Groundwater Overdraft and Management

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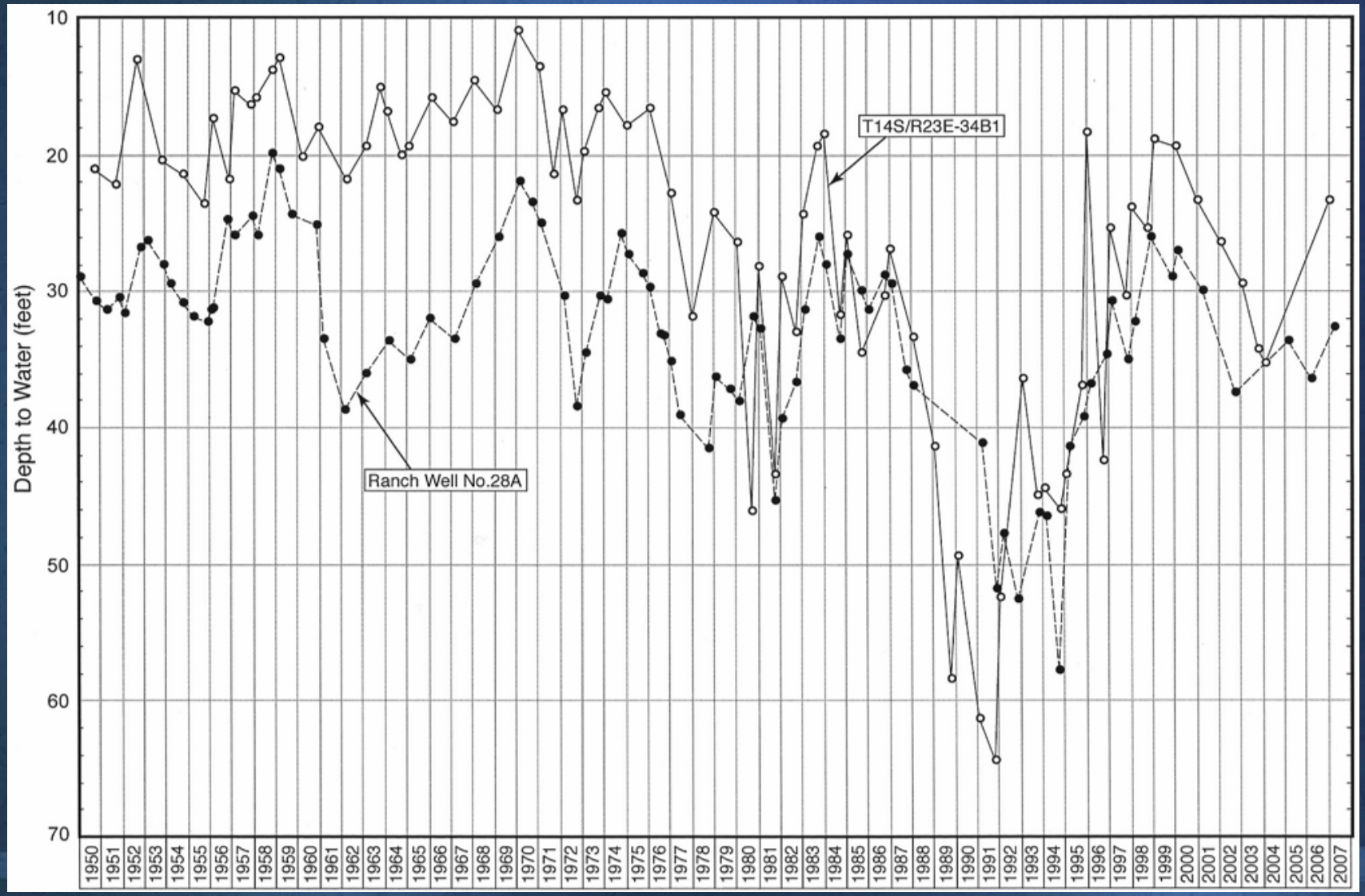
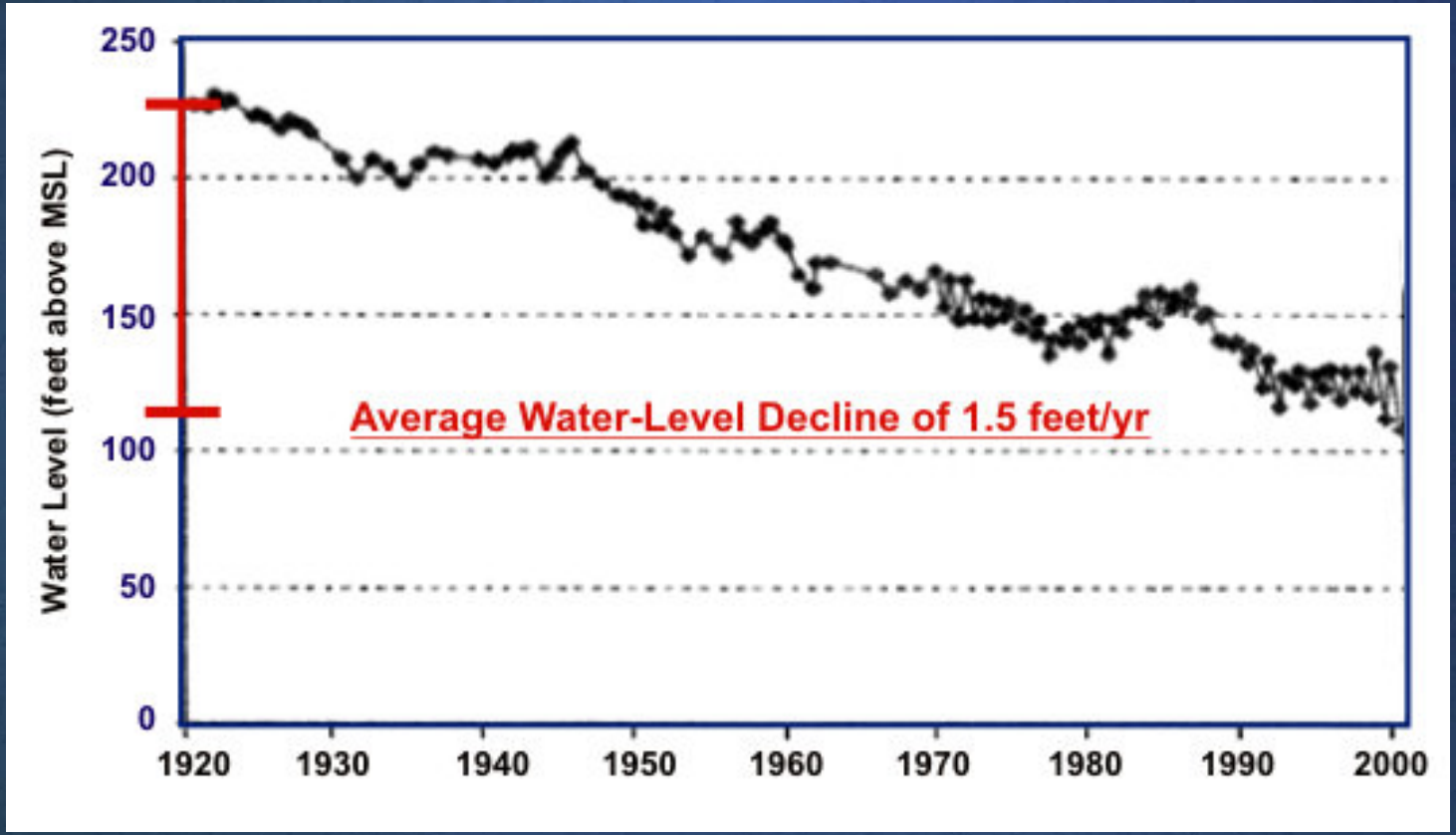
