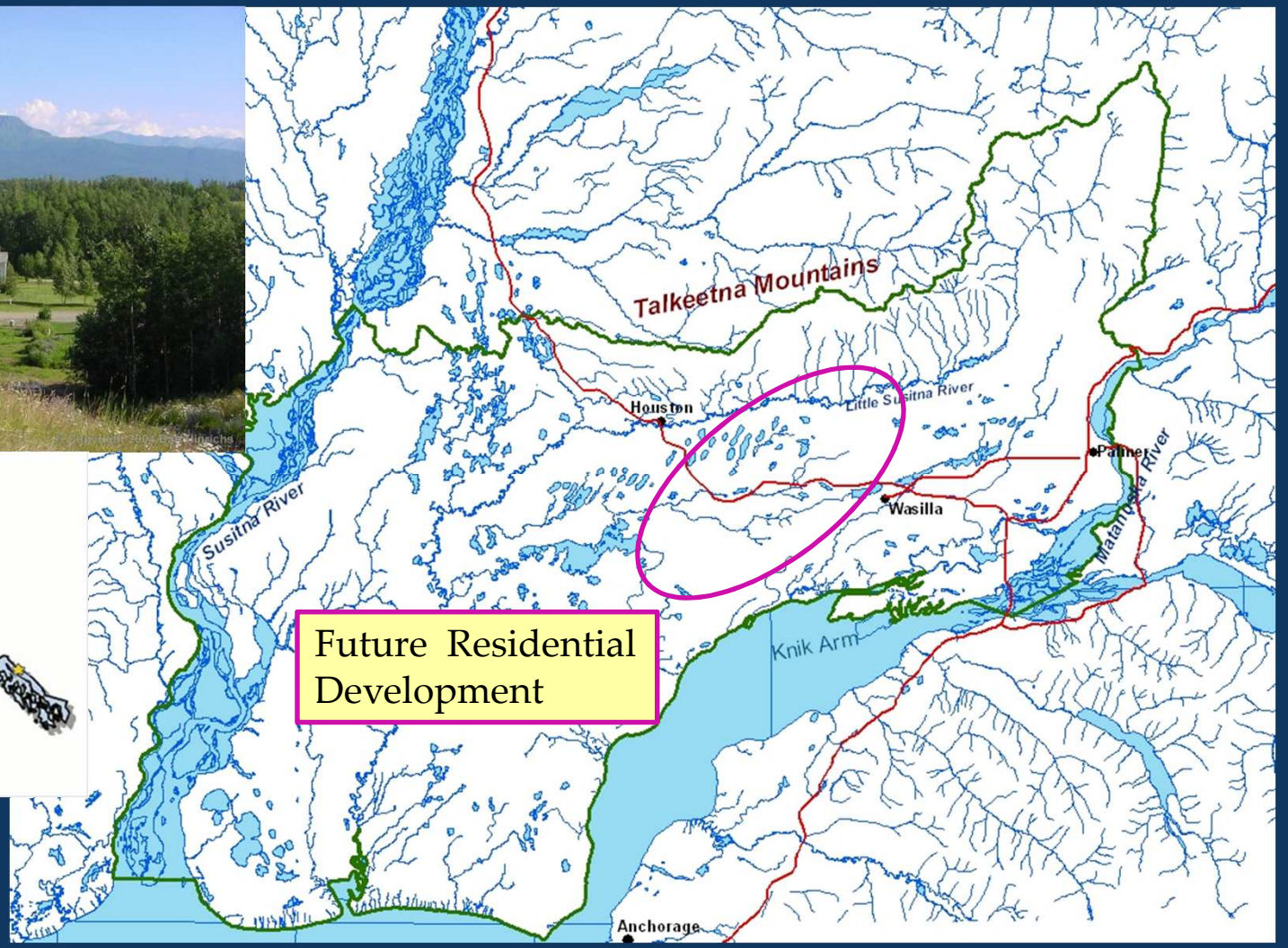
[1]Colin Kikuchi, [2]Steve Frenzel, [2]Dan Long, [3]Stan Leake, [1]Dr. Ty Ferre

[1]University of Arizona, Department of Hydrology and Water Resources
[2]U.S. Geological Survey, Alaska Science Center
[3]U.S. Geological Survey, Arizona Water Science Center

AWRA, Alaska Section 2011 Meeting

Matanuska-Susitna Valley Study Area





Mat-Su Groundwater Study Area. Flow model boundaries in green, highways in red.

Stakeholder Concerns → Study Objectives

Concerns:

Groundwater-lake exchange (water quality)

Gravel pits, planned developments

Effects of current and future pumping

Objectives:

Improve conceptual understanding

Simulate groundwater flow patterns

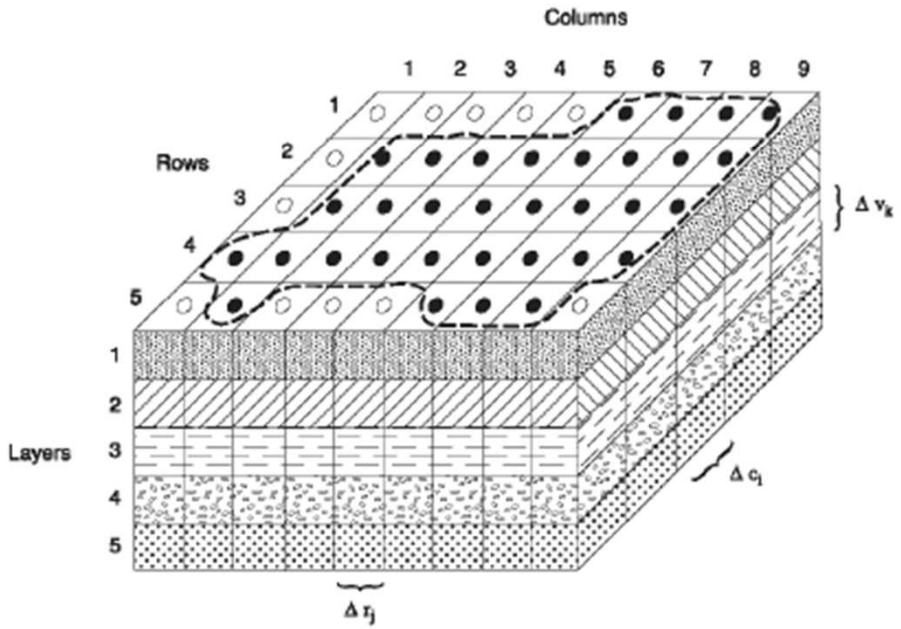
http://www.asphaltwa.com/wapa_web/modules/03_materials/images/sand_and_gravel.JPG

