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Regional Hydrology of the Nopal I Site, Sierra Peña Blanca, Chihuahua, Mexico

Geological Society of America

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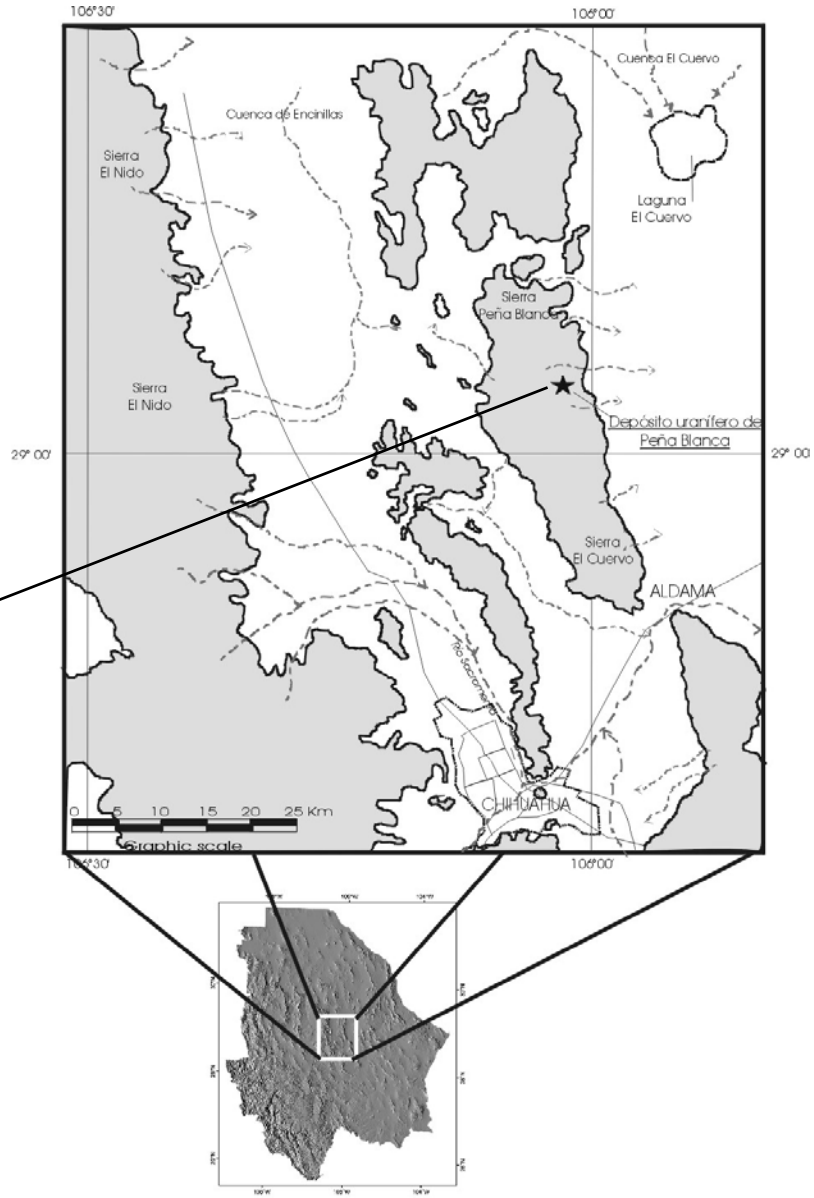
Objectives

