Understanding Arizona Basin Hydrology

Photograph by Bert Duet, U.S. Geological Survey

University of Arizona Water Resources Research Center 2006 Water Conference

Providing Water to Arizona's Growing Population: How Will We Meet the Obligation?

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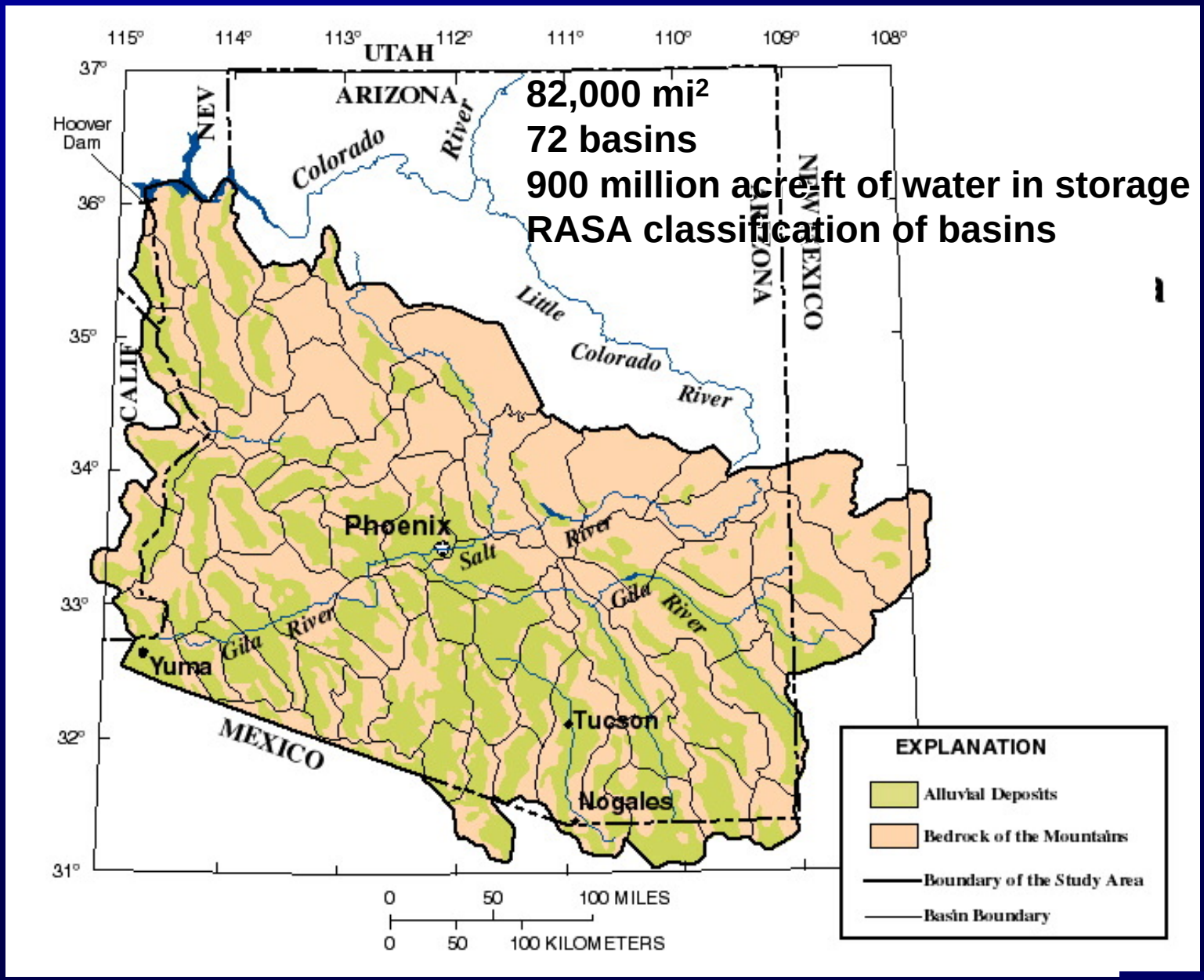
122 North Second St., Phoenix AZ 85004