Doubloon Lake, photo by Colin Kikuchi

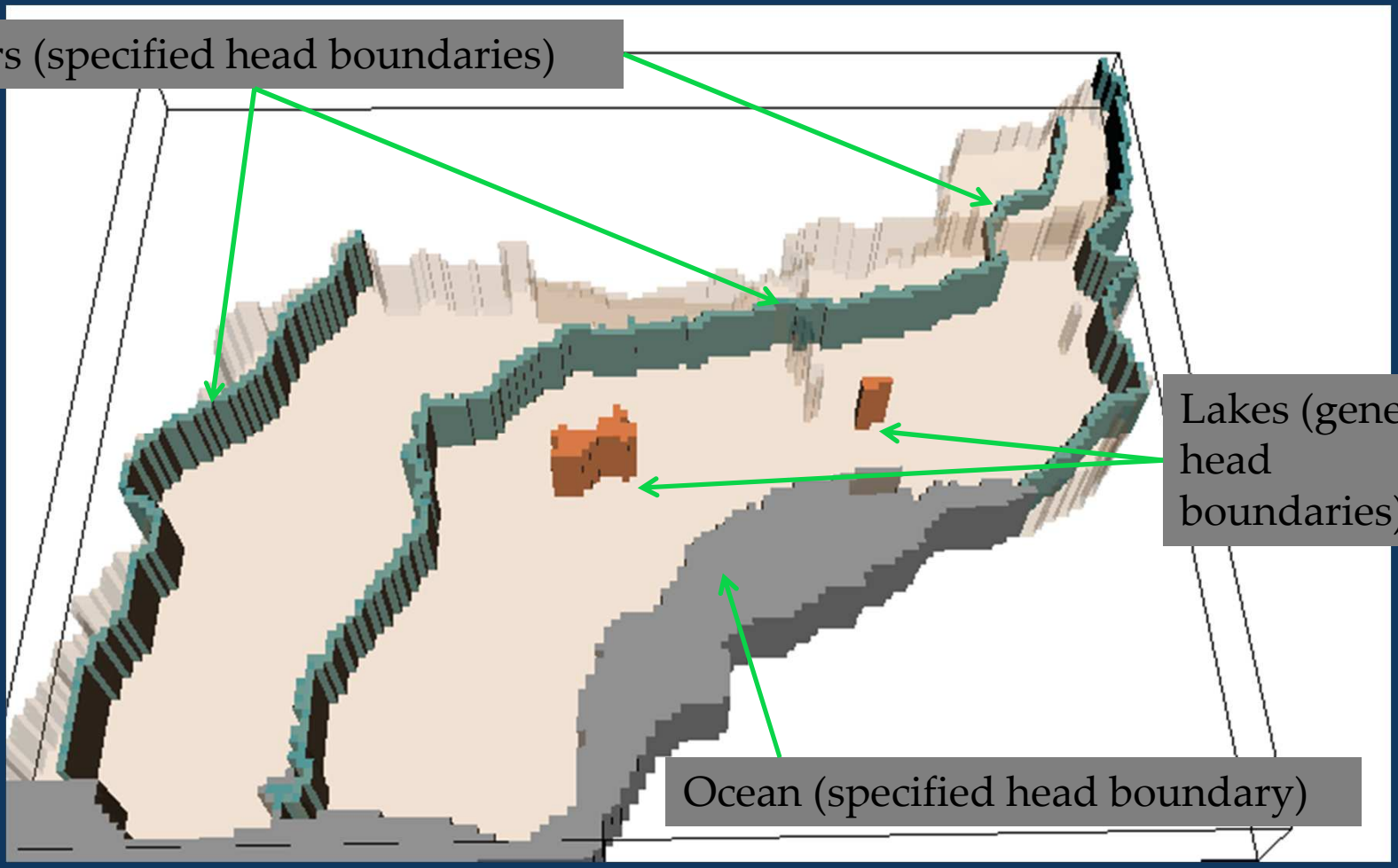
Modeling Platform: MODFLOW-2005

USGS
science for a changing world

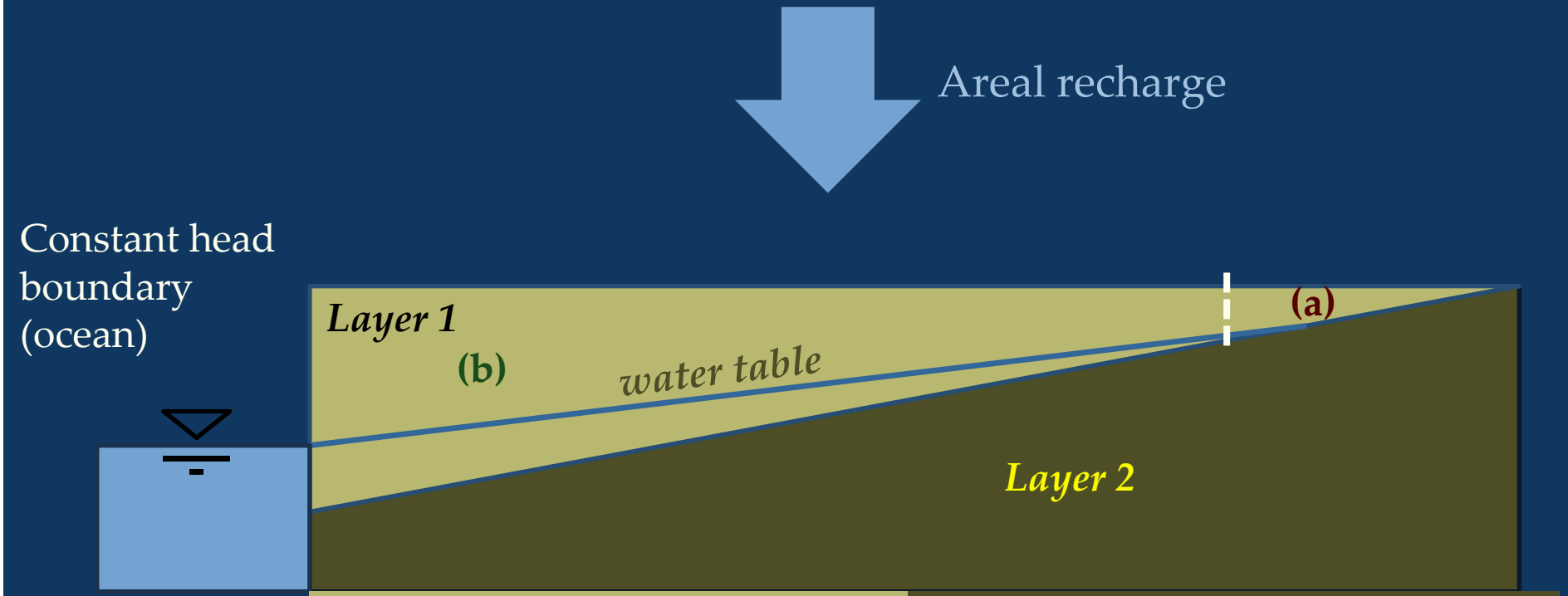
MODFLOW-2005, The U.S. Geological Survey Modular Ground-Water Model—the Ground-Water Flow Process