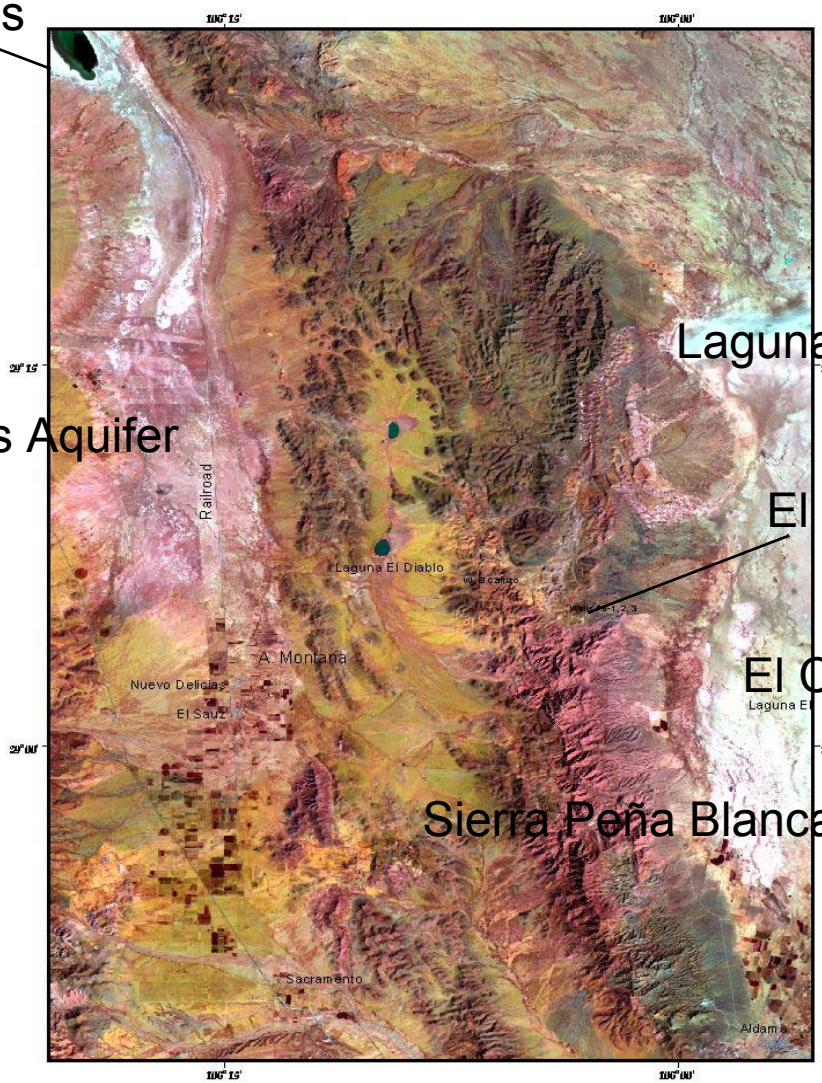
- Determine the main source of the groundwater (GW) found within the DOE wells (PB-1, PB-2, and PB-3)
- Determine whether the Nopal 1 GW has any relationship to the connectivity between the regional Encinillas Aquifer to the west and the El Cuervo Aquifer to the east.

Location Map

- **Study area**
  - **State of Chihuahua, northern Mexico**
  - **Peña Blanca Range is northern of city of Chihuahua**
  - **El Nopal 1 Site is located 50 km from the city of Chihuahua**



Main Physiographic Features



TM satellite image

Methodology

1. Thematic Mapper (TM) satellite image was prepared and used as a georeferenced map
2. Digital elevation model (DEM) coupled with TM image was used to create a 3-D views to visualize main geocharacteristics
3. Differential global positioning system (GPS) survey collected geodetic data from wellheads in the:
   - Encinillas Basin
   - El Cuervo Basin
   - El Nopal 1 Zone
4. Potentiometric survey in the three main groundwater systems
5. Analysis of historical potentiometric database
6. Geographic information system was initiated

