

LANL General Groundwater

Conceptual models of White Rock Canyon Springs

**Elizabeth Keating, Patrick Longmire
David Rogers**

**Earth and Environmental Sciences
Risk Reduction and Environmental Stewardship
Los Alamos National Laboratory**

**Groundwater Protection Program
Quarterly Meeting
October 25, 2004**

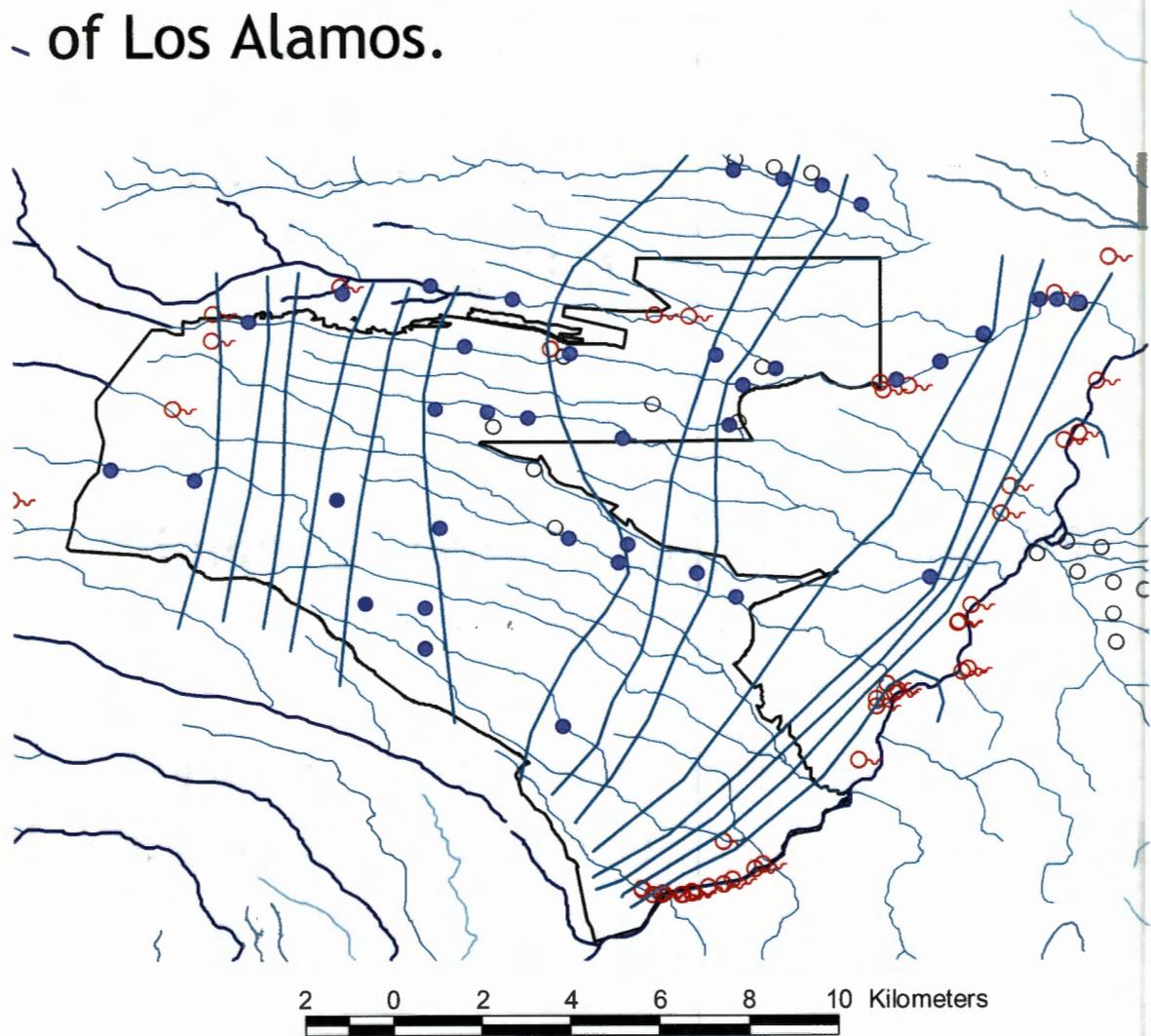


**Groundwater
Protection Program**



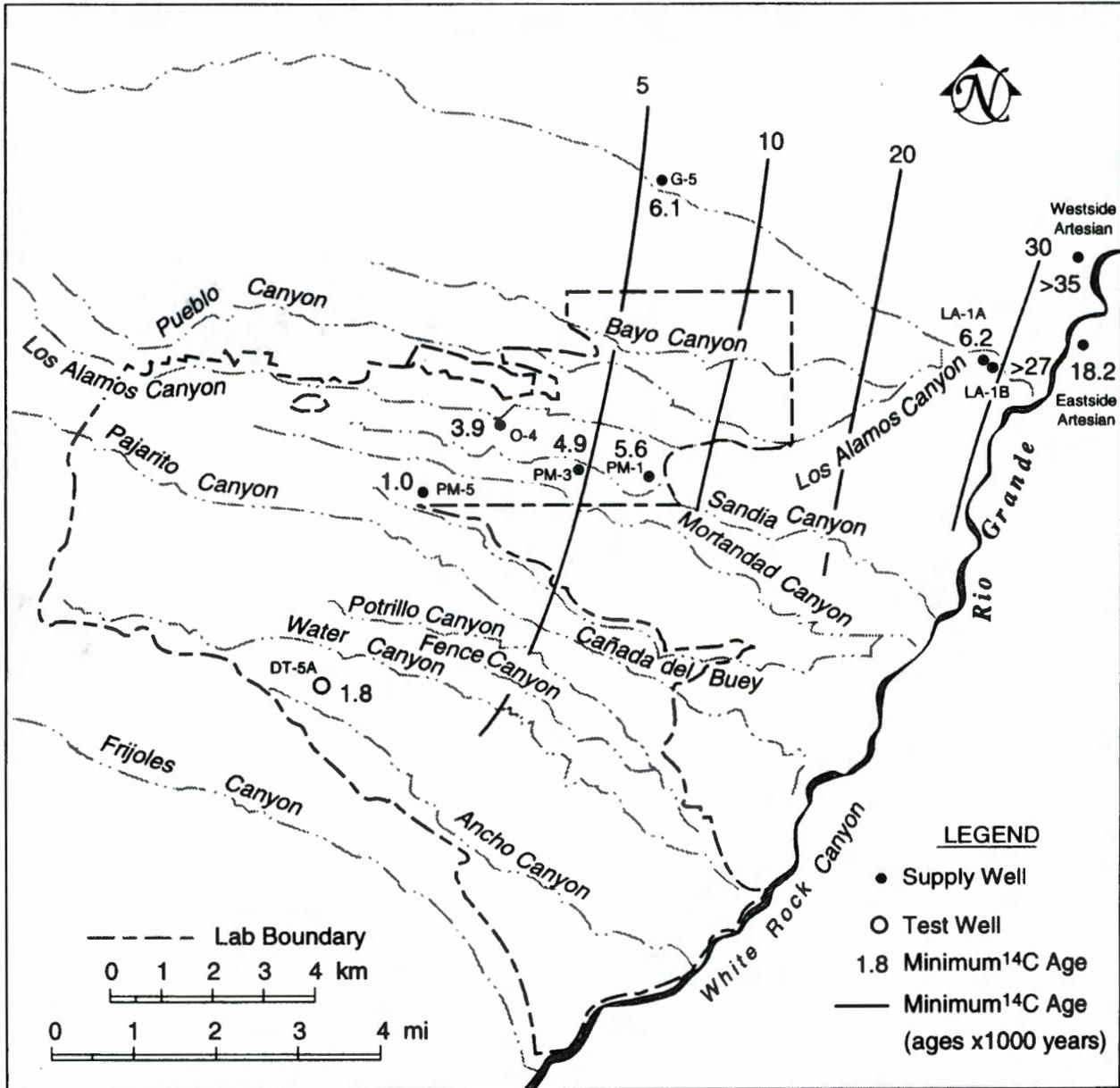
13879

Elevation contours of the top of the regional aquifer in the vicinity of Los Alamos.