Model features:



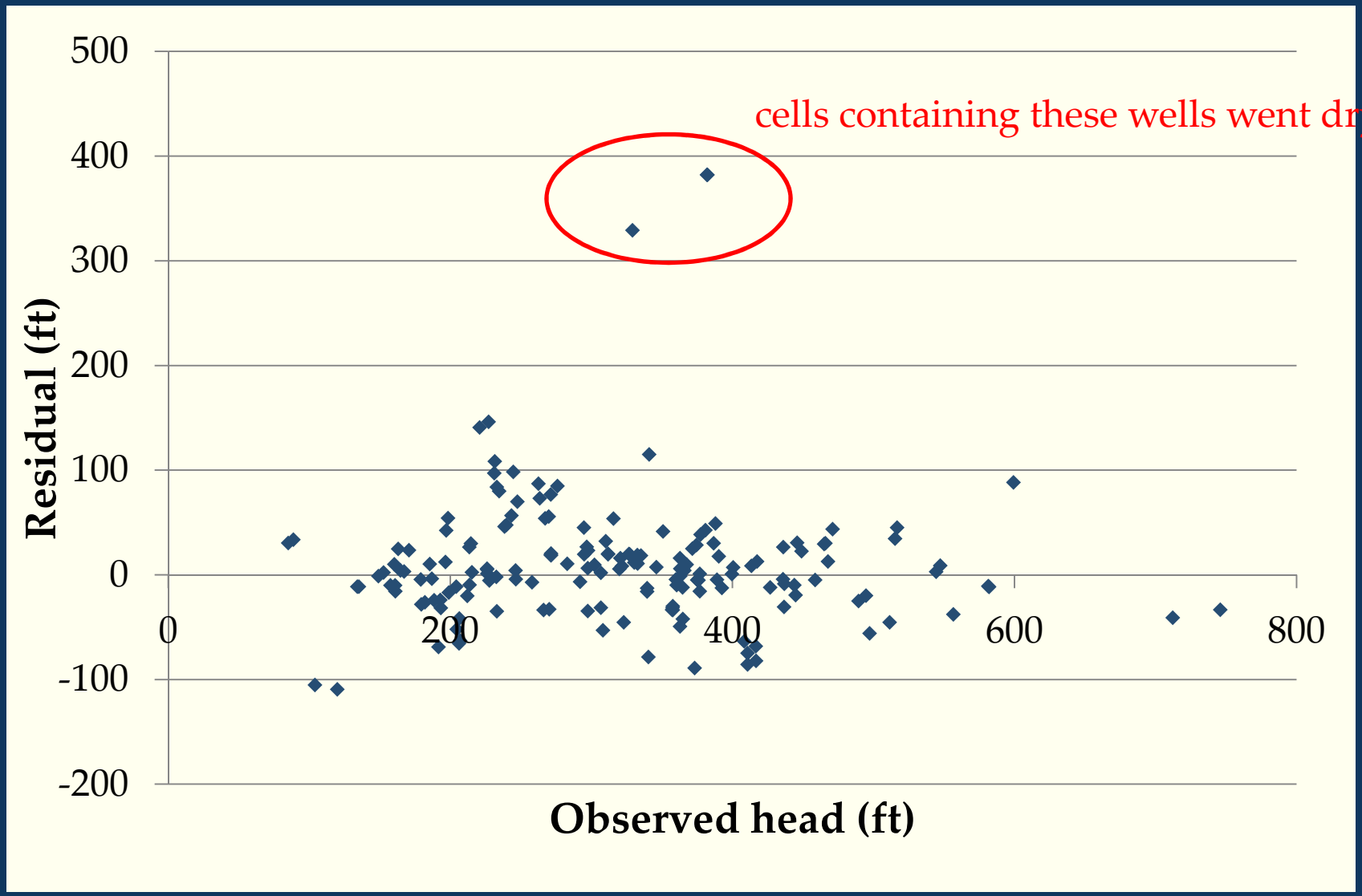
Model features (in cross-section)