Initial Data

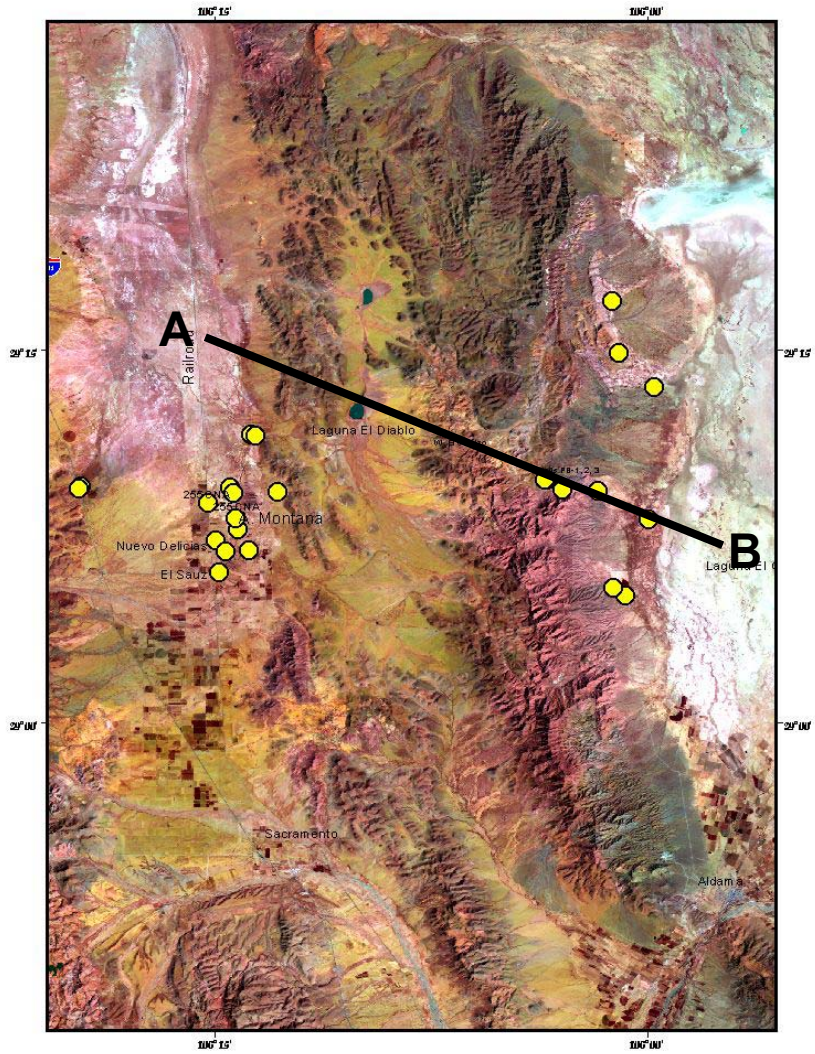
- El Nopal 1, uranium mineralized body, is located at the Peña Blanca Range, in Chihuahua, MX. The adit has a mean elevation value of 1463 m.
  - To the East is located the Encinillas Basin
    - ground mean elevation ≈ 1560 m
  - To the West is located the El Cuervo Basin
    - ground mean elevation ≈ 1230 m