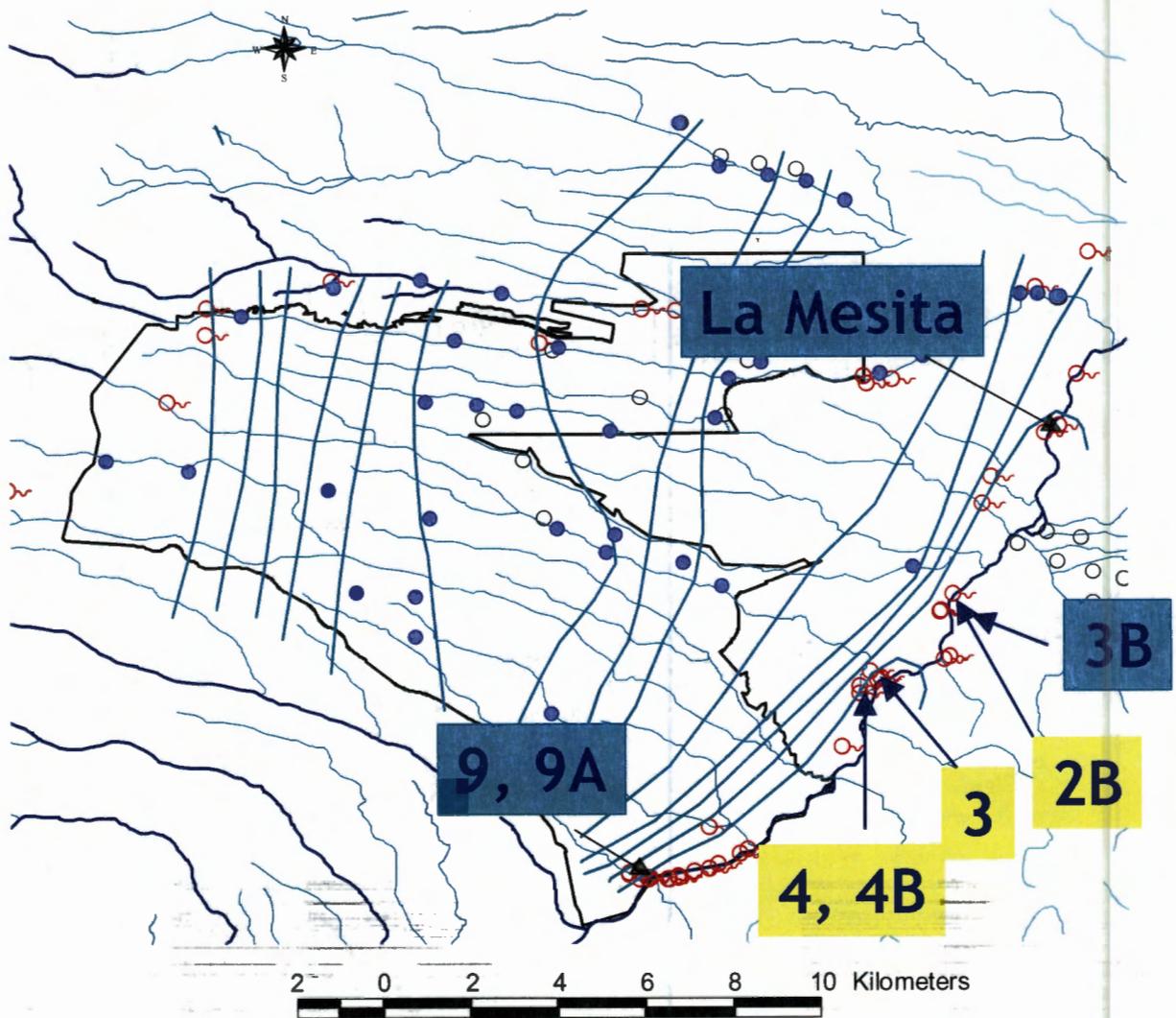


Due to extremely complex geology, the hydrologic relation between springs, nearby surface waters, perched and regional aquifers, and the Rio Grande is *unclear*

Carbon-14 age dates (Rogers et al., 1996)