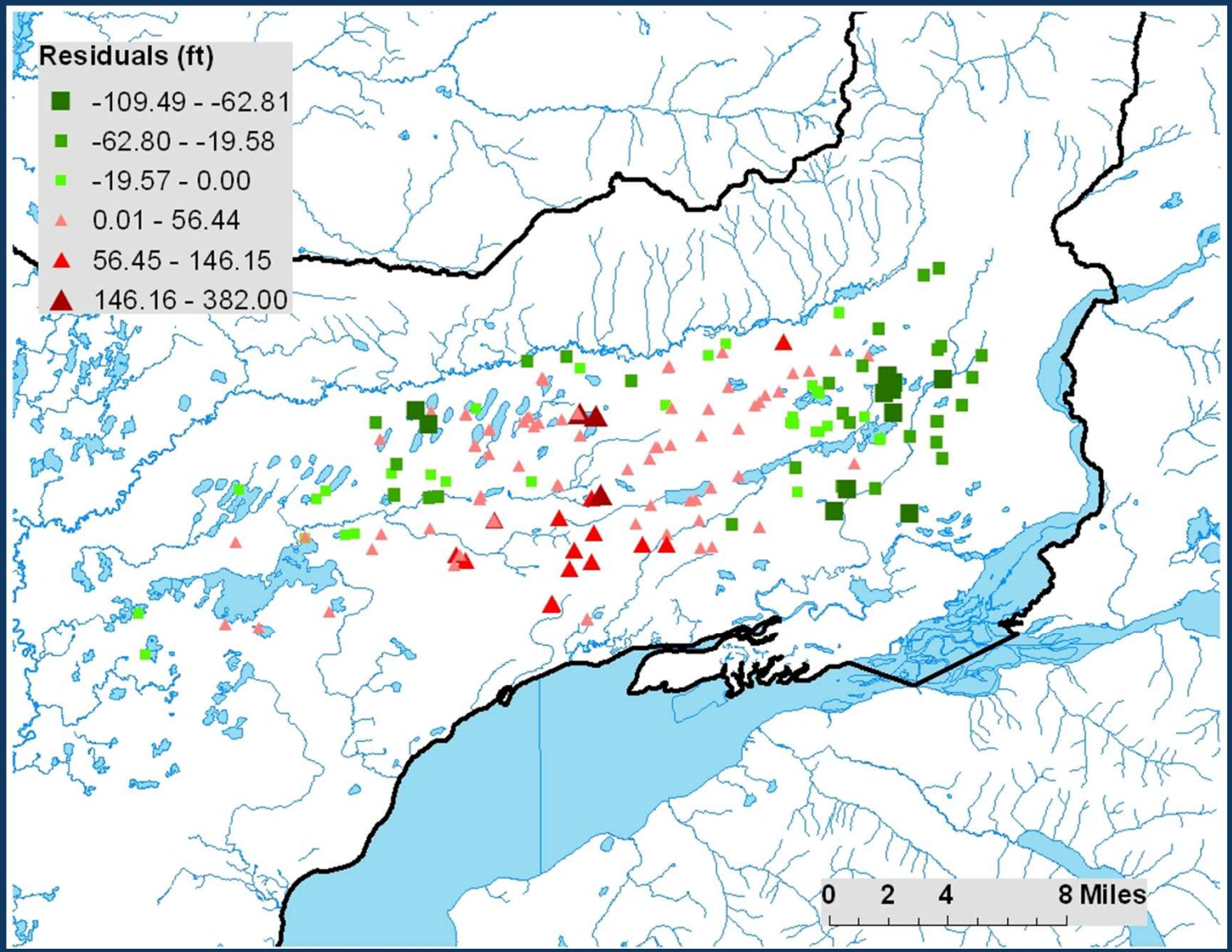
Layer 1: (a) Crystalline rocks and (b) unconsolidated sediments

Layer 2: Sedimentary, metamorphic rocks (e.g. Chickaloon, Arkose Ridge fm.)

Residuals (observed water levels – simulated equivalents)



Spatial distribution of residuals



Spring/summer 2010: Steps for model refinement

1. Quantify water fluxes between groundwater and surface water, use as model calibration targets

2. Improve conceptual understanding of regional hydrogeology

3. Develop an independent, physically-based model of groundwater recharge

1. Quantify water fluxes | 2. Improve conceptual understanding | 3. Independent recharge model

- ***Lucile Creek: Detailed study***

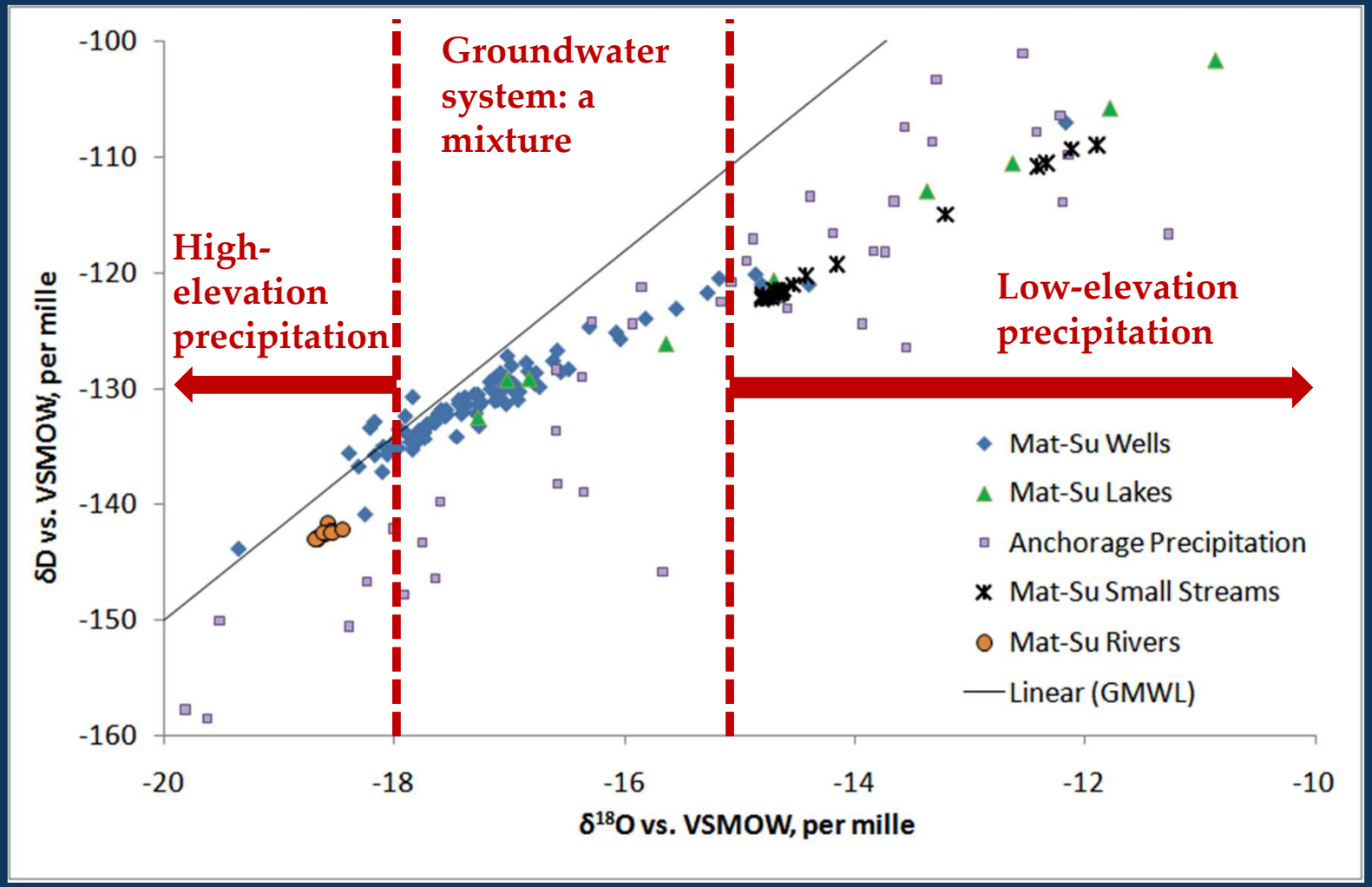
- ***Seepage studies*** along Little Susitna River, Meadow Creek
  - Differential discharge (seepage runs)
  - Thermal profile