John Hoffmann

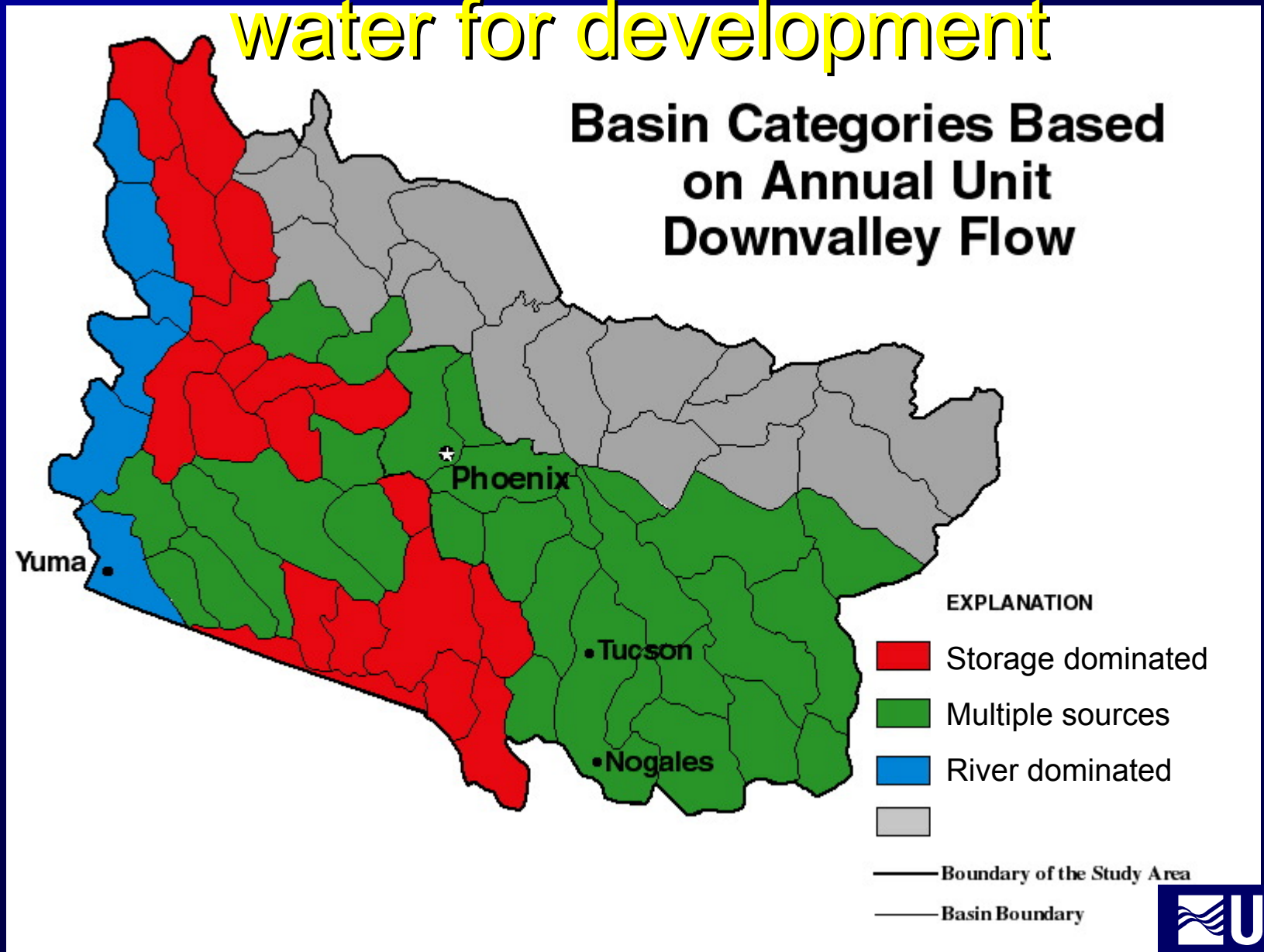
U.S. Geological Survey

Understanding Arizona Basin Hydrology

- Key to answering some basic questions such as:
  - How much water do we have?
  - Are we running out of water?
  - Where are the resources stressed?
  - Where is ground water available for future supplies?
  - What are the consequences of development?


82,000 mi²
72 basins
900 million acre-ft of water in storage
RASA classification of basins
UTAH
ARIZONA
NEV
CALIF
NEW MEXICO
Hoover Dam
Colorado River
Little Colorado River
Salt River
Gila River
Phoenix
Yuma
Tucson
Nogales
MEXICO
115°
114°
113°
112°
111°
110°
109°
108°
37°
36°
35°
34°
33°
32°
31°
0 50 100 MILES
0 50 100 KILOMETERS
EXPLANATION
Alluvial Deposits
Bedrock of the Mountains
Boundary of the Study Area
Basin Boundary