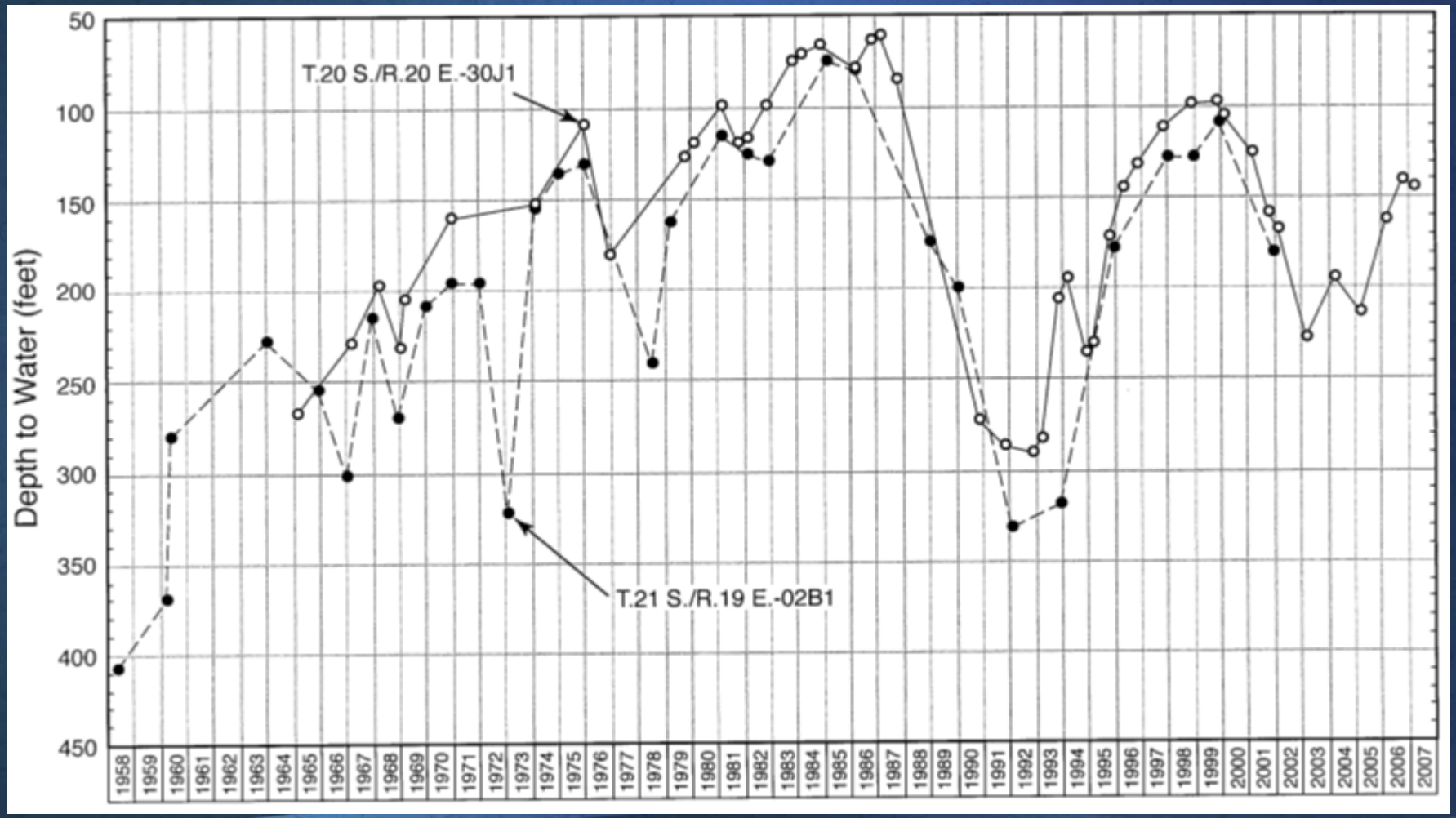
Water-Level Hydrographs for Wells East of Sanger