- ***Lake water budgets:*** hydrometric, isotope mass balance approaches
  - Memory Lake
  - Seymour Lake
  - Lucile Lake

1. Quantify water fluxes

2. Improve conceptual understanding

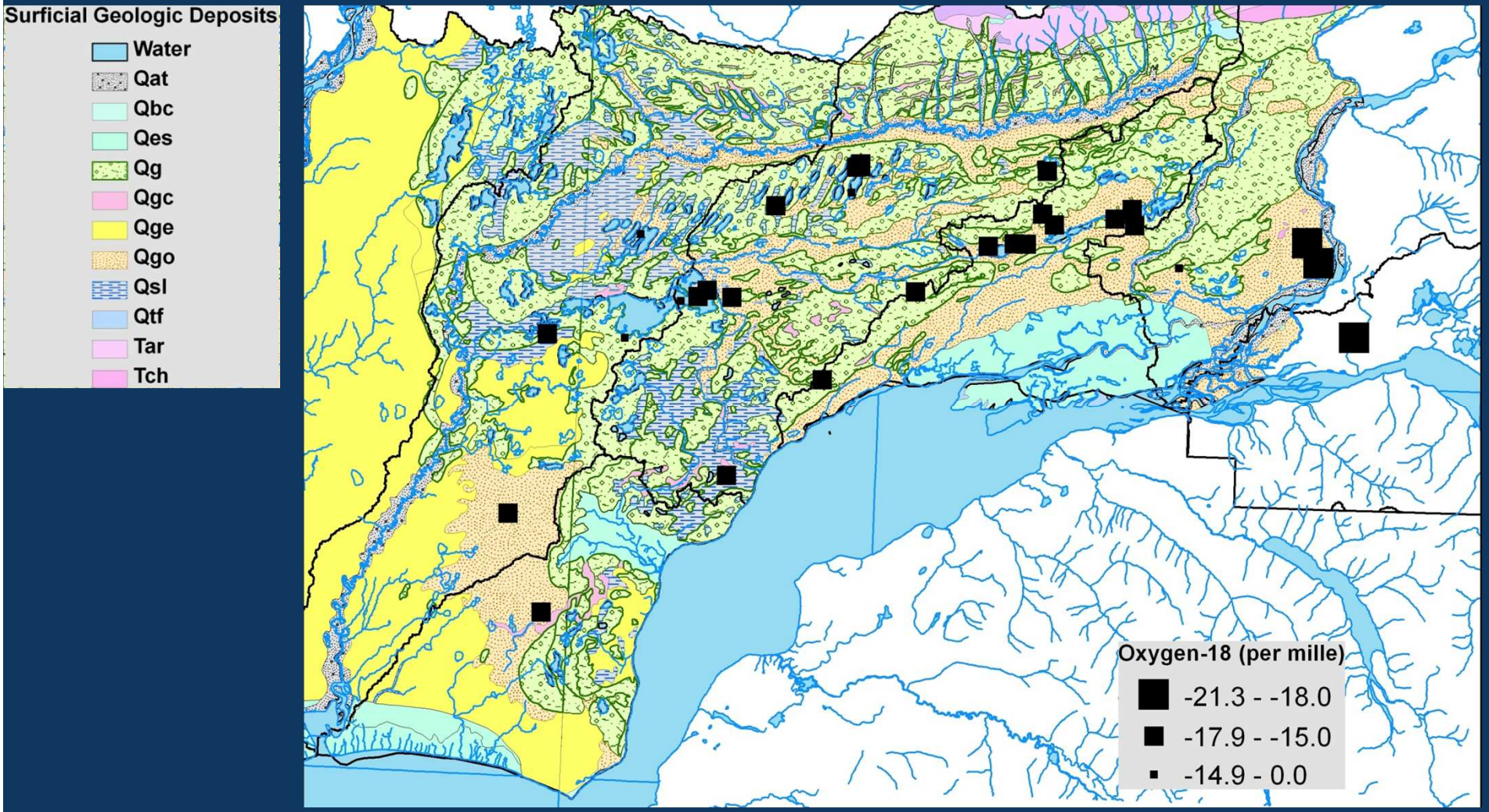
3. Independent recharge model



1. Quantify water fluxes

2. Improve conceptual understanding

