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Inyo County, California
Regional Ground Water Monitoring Program and Ground Water Issues

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From models to performance assessment; the conceptualization problem:

Ground Water, 2003, v. 41. p.571-577.

The conceptual model is an *a priori* decision made by the analyst.

- Modelers regard our conceptual models as immutable.

- Time and again errors in prediction revolve around a poor choice of the conceptual model.

- More often than not, data will fit more than one conceptual model equally well.

- Good calibration does not ensure a correct conceptual model.

- Probabilistic sampling of the parameter sets does not compensate for uncertainties in what are the appropriate conceptual models, or for wrong or incomplete models.

Discussion of the paper with ***Shlomo Neuman***

What to do about the conceptual problem—one idea is to imagine all possible conceptual models and then select among them (***Shlomo's idea***)

SURPRISE—*surprise* is the collection of new information that renders one's original conceptual model invalid

EXAMPLES—Geology: Plate Tectonics
WIPP, Yucca Mountain

PROTOTYPE	MODELER	SURPRISE
Coachella Valley	Swain—post asudit	yes
HYDROCOIN	Konikow—post audit	yes
Los Angeles—MTBE	Bredehoeft	yes
Ontario Uranium tailing	Flavelle—post audit	yes
Summitville	Bredehoeft	yes
WIPP	DOE	yes
Yucca Mountain	DOE	yes
Other model studies	22	no (3?)
	29 studies	7 yes (3?)

- 20-30% of conceptual models in my small sample were shown to be invalid

- How frequently are conceptual models wrong?
  Post Audits suggest 20-30% of the time

- Groundwater Hydrologists have trouble selecting the appropriate conceptual models

Shlomo Neuman (personal communication)—

Yet no matter how large the supporting database may be, there always is a possibility that new observations and experimental data become available which the existing theory (or model) can neither reproduce nor explain….

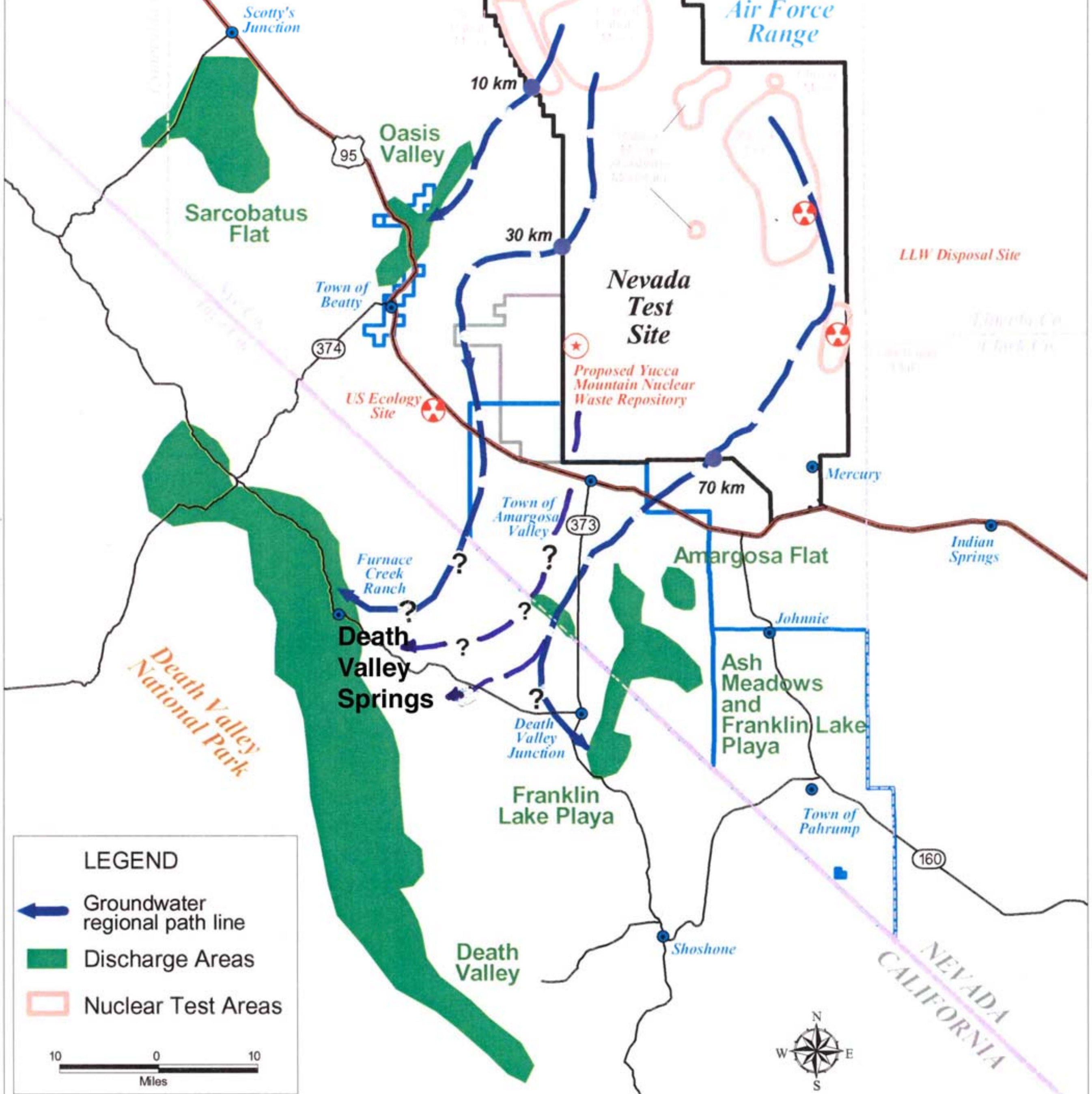
Introduces Additional Uncertainty into Modeling
Unaccounted for by PA