Basin category based on source of water for development



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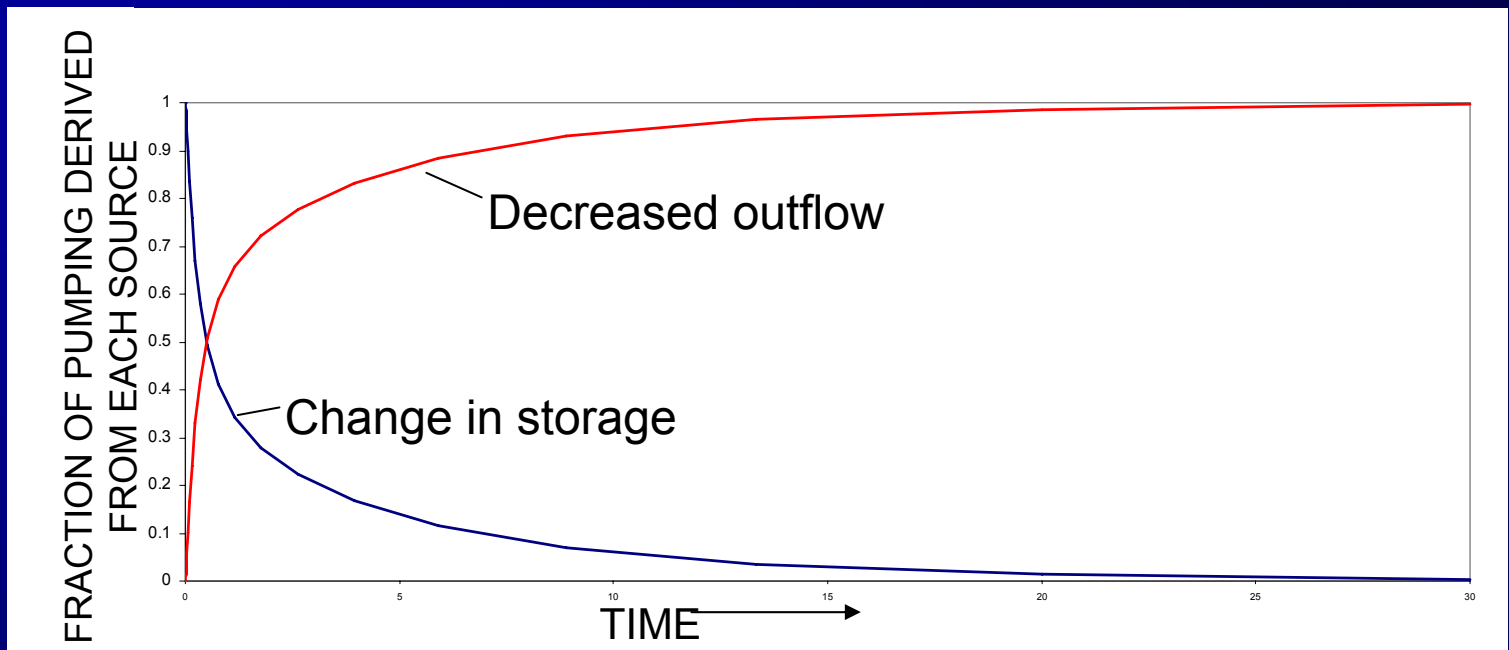
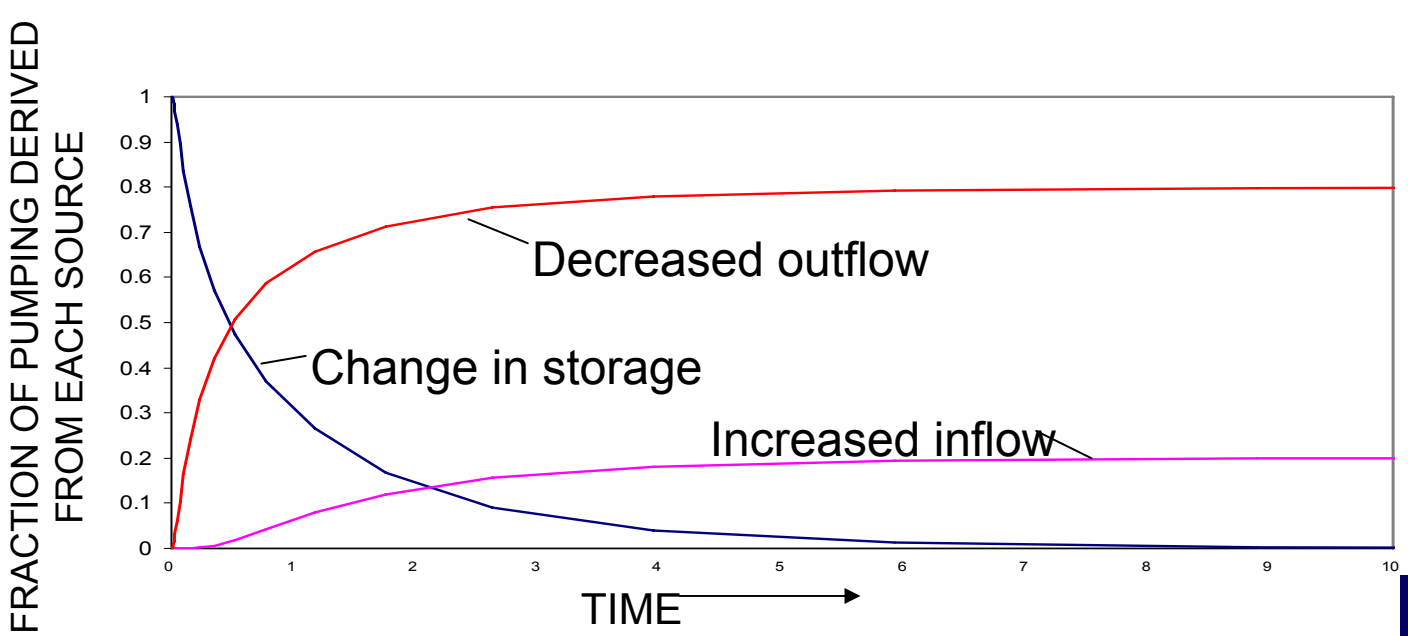
Sources of water for basins with multiple sources