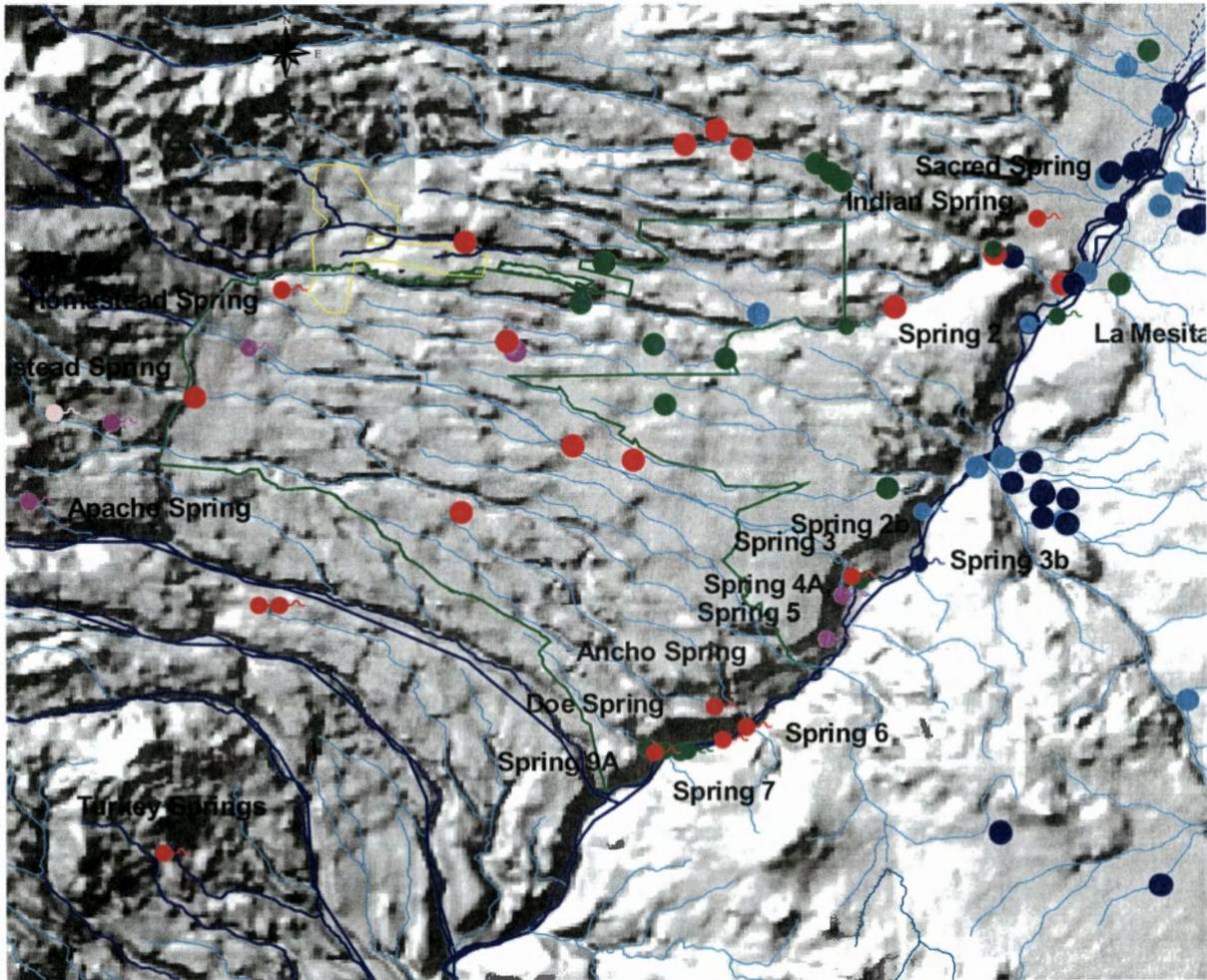


^{14}C data (Rogers et al., 1995) and oxygen isotope data (Anderholm, 1994) suggests that some groundwater waters near the Rio Grande are tens of thousands of years old.



^3H data

- some springs are mostly or entirely young (< 60 years) water