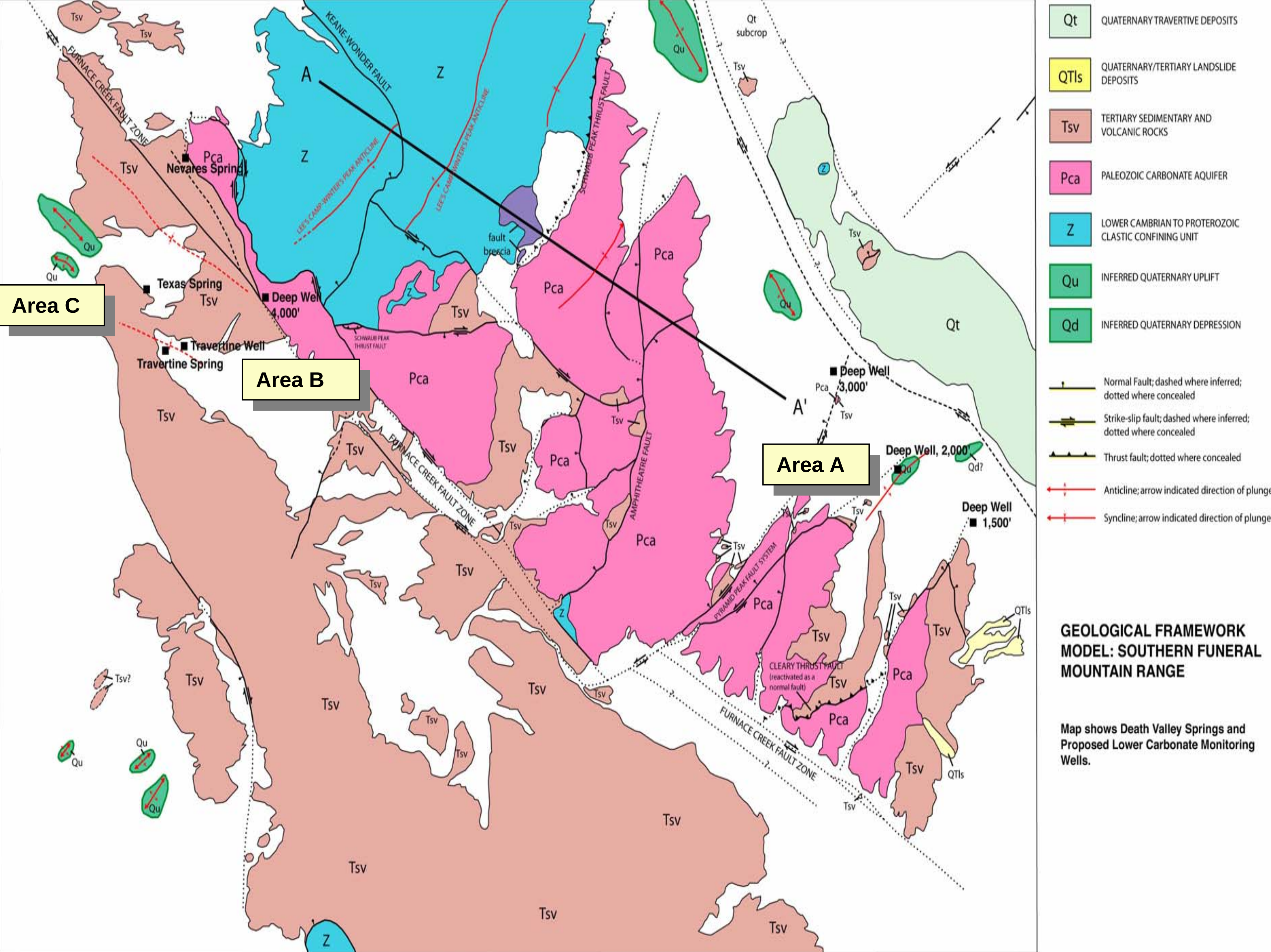
Inyo County Concerns

- Radioactive nuclide transport through the LCA into the Death Valley springs.

- Degradation of the upper gradient in the LCA impact on Furnace Creek spring flows, and on the potential of inducing radioactive nuclide transport from Yucca Mountain.