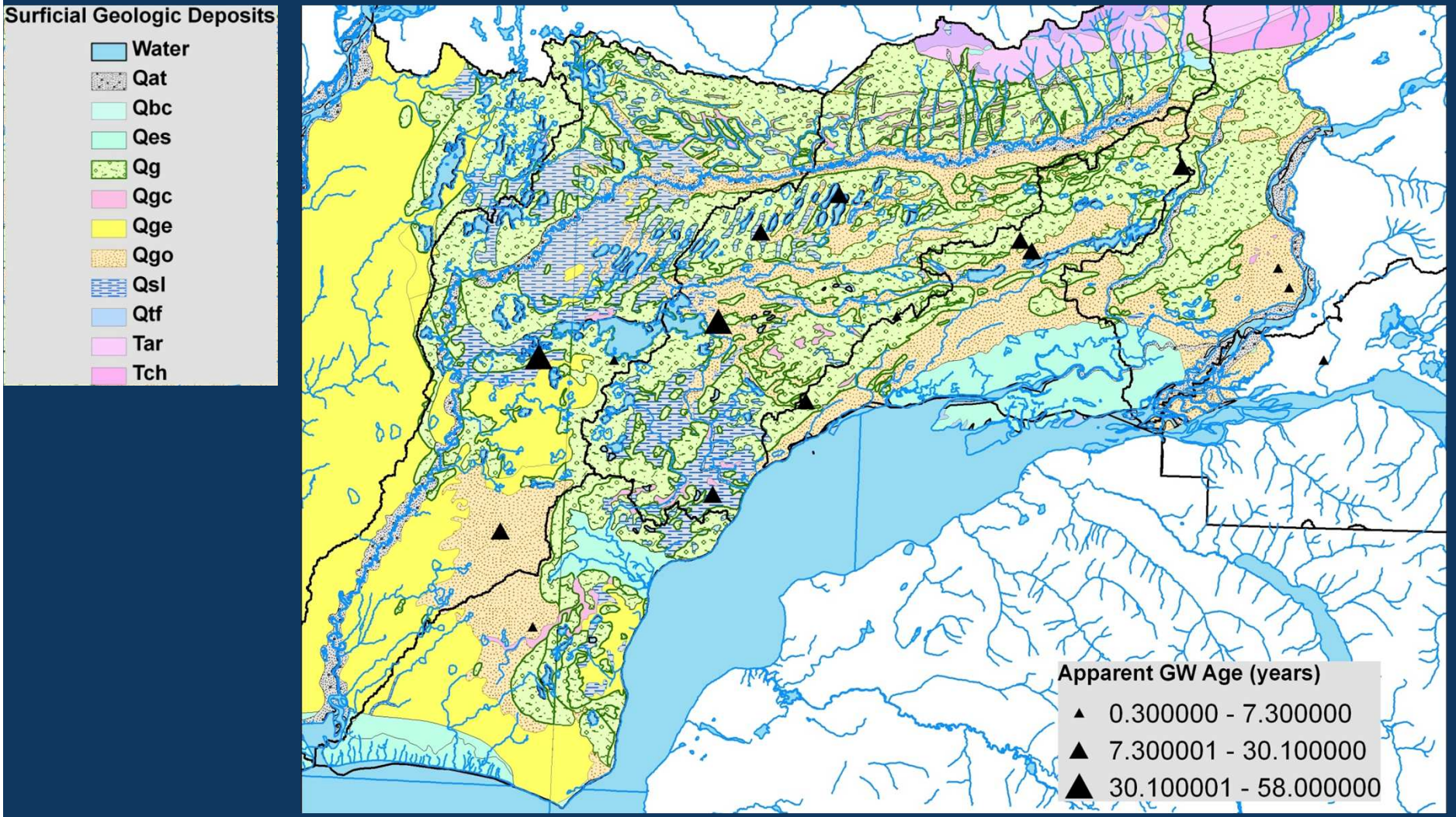
3. Independent recharge model



1. Quantify water fluxes

2. Improve conceptual understanding

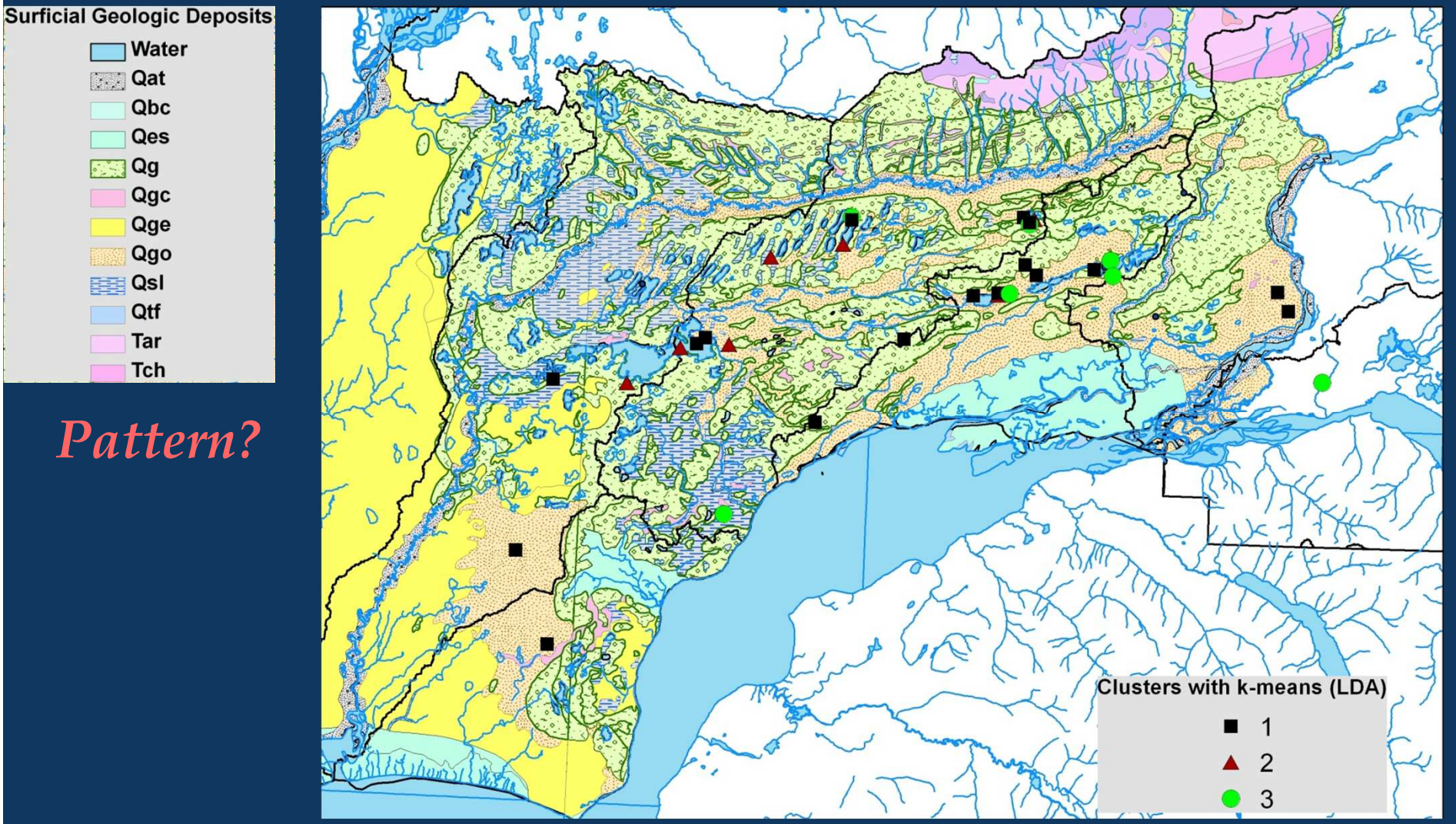
3. Independent recharge model



1. Quantify water fluxes

2. Improve conceptual understanding

3. Independent recharge model

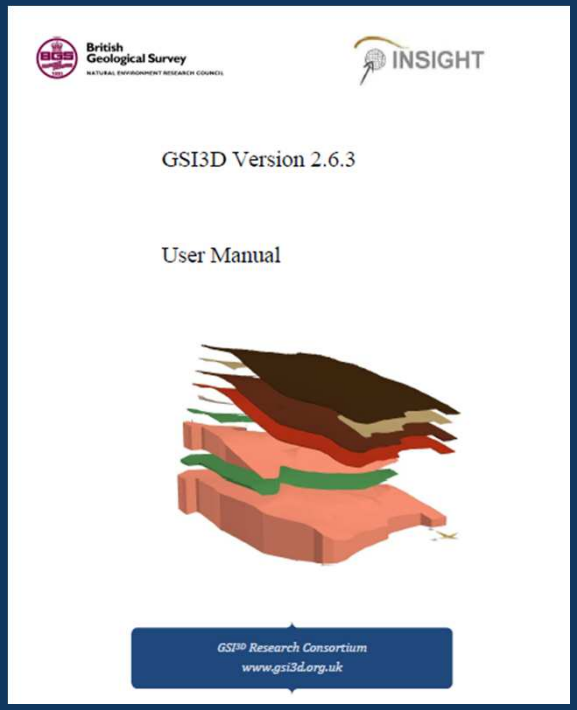


Pattern?