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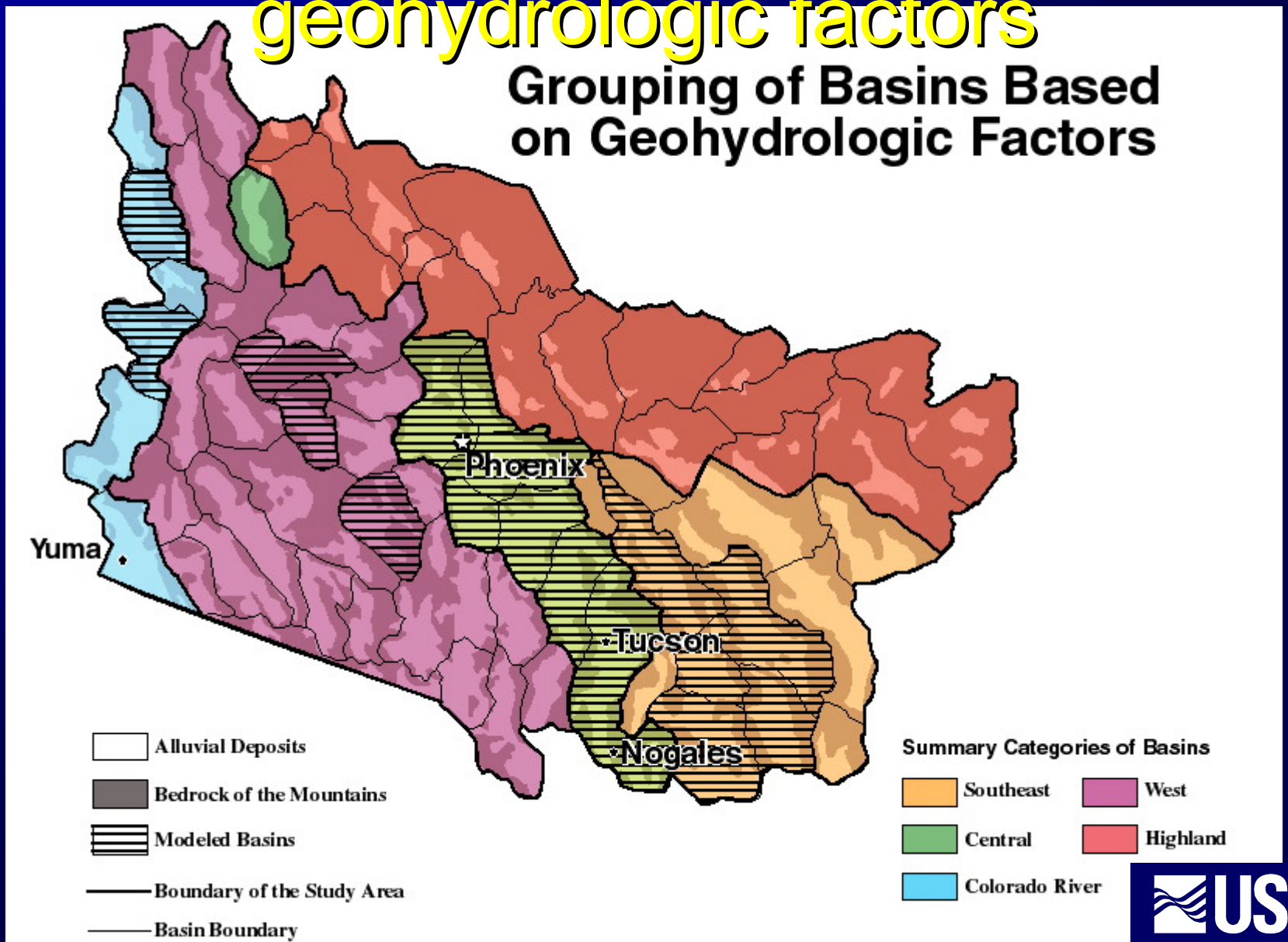
Basin category based on geohydrologic factors




ARIZONA
RURAL WATERSHED INITIATIVES and ACTIVE MANAGEMENT AREAS
Detrital Valley
Hualapai Valley
Coconino Plateau study area
Kingman
Flagstaff
Upper and middle Verde River watersheds study area
Prescott
Sacramento Valley
Mogollon Highlands study area
Phoenix
Phoenix Metropolitan area
Middle San Pedro Basin
Pinal
Yuma
Tucson
Willcox
Willcox Basin
Tucson
Benson
Santa Cruz
Douglas Basin
0 50 MILES
0 50 KILOMETERS

Sate of Arizona's Rural Watershed Iitiative

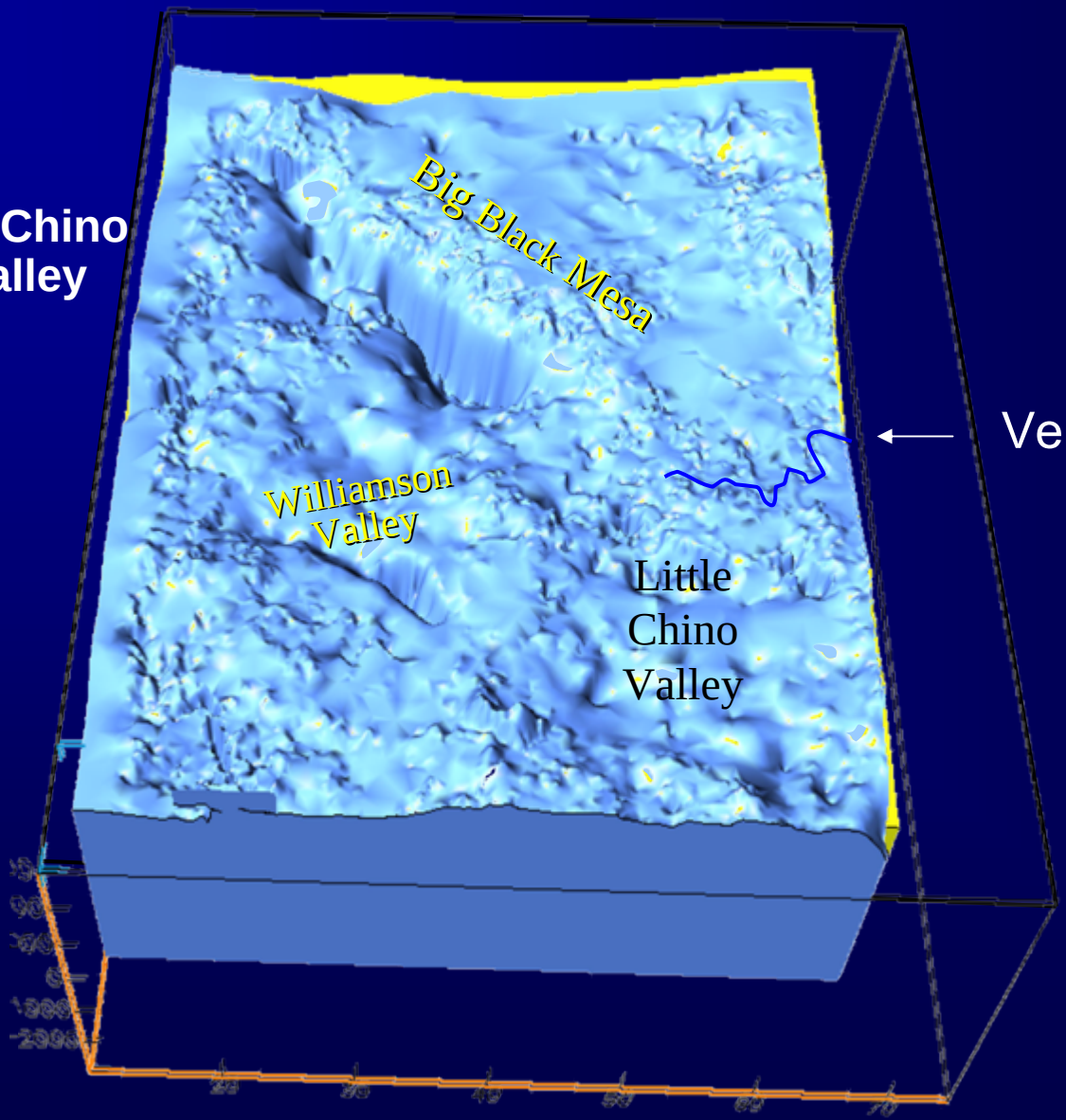
- Describe watersheds based on State priorities.
- Most rural issues linked to ground-water sustainability.
- Commonality of information needs for resource management/development.
- Aquifer information an enduring resource.
  - Hydrology
  - Geology
  - Water Budget
  - Land use