- some springs are older (100 – 1000's of years old?)

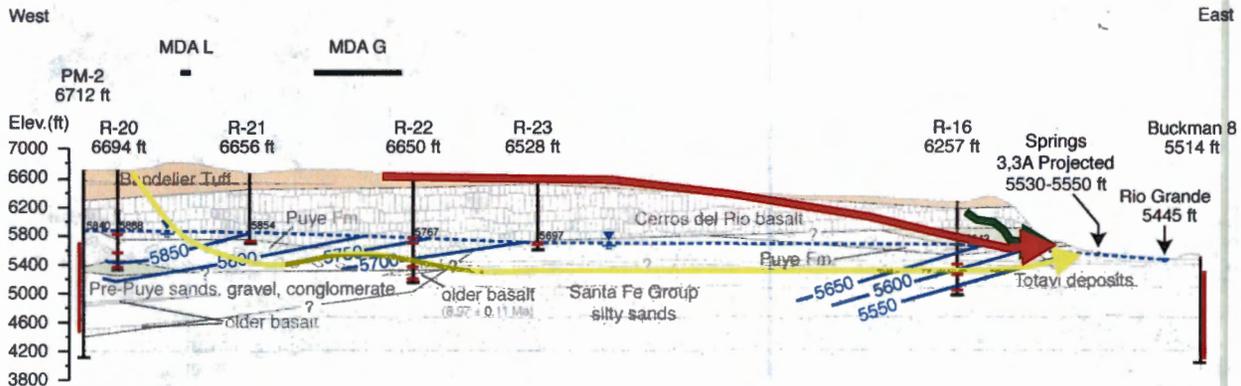


5 0 5 10 15 Kilometers

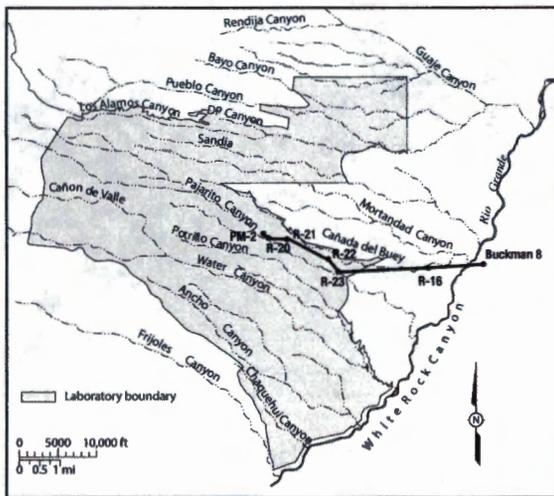
- TDS
- 0 - 100
 - 100 - 150
 - 150 - 200
 - 200 - 300
 - 300 - 400
 - 400 - 5000

Total dissolved solids (mg/l)

How do you bring young water to a spring?