Statement of Problem

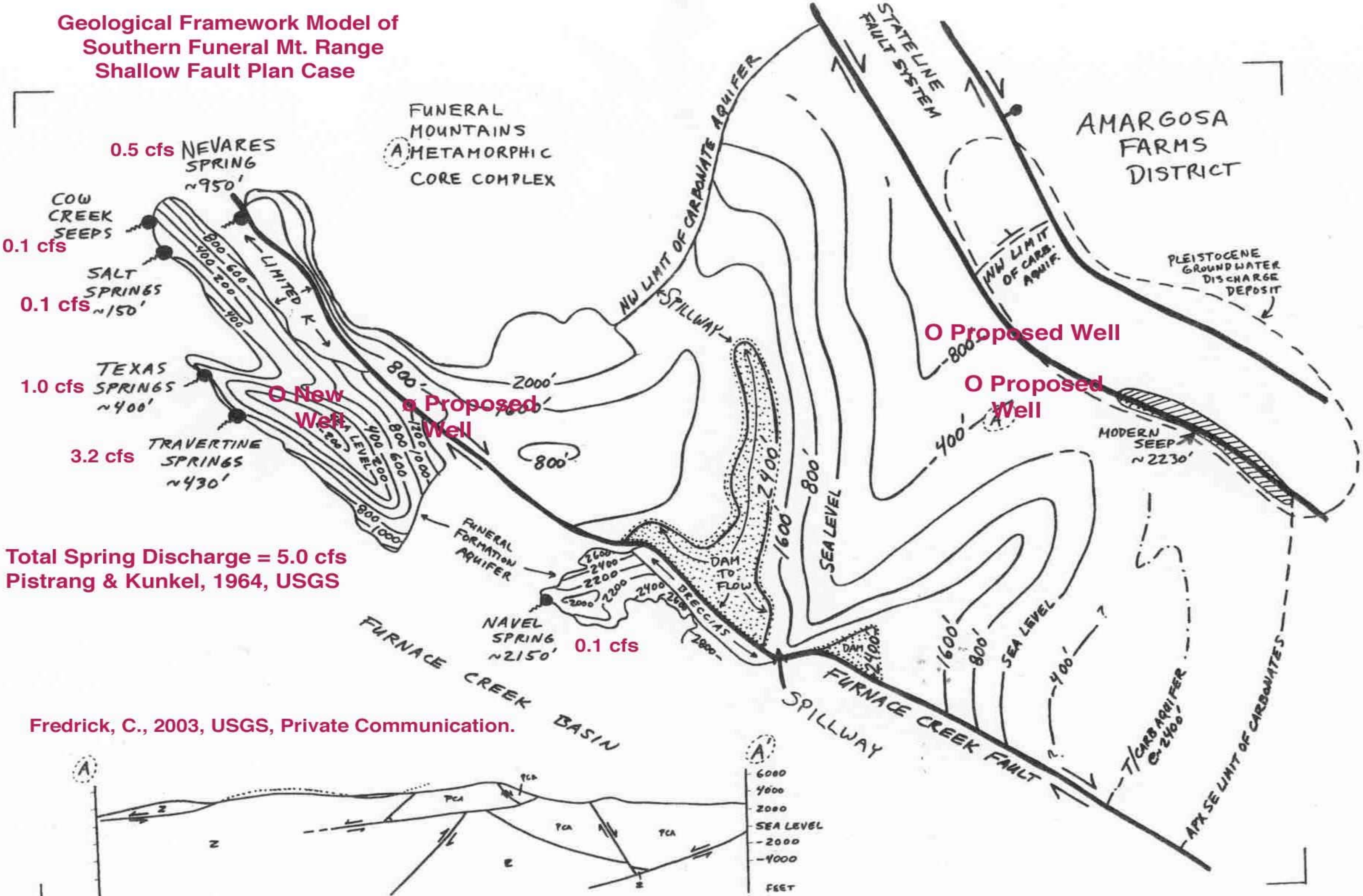




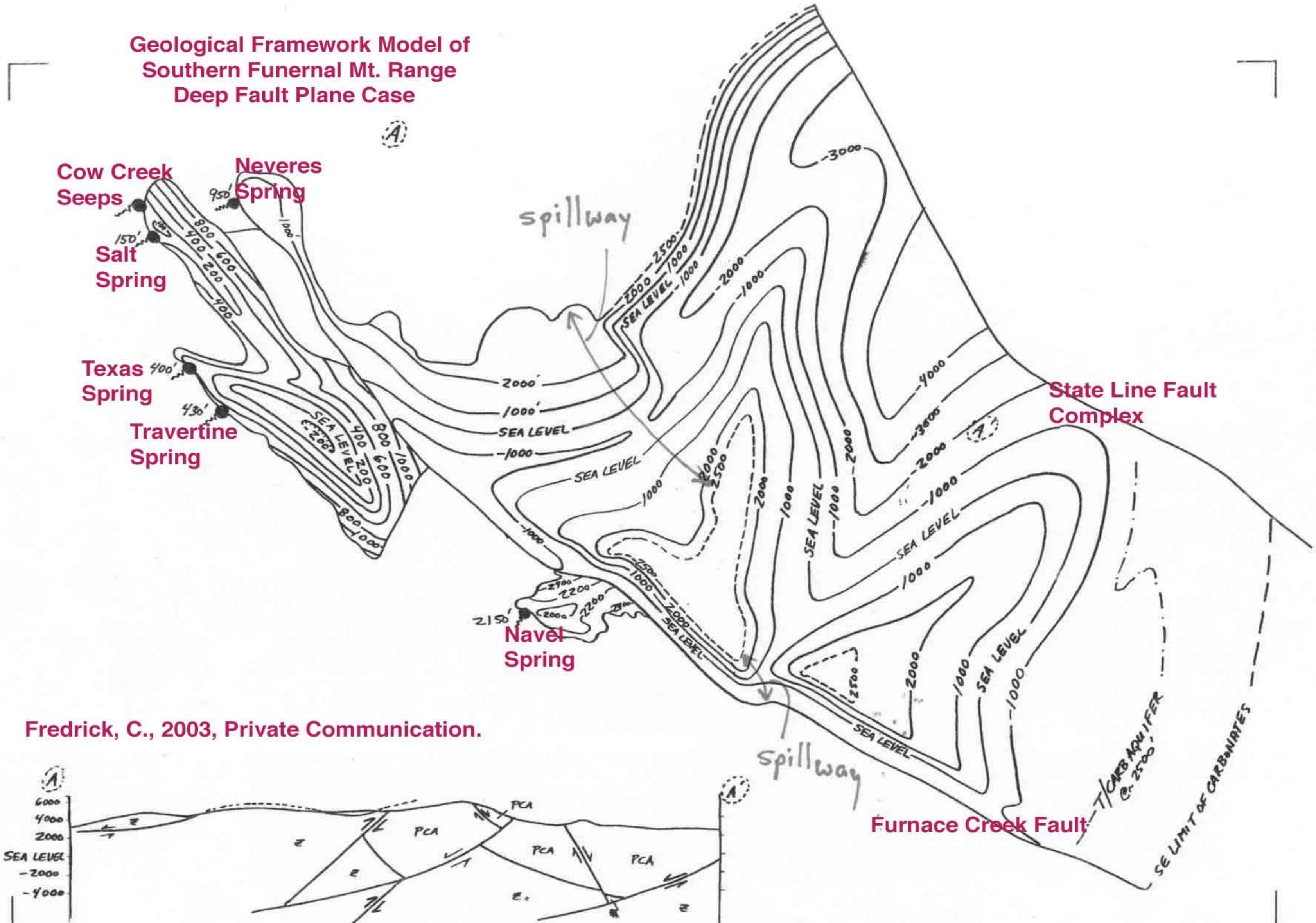