Examples of enduring information useful in better understanding Arizona basin hydrology

- Basin geometry: especially useful in those basins where storage is the primary source of water for development-- also useful for estimating the timing of capture

- Distribution of fine-grained materials in basin fill deposits: especially useful for basins having streamflow as a potential source-- also important for assessing storage and potential land subsidence

BASIN THICKNESS FROM GRAVITY DATA



Ack: Vicki Langenheim

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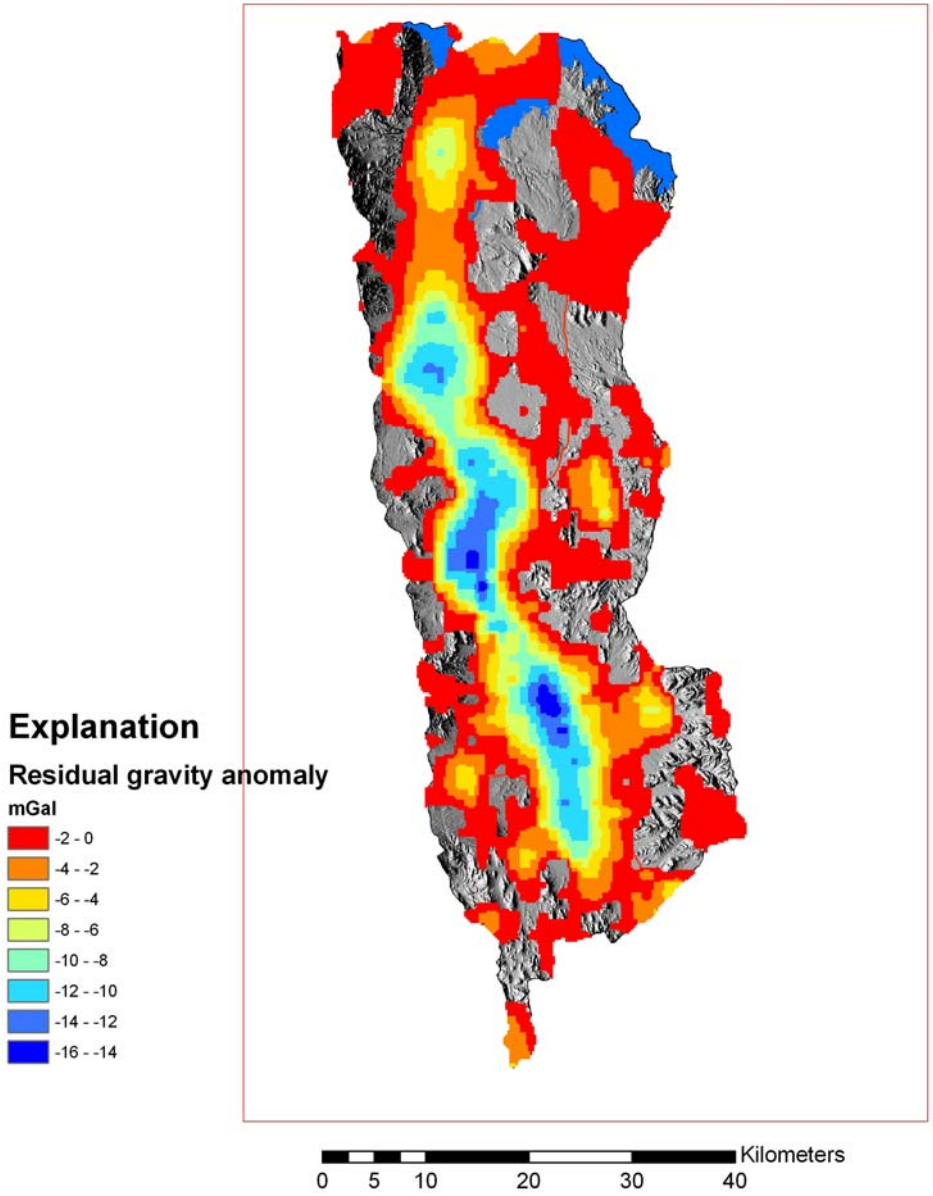
Detrital Basin