Topo difference 330 m

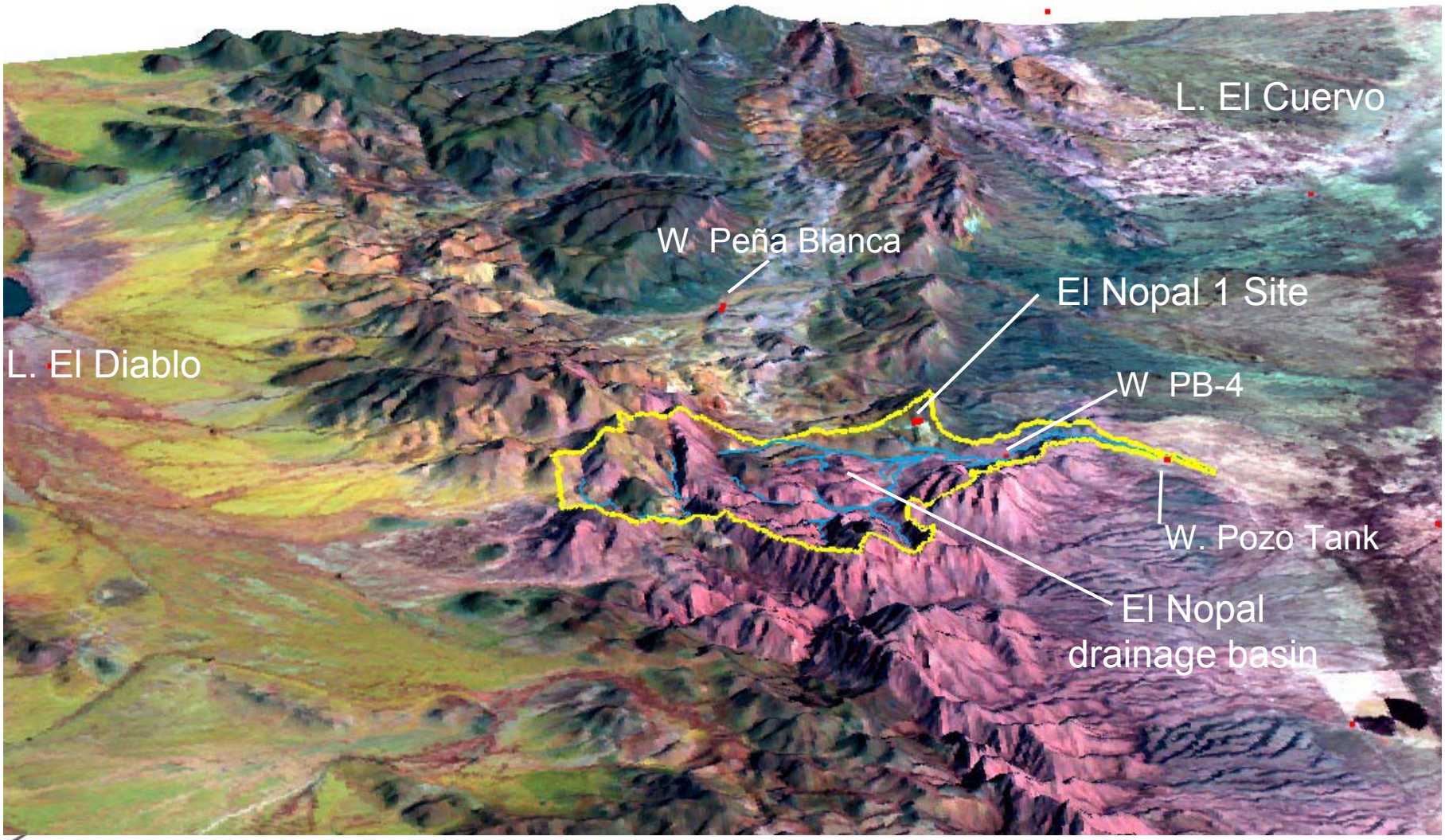
- In 2003, the US-DOE sponsored the drilling of three deep wells at the Nopal 1 Site
  - **Groundwater table was found between 1240 and 1242 m**
- Topography and geological structures imply a potential GW flow from West to East