GEOLOGICAL FRAMEWORK MODEL: SOUTHERN FUNERAL MOUNTAIN RANGE

Map shows Death Valley Springs and Proposed Lower Carbonate Monitoring Wells.

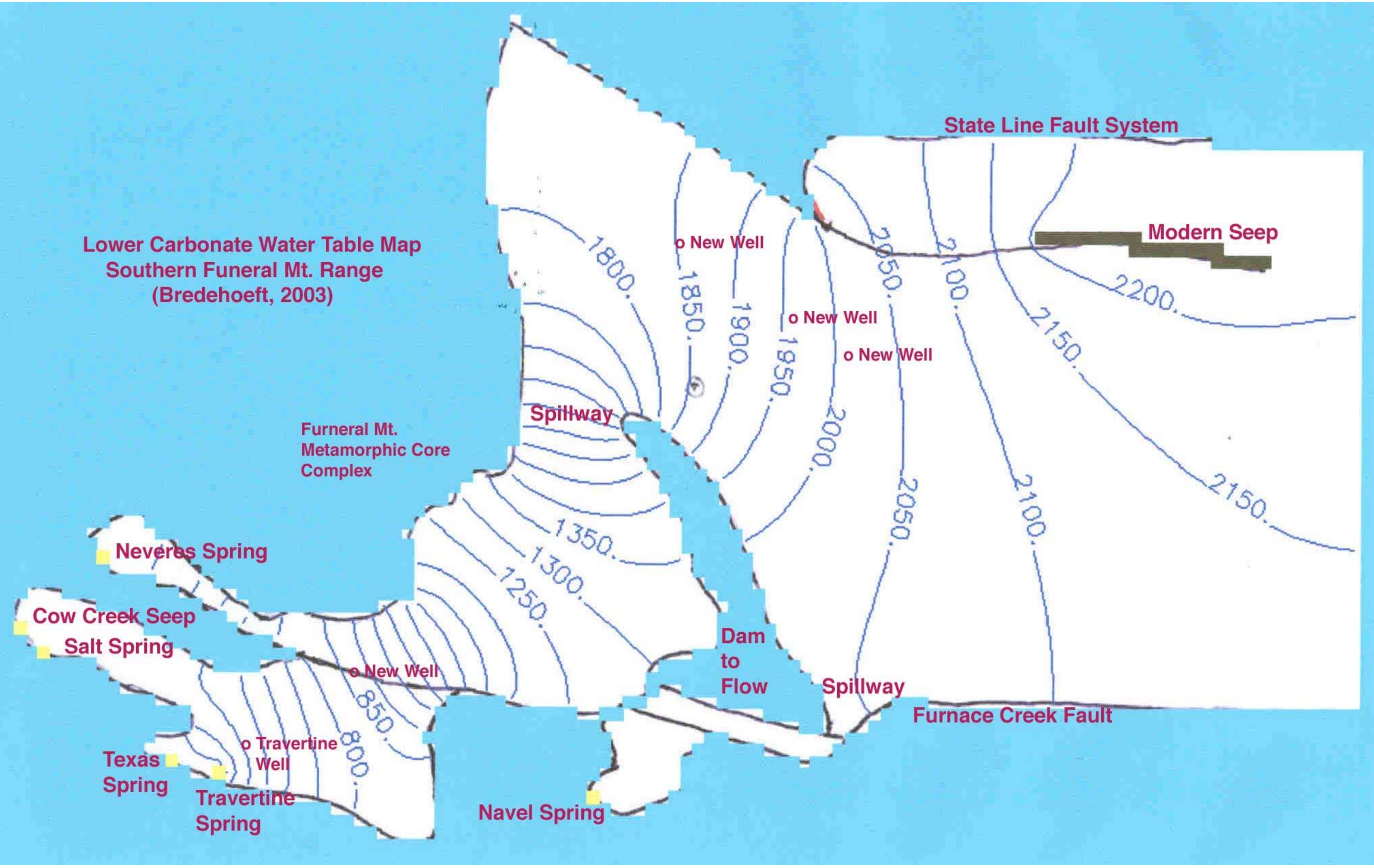
Geological Framework Model of Southern Funeral Mt. Range Shallow Fault Plan Case