Residual Bouguer Gravity Anomaly for Detrital Basin

Data collected, compiled with existing data, and reduced by ADWR

Ack: Paul Ivanich

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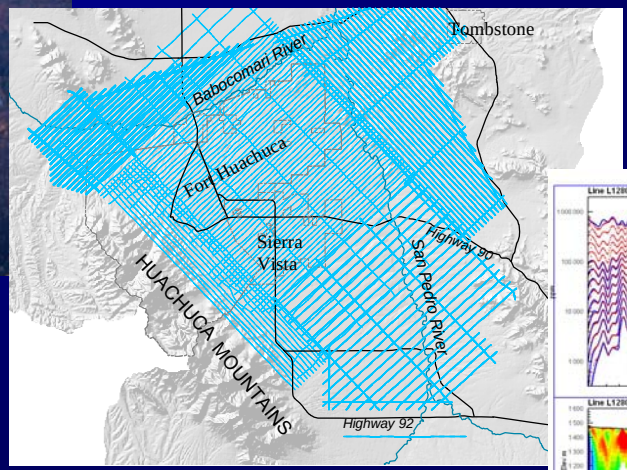
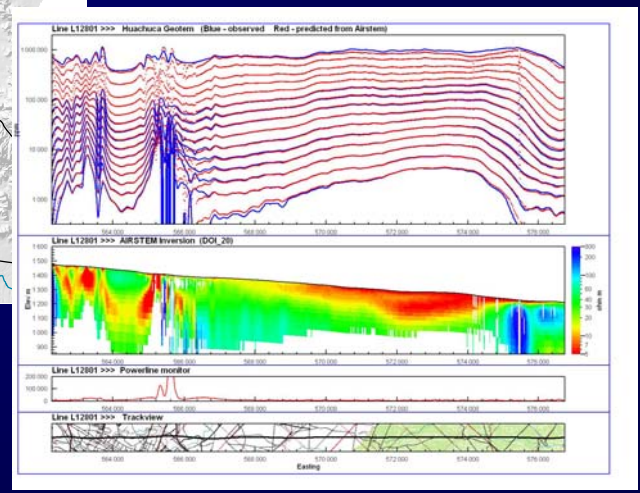
Mapping of aquifer extent and extensive silt and clay layers using aerial transient electromagnetic surveys





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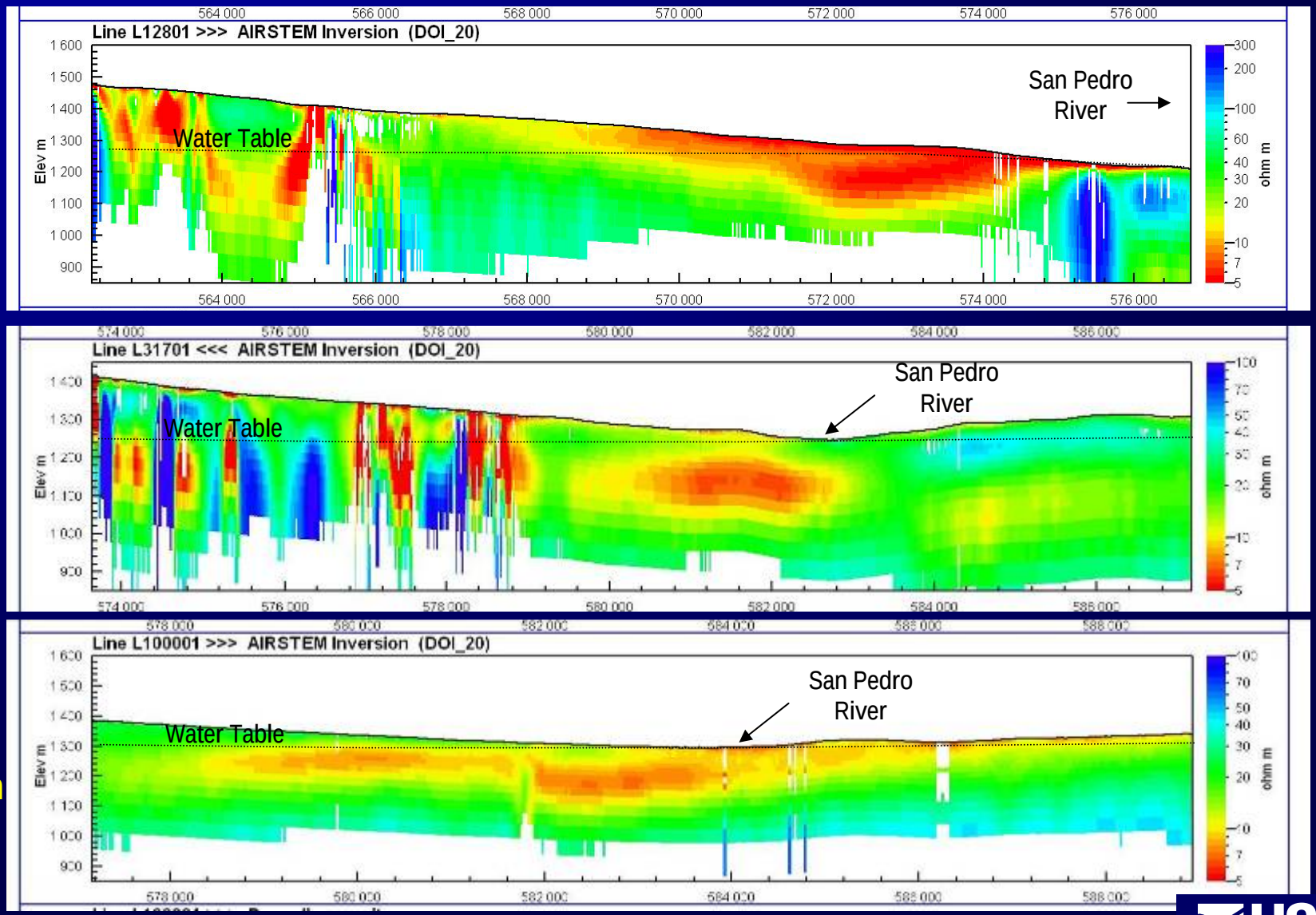
SOUTHWEST