Results

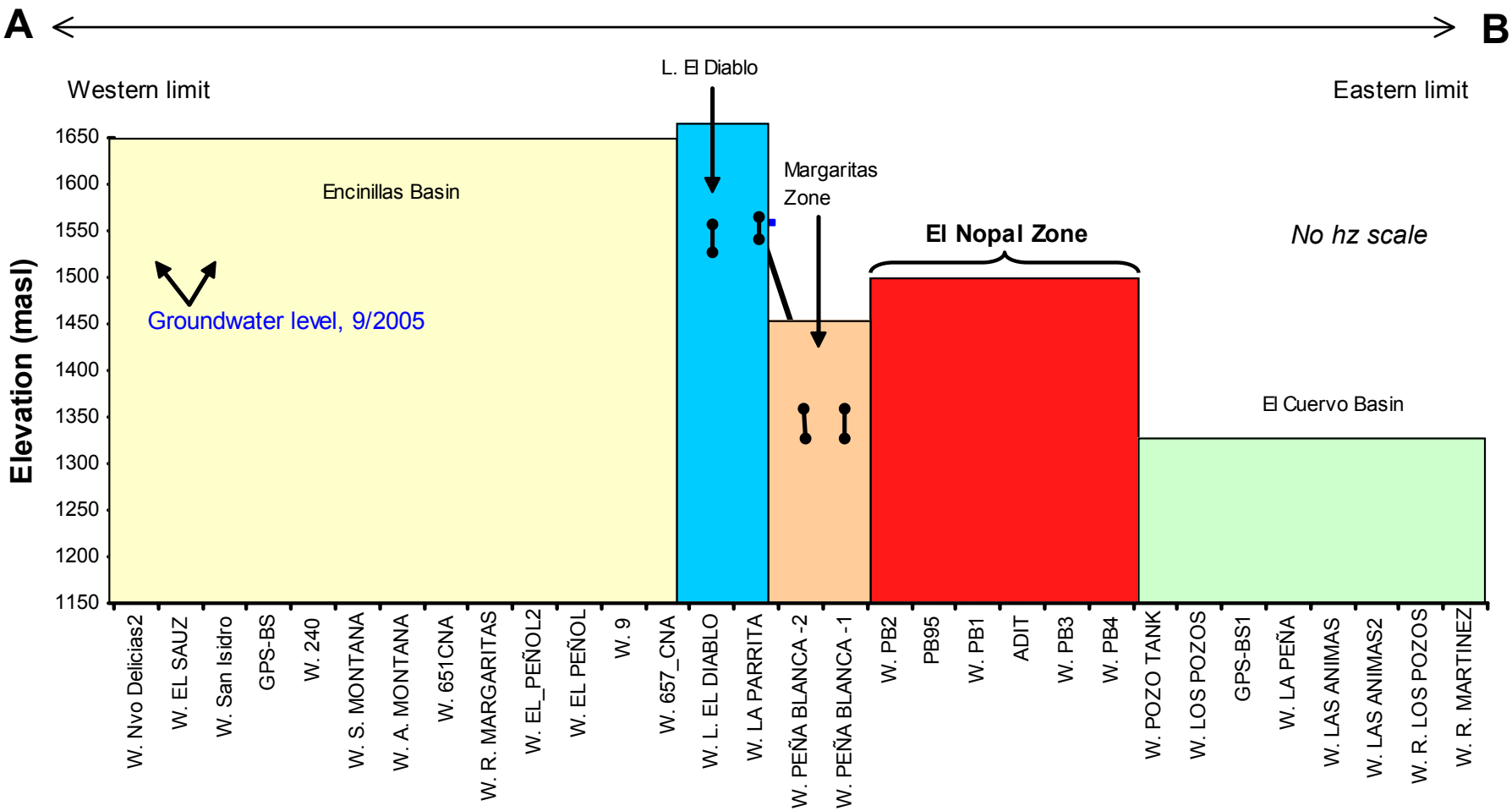
- Sampling points distribution at the study area
- A-B hydrogeologic profile



