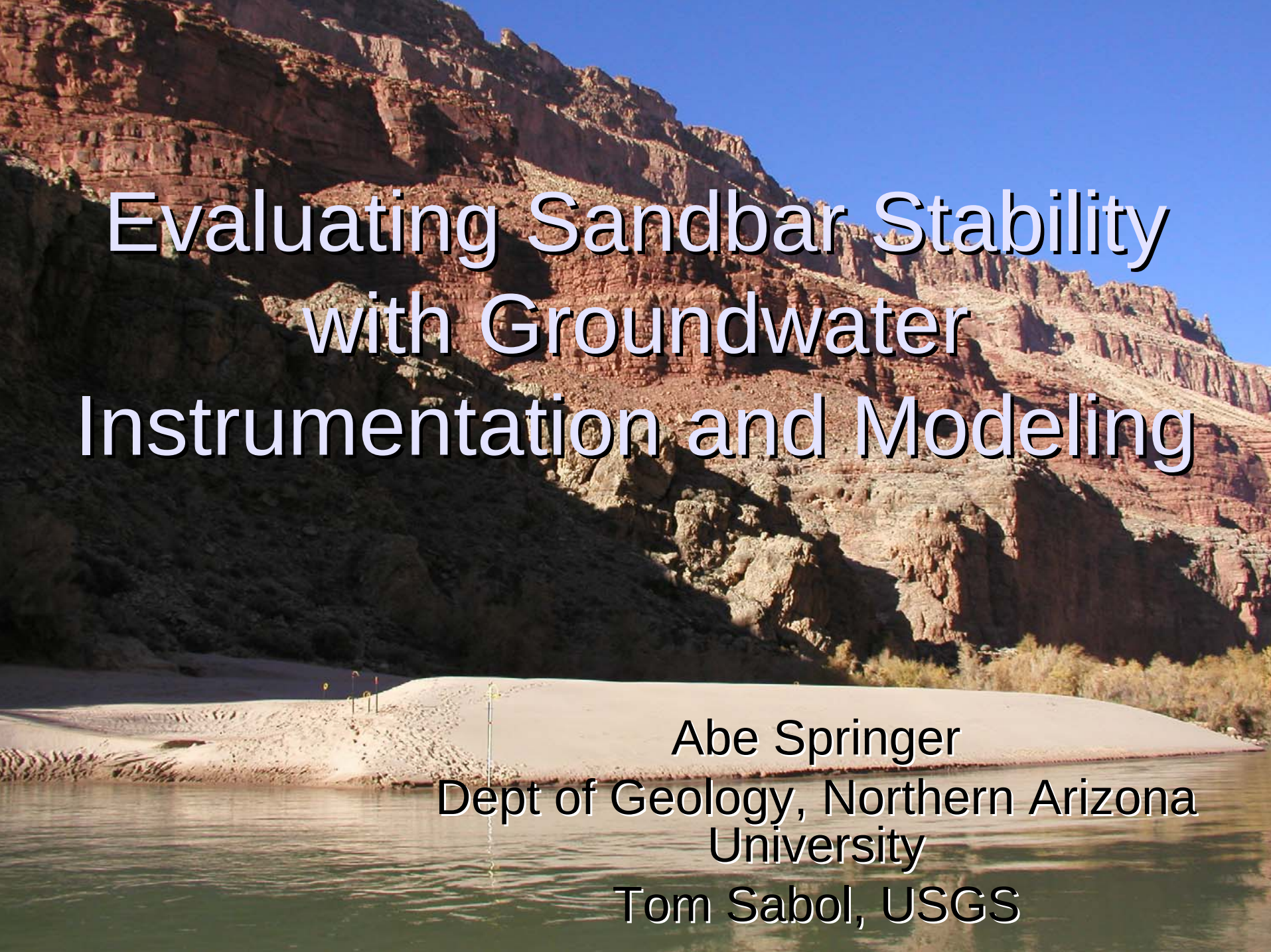

Evaluating Sandbar Stability with Groundwater Instrumentation and Modeling

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Tom Sabol, USGS

Outline

- Purpose
- Field instrumentation
- Field measurements
- Field results
- Modeling
- Summary