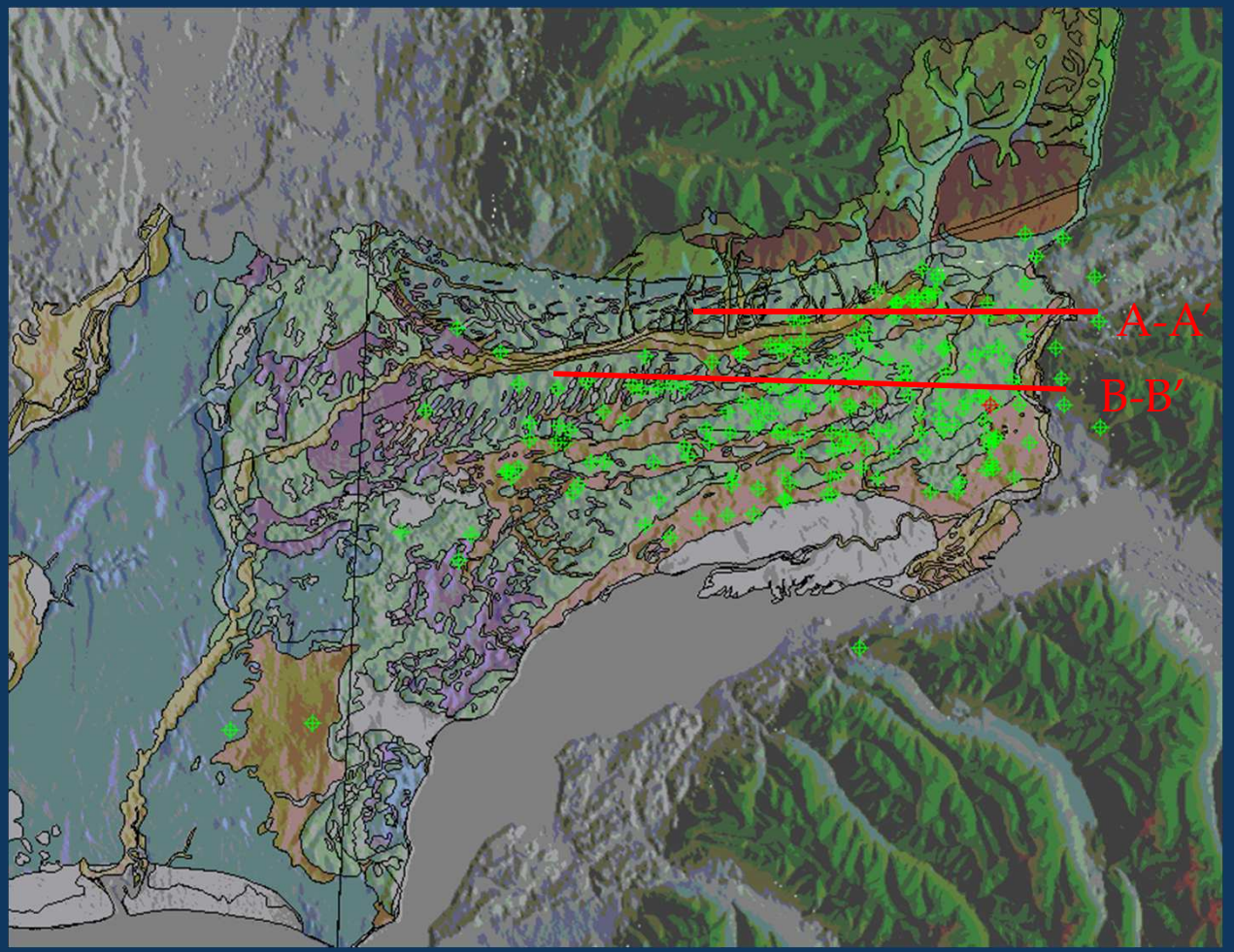
1. Quantify water fluxes

2. Improve conceptual understanding

3. Independent recharge model



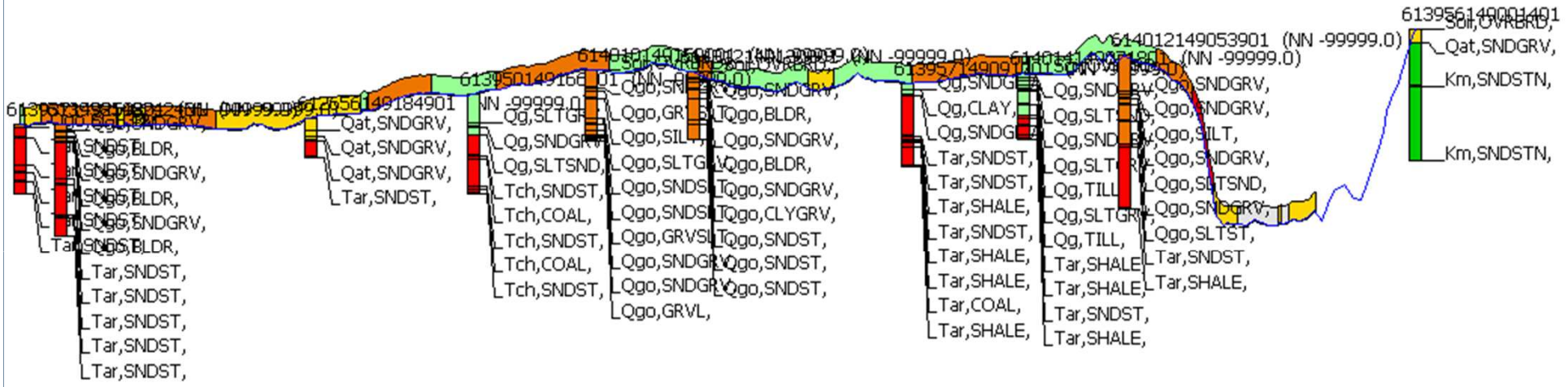
GSI3D: Geologic Modeling Platform



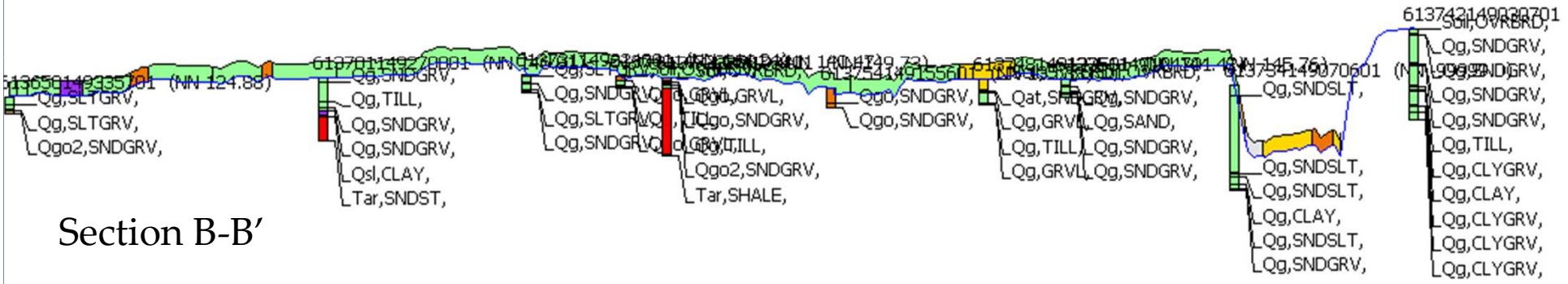
1. Quantify water fluxes

2. Improve conceptual understanding

3. Independent recharge model



Section A-A′



Section B-B′

Unit classification

Option 1. Borehole lithologies → lithofacies → hydrofacies

Option 2. Borehole lithologies → stratigraphy → hydrofacies

Spatial distribution of units