NORTHEAST

south

north



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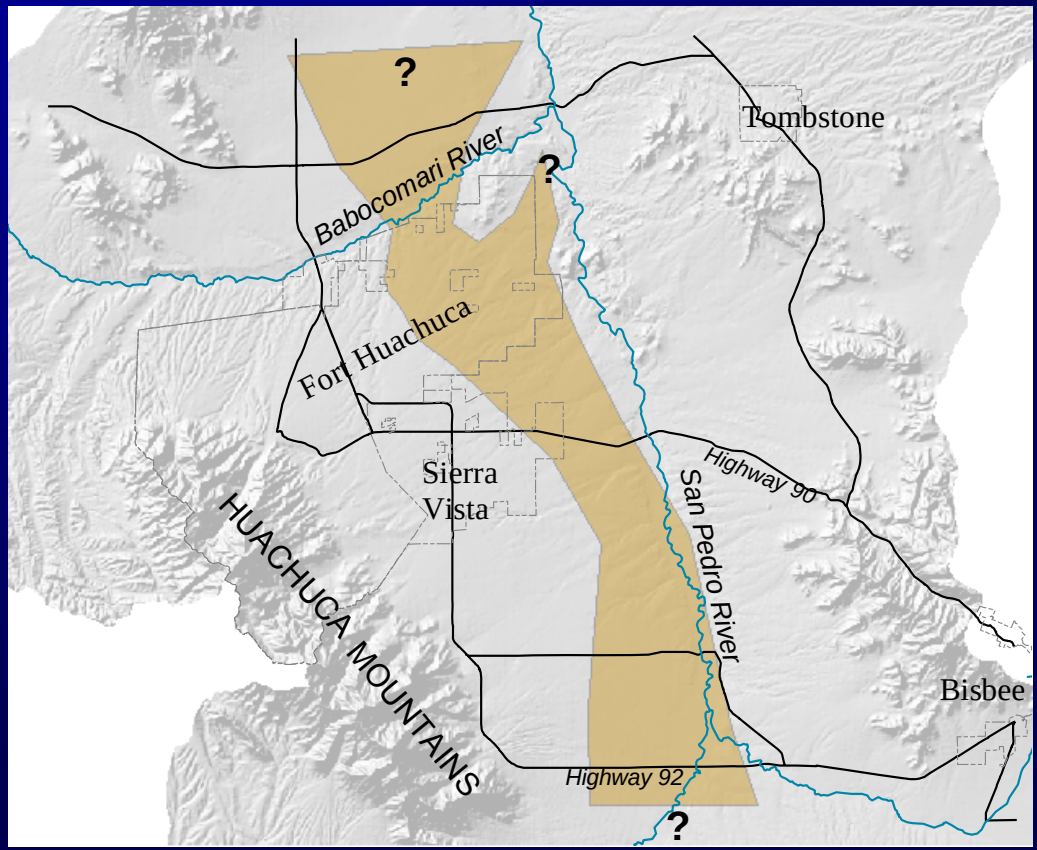
APPROXIMATE DISTRIBUTION OF EXTENSIVE SILT AND CLAY LAYERS



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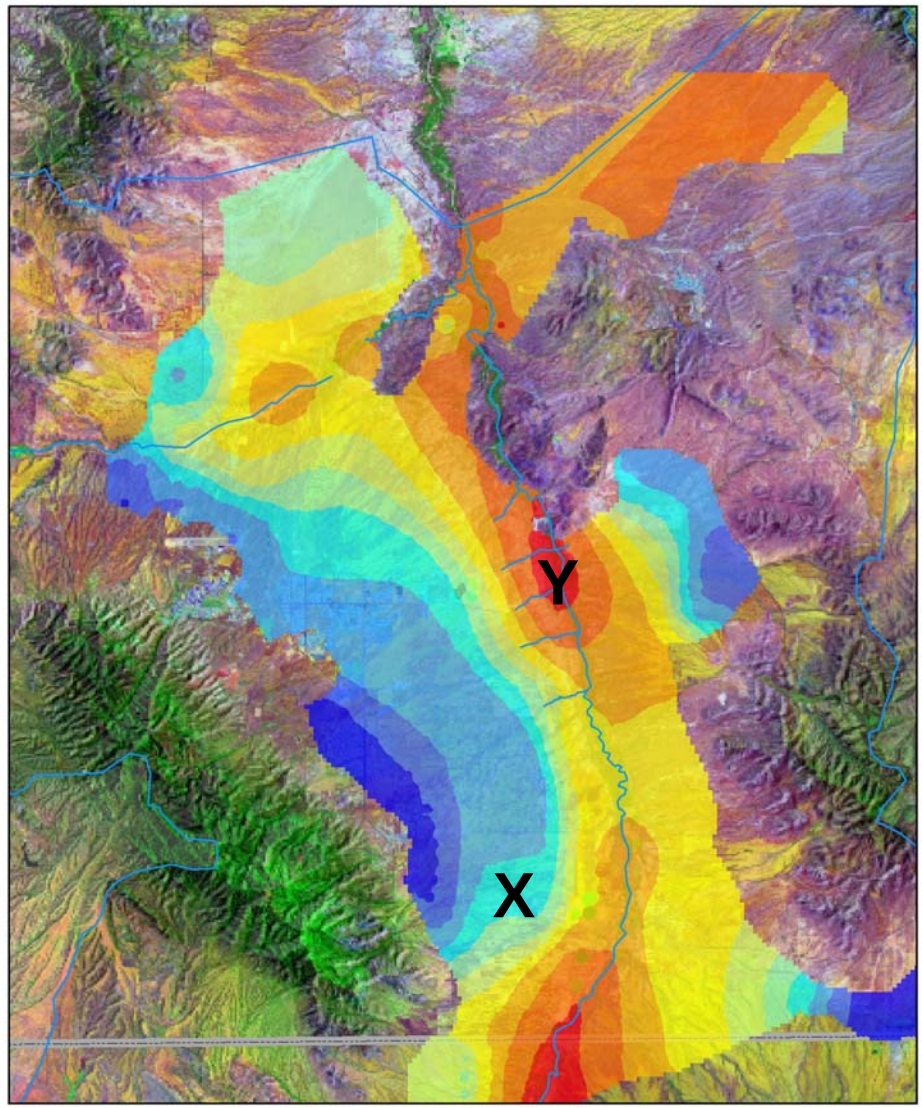
Upper San Pedro: Simulated Captur
Multiple sources of water to wells