Water-Level Hydrographs for Well Southwest of Madera



Water-Level Hydrographs for Lower Aquifer Wells in the Lakeside Area



Water Budget for Groundwater

Sources of Inflow	Amount (AF/yr)
Streamflow Seepage	_____
Canal Seepage	_____
Deep Percolation from Irrigation	_____
Groundwater Inflow	_____
Intentional Recharge	_____
Subtotal:	_____

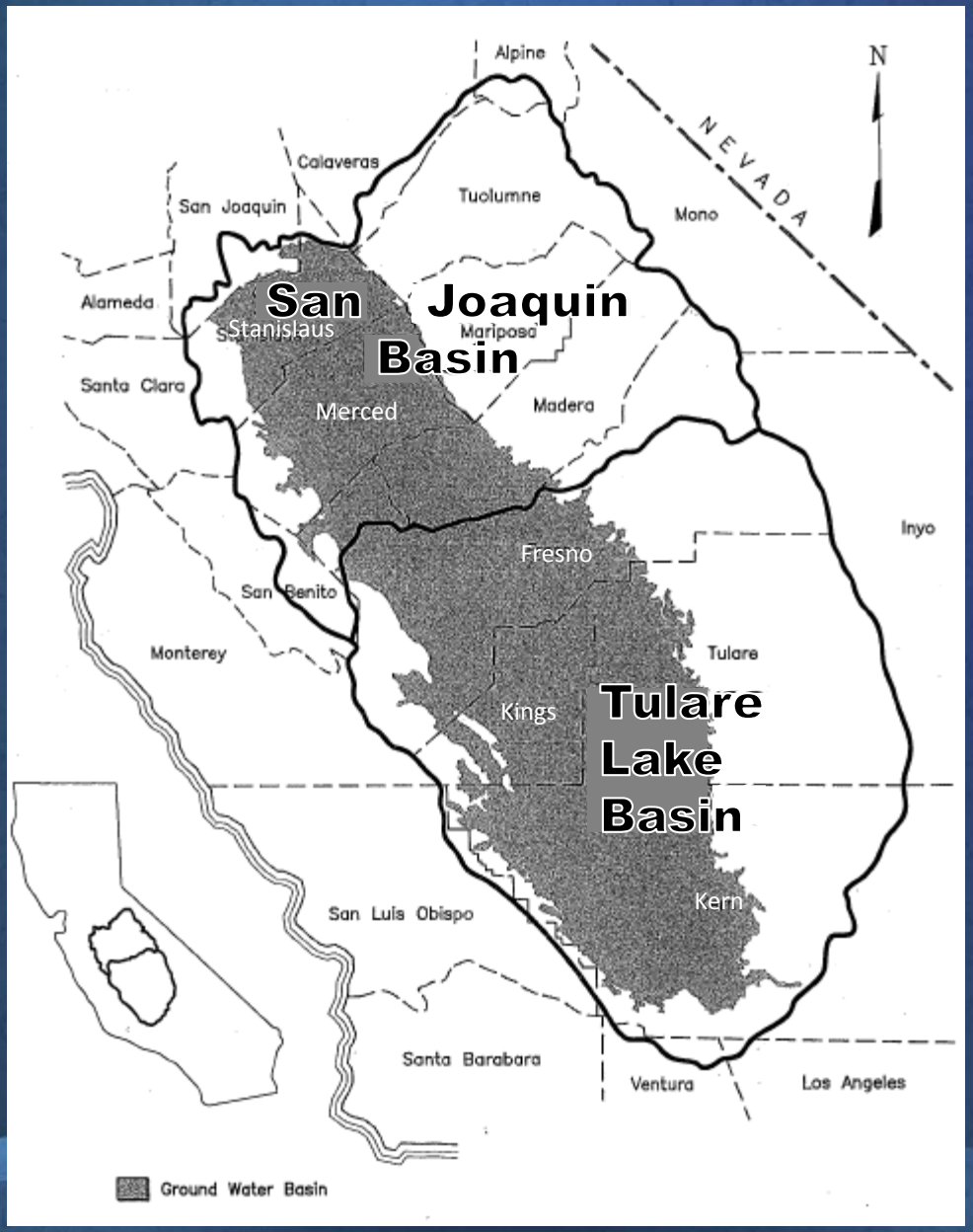
Sources of Outflow	Amount (AF/yr)
Pumpage	_____
Groundwater Outflow	_____
Subtotal:	_____