Dave Broxton

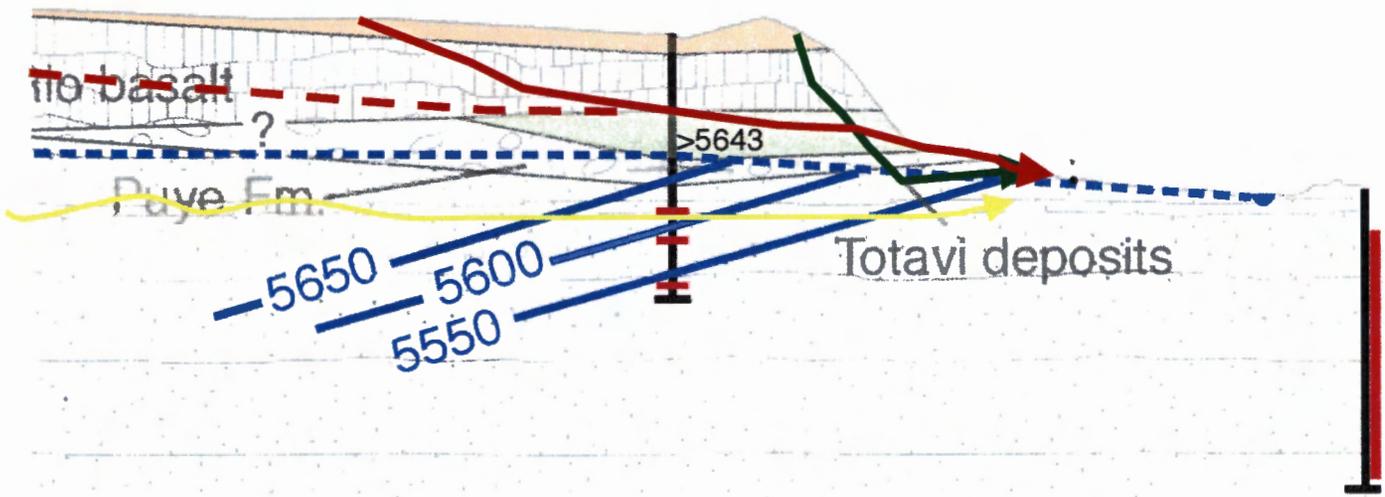


- 1
- 2
- 3

Surface waters and alluvial aquifers are *known* fast pathways

Fast pathways in the regional aquifer have *not* been established

(they certainly may exist)



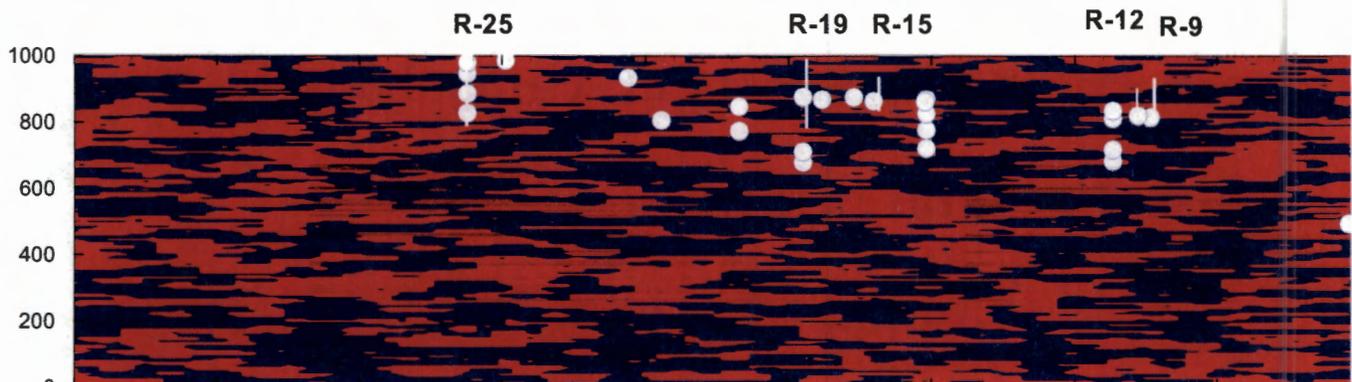
-  Fast pathway in regional aquifer
-  Short pathway
-  Fast pathway in perched aquifer