For example: Pumping at point X at a rate of 100 AF/yr would result in a 30-40 percent decline in discharge, or 30-40 AF/yr in discharge to the sum of streams ET, springs, and ground-water outflow from the basin.



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Mapping of fine-grained units and aquifer extent

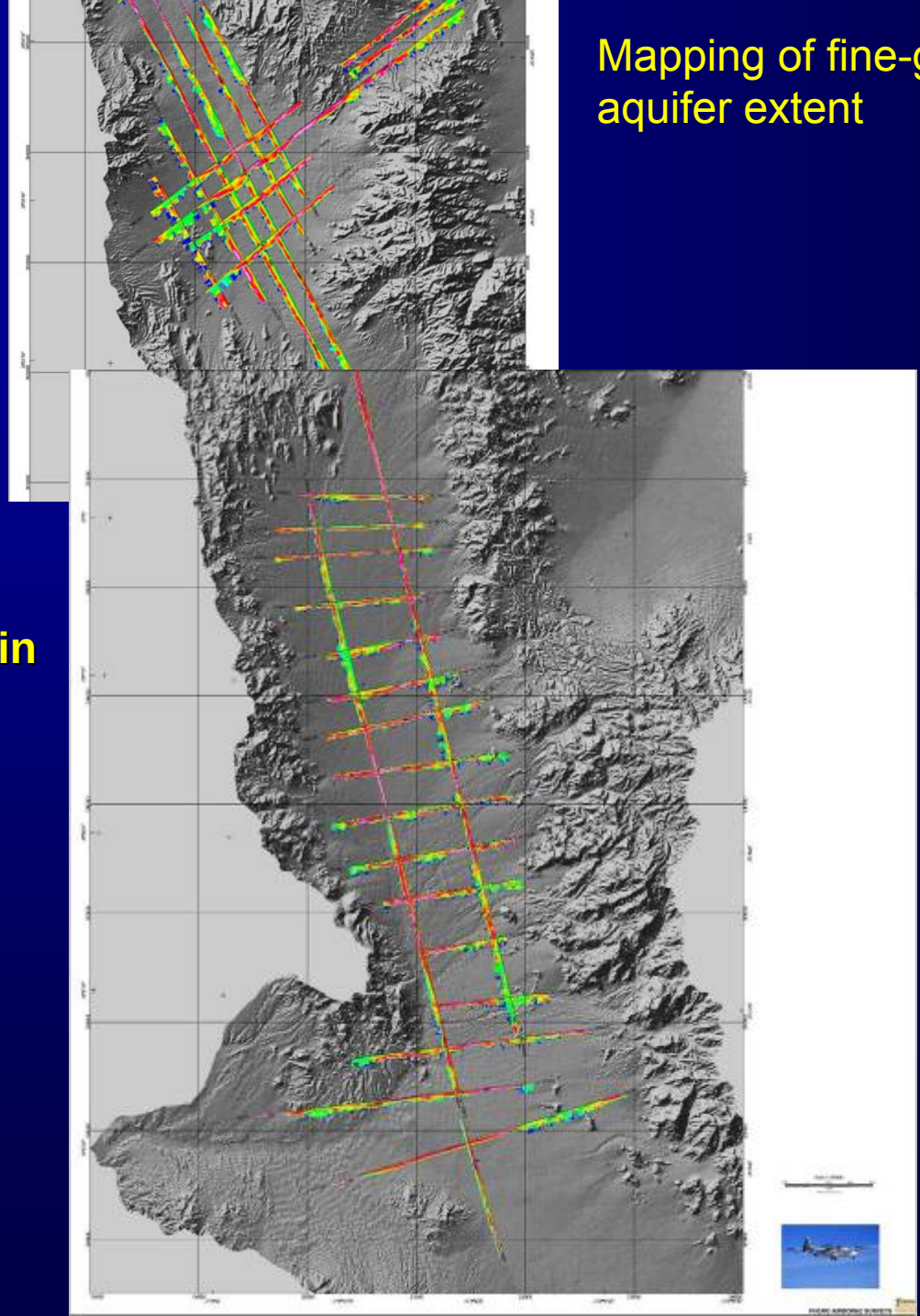
Detrital Basin

Hualapai Basin

Sacramento Basin

USGS

Mapping of fine-grained units and aquifer extent



Sacramento Basin

Middle San Pedro

Willcox and Douglas Basins

SUMMARY

- Understanding the alluvial basin hydrology is key to answering some basic questions such as:
  - How much water do we have?
  - Are we running out of water?
  - Where are the resources stressed?
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•A better understanding of basin hydrology will provide us a better chance at predicting consequences of development

•Better equipped water managers and decision maker for development decisions