Photo by J. Miller

Purpose of Study

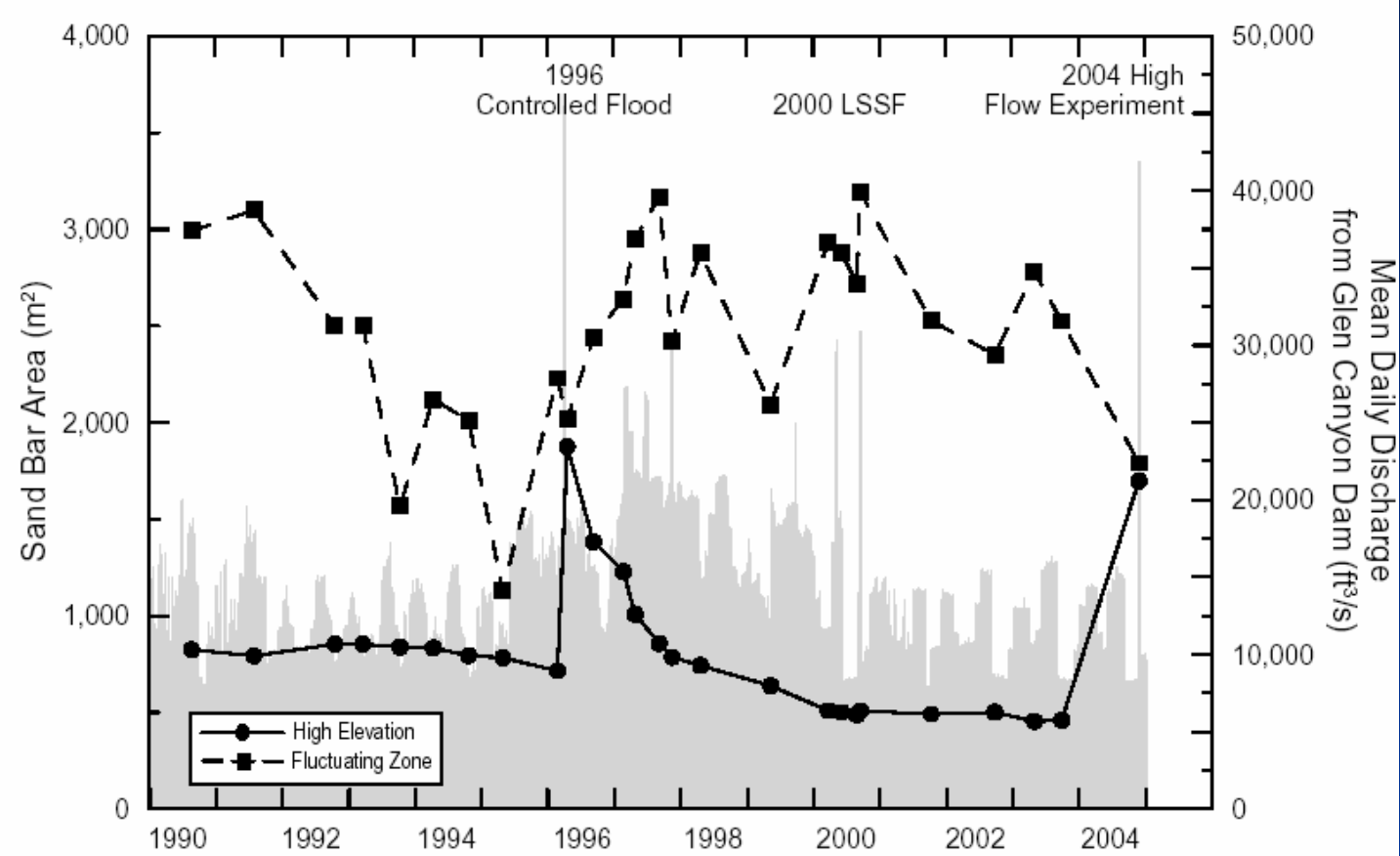
11/16/04

12/05/04

- Simulate with a numerical groundwater model how hydraulic heads at 30.5M right respond to wetting and dewatering with new sediments from November 2004 BHBF.