In 2002, we presented modeling results for the regional aquifer system *alone*, with a focus on the deeper (water supply wells) portion of the aquifer. This was not a contaminant transport study, and there was no attempt to represent possible fast pathways

Calculating travel times in the regional aquifer

- high permeability
- low permeability

Conceptual model 1: both high and low permeability layers exist. Use pump test data, well logs and outcrop measurements to determine spatial relationships

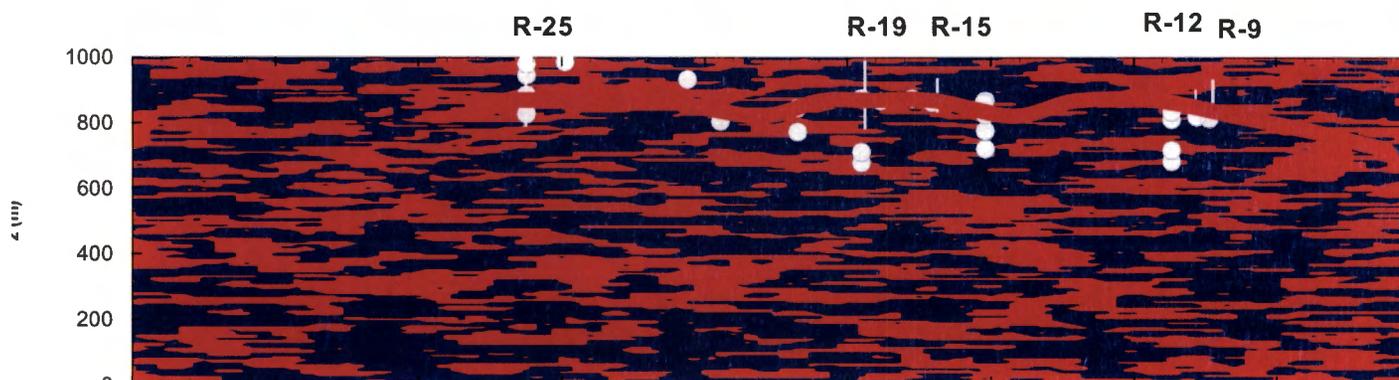


Resulting travel times tend to be slow

Calculating travel times in the regional aquifer

- high permeability
- low permeability

Conceptual model 2: both high and low permeability layers exist, but we assume there are hypothetical continuous fast pathways



Resulting travel times tend to be fast

Overview

- We agree with these conclusions of the Rice report:
 - It is *possible* for groundwater to be part of a larger transport system that brings solutes from LANL to the Rio Grande in less than 60 years
 - It is *possible* that LANL-derived contaminants are in some White Rock Canyon Springs

Overview

- Based on geologic and hydrologic characteristics of the alluvial, perched, and regional aquifer, as well as contaminant distributions
 - the most likely “fast pathways” from LANL to the Rio Grande exist in surface waters and alluvial aquifers;
 - fast pathways (high permeability zones in the regional aquifer) are unlikely to transport large fluxes of contaminants within the regional aquifer great distances

Overview

- Contaminant transport modeling is currently focused on Pajarito Plateau water supply wells, which are at the highest risk.
- Unlike the Buckman well capture zone study (Vesselinov et al., 2002), which was not a contaminant transport study, these studies consider both slow and fast pathways in detail.

If there are fast pathways that are capable of transporting contaminants quickly (over large distances) to springs in White Rock Canyon, what should we do?

- Contaminant source control (outfalls)
- Monitor alluvial, perched, and regional aquifer systems
- Continue to improve our understanding of the hydrogeology of the site
 - Geologic characterization
 - Tracer studies
 - (TW-8, R-14)
 - ^3H /Helium dating of young groundwaters
- What else?