Spillway model, version 1: Structure contour map drawn on the base of the Paleozoic carbonate aquifer (northeast of the Furnace Creek fault) and the Funeral Formation alluvial aquifer (southwest of the Furnace Creek fault). Note the two spillways in the central part of the southern Funeral Mountains. In this bounding case, the thickness of the aquifer at the spillways is minimized.



Spillway model, version 2: same as figure 4, except that this is a bounding case in which the thickness of the aquifer at the spillways is maximized.



Lower Carbonate Water Table Map
Southern Funeral Mt. Range
(Bredehoeft, 2003)
State Line Fault System
Modern Seep
o New Well
o New Well
o New Well
1800
1850
1900
1950
2000
2050
2100
2150
2200
2050
2100
2150
Spillway
Furneral Mt.
Metamorphic Core
Complex
1350
1300
1250
Neveres Spring
Cow Creek Seep
Salt Spring
o New Well
850
800
Dam
to
Flow
Spillway
Furnace Creek Fault
o Travertine
Well
Texas
Spring
Travertine
Spring
Navel Spring

Results of Modeling

- Shallow fault system unrealistic: water table below bottom of shallow carbonate fault.
- Model reproduced spring flows accurately.
- Resulting transmissivity of 0.2 ft^2/sec.
- Model insensitive to Furnace Creek Fault.

Inyo County's Main Issues

- A LCA ground water flow path most likely exists thru the Southern Funeral Mt. Range.

- Maintenance of upward gradient in LCA critical to supporting spring flows, and prevention of radioactive nuclide transport from Yucca Mt.
  - Very fragile hydraulic system in Southern Funeral Mt. Range.
  - A 50 foot change in hydraulic head would significantly impact Furnace Creek Springs.

Inyo County's Yucca Mountain Regional Groundwater Program

- Construct three (3) monitoring wells in LCA on eastside of Southern Funeral Mt. Range
- Construct Echo Canyon monitoring well in LCA in Death Valley National Park
- Constructed Travertine Spring monitoring well in Death Valley National Park
- Conduct a water balance analysis of Furnace Creek alluvial fan area to determine total discharge from major Furnace Creek springs