Photos by R. Parnell

Sand Bar Area and Volume, 30M

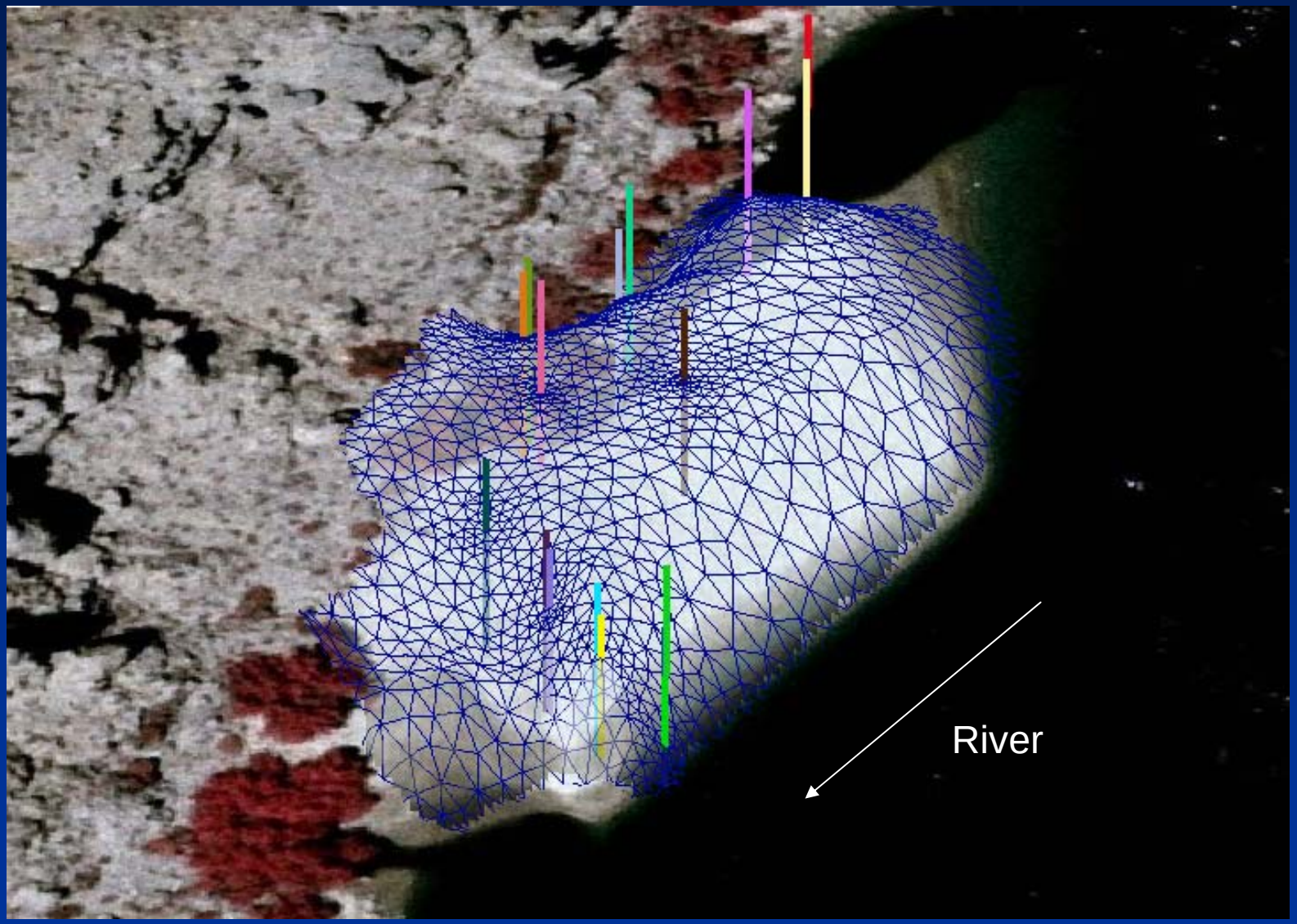


NAU Sandbar Studies

Field Instrumentation

- Installed
  - 14 wells
  - 2 stage gages
- 30.5M right
- November 29-30, 2004
- Post BHBF

Finite element mesh and well locations



Field Instrumentation

- Pressure Transducers
  - In-Situ, Inc.
  - SSP-100 miniTroll
- Range
  - 0 to 15 PSI
- Accuracy
  - +/- 0.200 % full scale
- Measured water levels every 15 minutes till March 2005