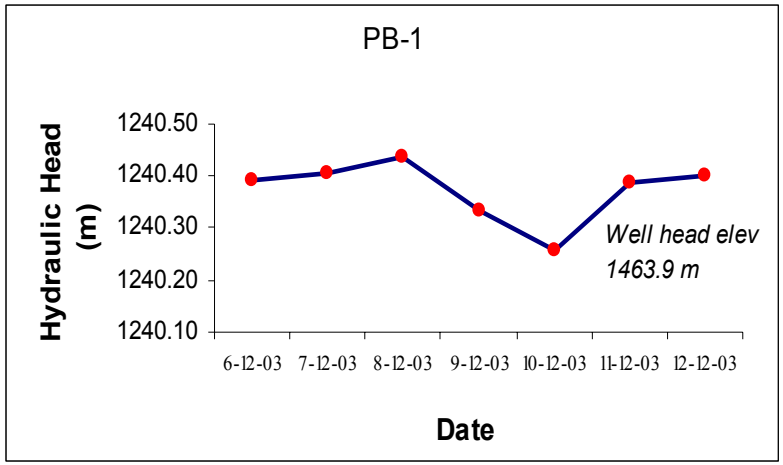
DEM-TM: S-N view of the study area

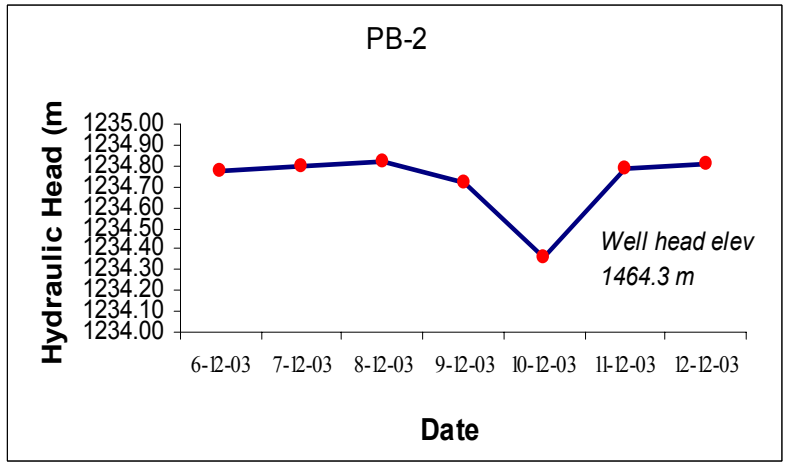


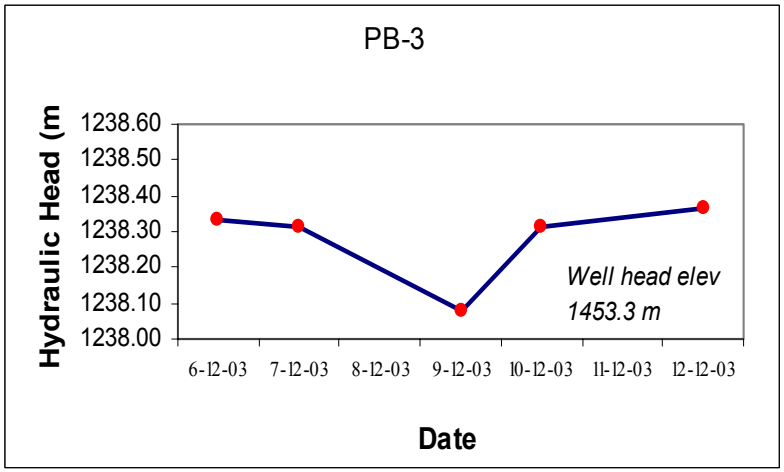
Topographic and GW profiles

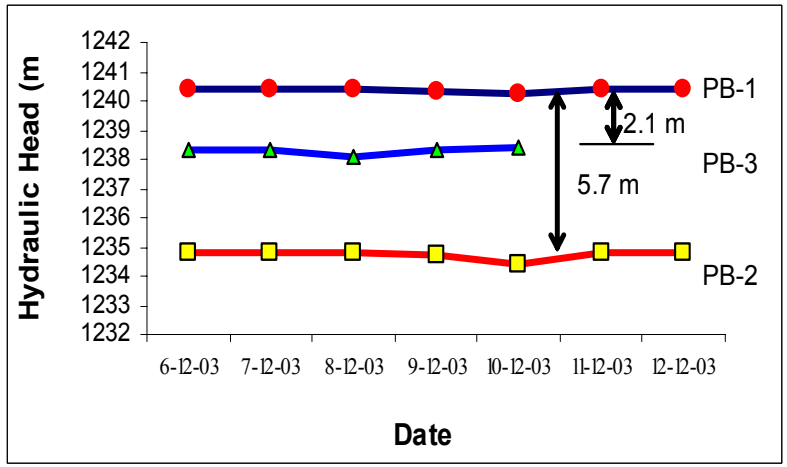


GW behavior in PB wells









Conclusions

- The regional potentiometric surface indicates a groundwater flow from West to East
  - El Cuervo Basin appears to be the discharge zone for the regional groundwater flow system
- However, the groundwater level beneath the Nopal I site is in accordance with the water table of the El Cuervo Basin rather than that of the Encinillas, the El Diablo or the Peña Blanca wells zone.
  - This indicates that there is a limited groundwater flow between the GW out of the Nopal Drainage Basin and the Nopal I Site
- The main source of GW found under the Nopal 1 Site might be rainwater that percolates through fractures and faults of the Peña Blanca Range and more likely in the El Nopal Drainage Basin
  - This idea is also supported by a large difference of GW hydraulic head values in the PB wells
  - This GW is flowing toward the El Cuervo Aquifer.

Conclusions

- **The limited groundwater flow under the Nopal 1 also might limit the radionuclide movement**

Thanks

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