Option 1. Manually draw sections, envelopes between boreholes

Option 2. Geostatistical modeling: Transition probabilities, lateral hydrofacies distribution

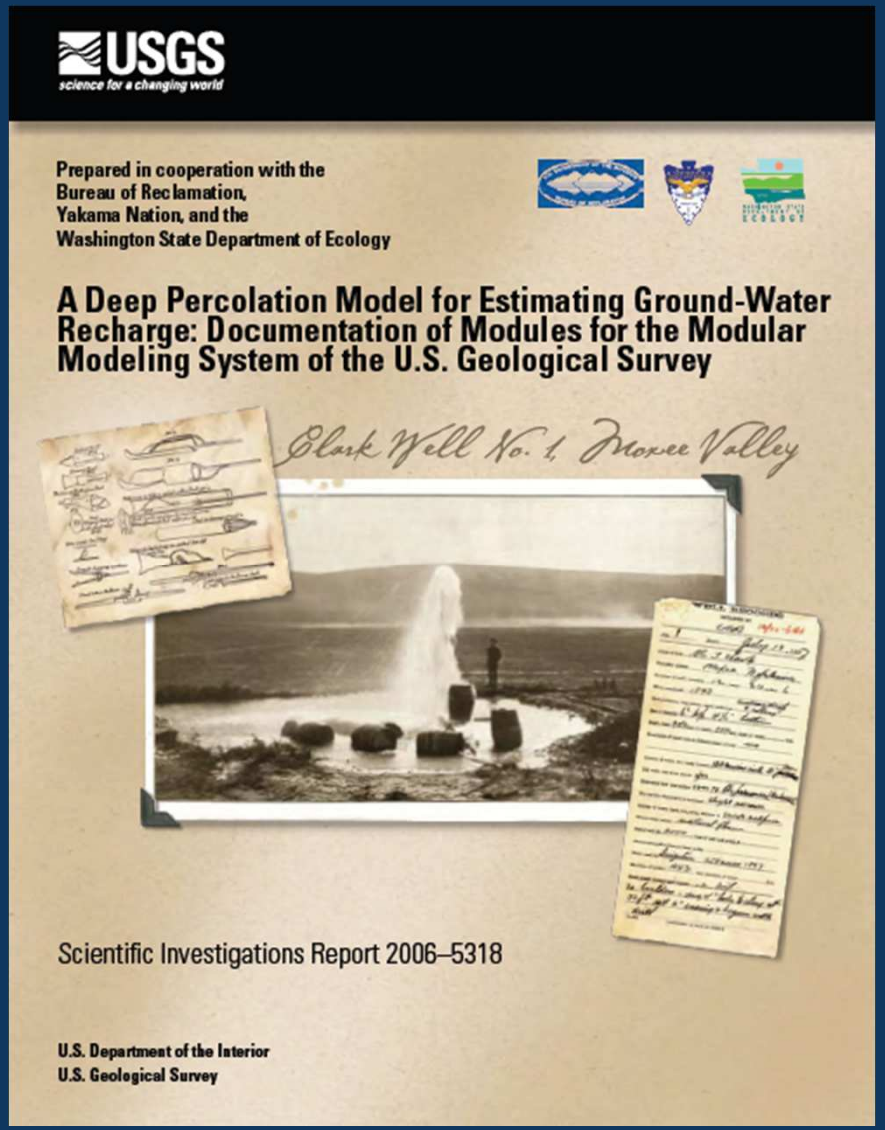
1. Quantify water fluxes

2. Improve conceptual understanding

3. Independent recharge model

The Deep Percolation Model (DPM) is:

- Spatially/temporally distributed
- Physically based
- Modular
- Free!



Acknowledgements

Special thanks to:

Jesse Dickinson and Janet Curran for their support and encouragement

Funding provided by:

U.S. FISH & WILDLIFE SERVICE

USGS
science for a changing world