Hydraulic conductivity

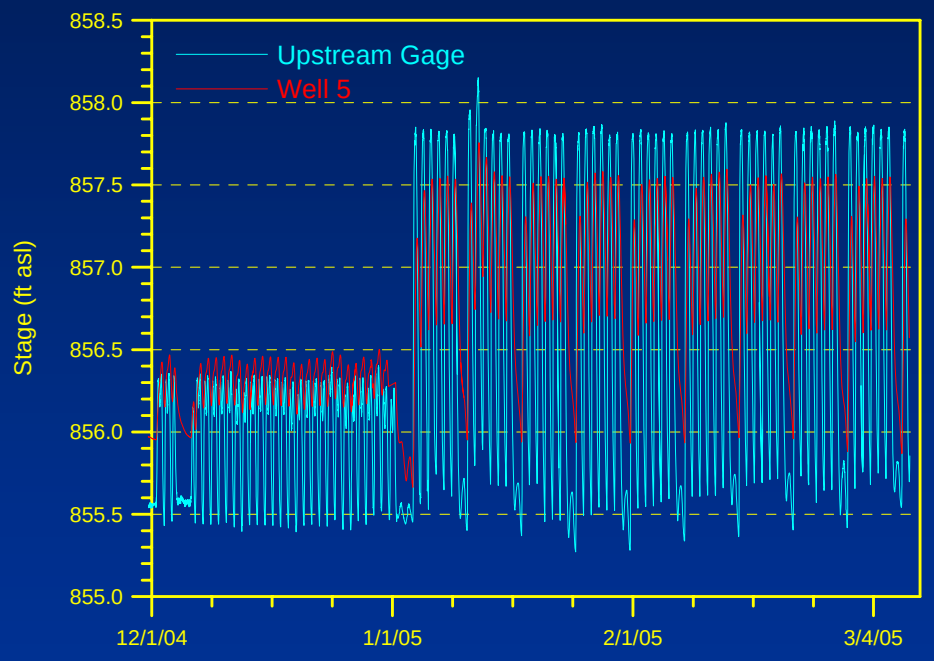
- Measured on all 14 wells
- Measured after the BHBF
- Falling head test
- Analyzed with Bouwer and Rice (1976) method
- Aquifer^{Win32} (ESI, Inc.)

Field Characterization

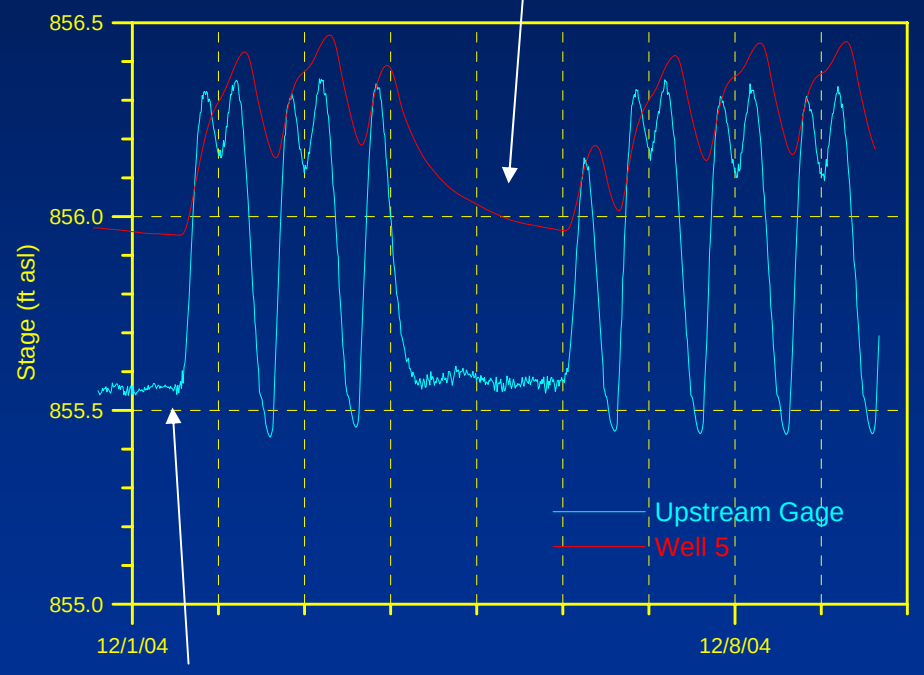
- Up to 2.6 m of new sediment deposited on 30M.
- Top of casing of wells surveyed by NAU Sandbar studies.

Photos by T. Sabol

Hydrographs for River Stage Gage and Well 5



8k low flow

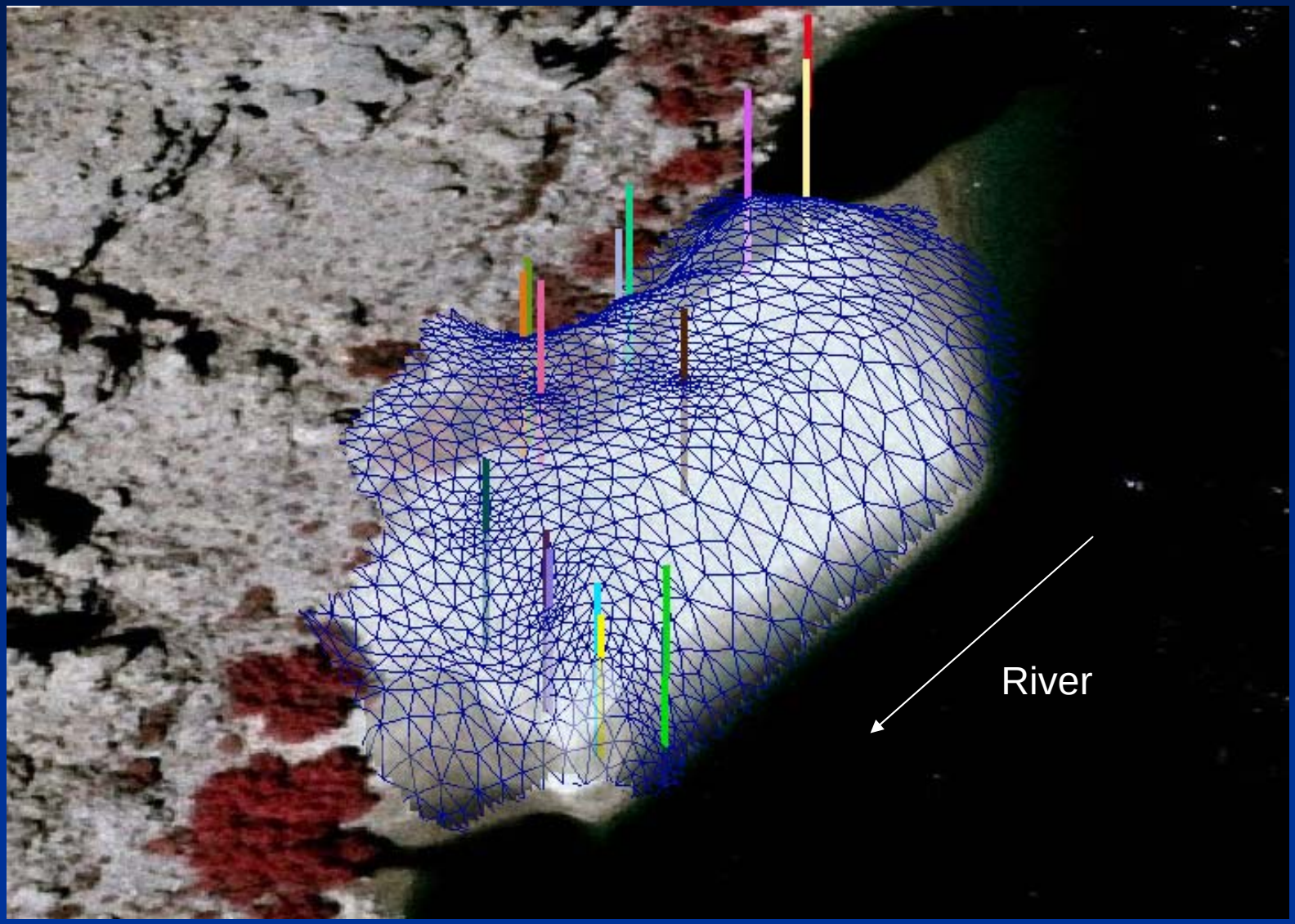


End of steady 8k flows

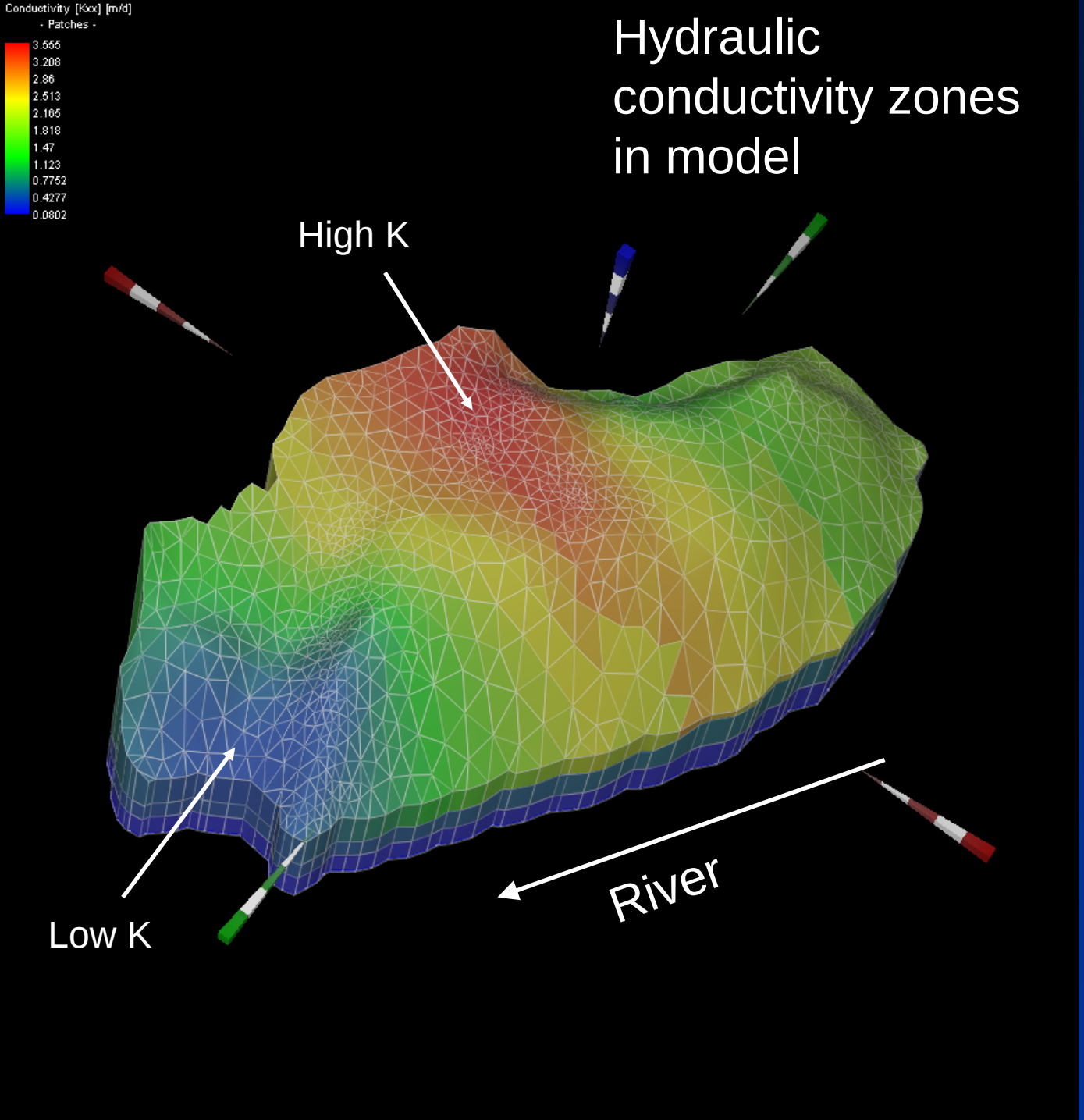
Groundwater Flow Model

- FEFLOW v5.2 (WASY, Berlin, Germany)
  - Finite element flow model
  - 3-D, Transient
  - Unconfined (moving mesh for water table)
- 30M model
  - 3 Layers
  - Heterogenous, anisotropic
  - Calibrated to measured hydraulic heads

Finite element mesh and well locations

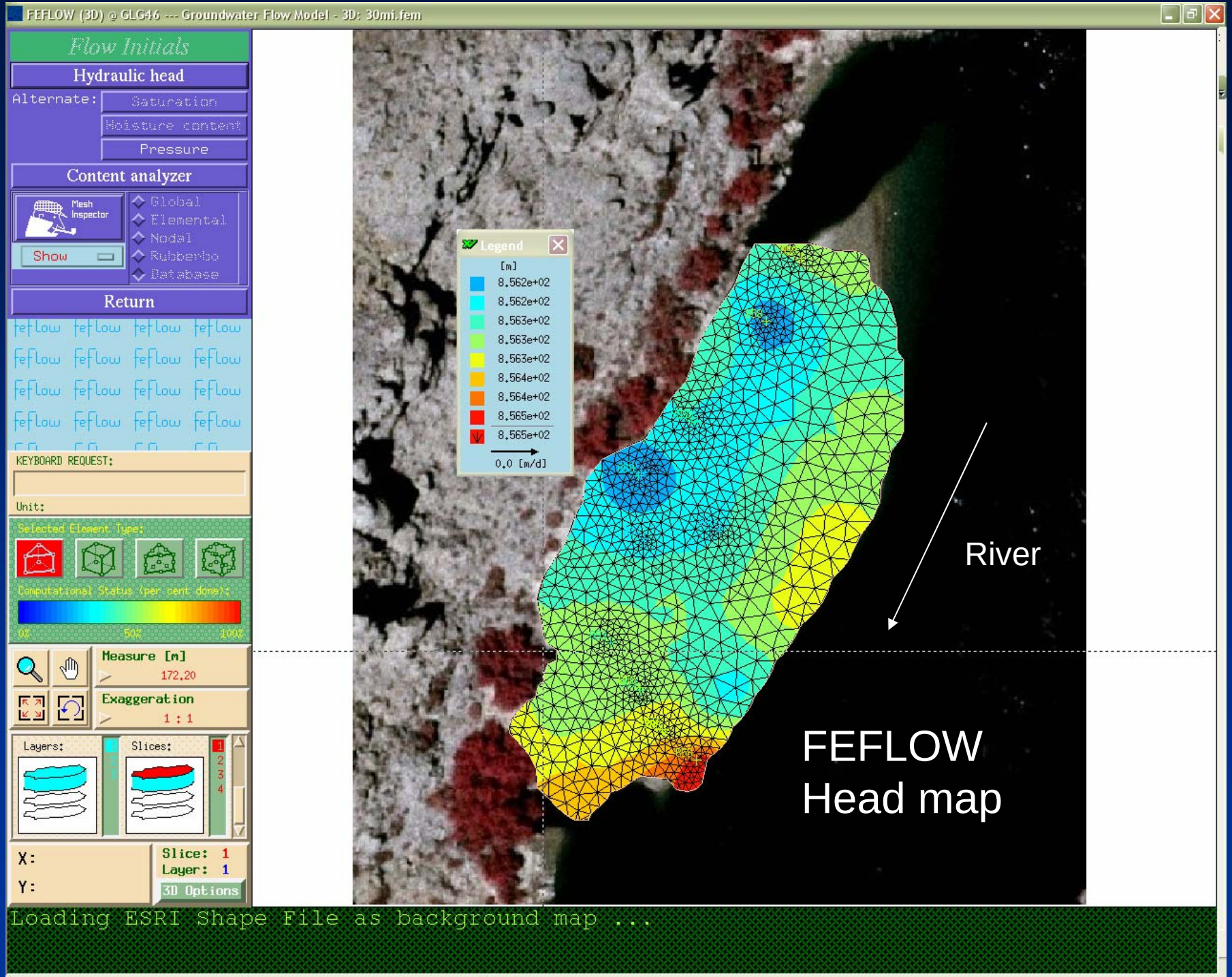


Hydraulic conductivity zones in model



3 layers

Heterogenous


FEFLOW (3D) @ GLG46 --- Groundwater Flow Model - 3D: 30mi.fem
Flow Initials
Hydraulic head
Alternate:
Saturation
Moisture content
Pressure
Content analyzer
Mesh Inspector
Global
Elemental
Nodal
Rubberbo
Database
Show
Return
KEYBOARD REQUEST:
Unit:
Selected Element Type:
Computational Status (per cent done):
0%
50%
100%
Measure [m]
172.20
Exaggeration
1 : 1
Layers:
Slices:
X:
Y:
Slice: 1
Layer: 1
3D Options
Legend
[m]
8.562e+02
8.562e+02
8.563e+02
8.563e+02
8.563e+02
8.564e+02
8.564e+02
8.565e+02
8.565e+02
0.0 [m/d]
River
FEFLOW
Head map
Loading ESRI Shape File as background map ...

Summary

- Use model to predict how different fluctuations affect rates of bar dewatering.
- Modeling results to follow, soon.

Acknowledgements

- GCMRC
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- NAU Sand Bar Studies