Change in Storage: Inflow minus Outflow = _____

Change in Storage Based on Water Levels

- **Water-level change (ft/yr) × specific yield (%) × Area = _____ (AF/yr)**
- **Specific yields commonly range from 10 to 20%**
- **For unconfined aquifers only.**

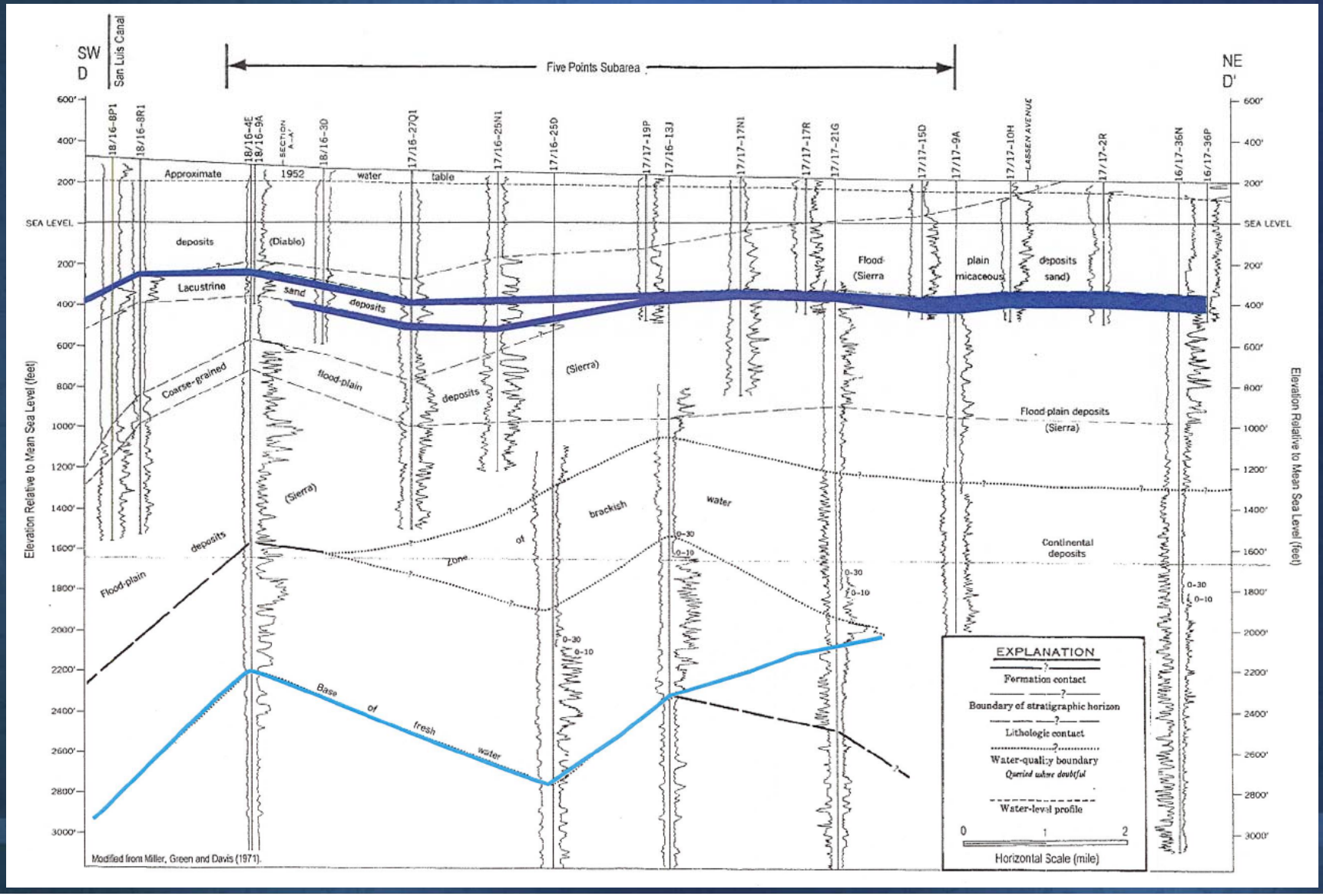
San Joaquin Valley Hydrologic Study Areas



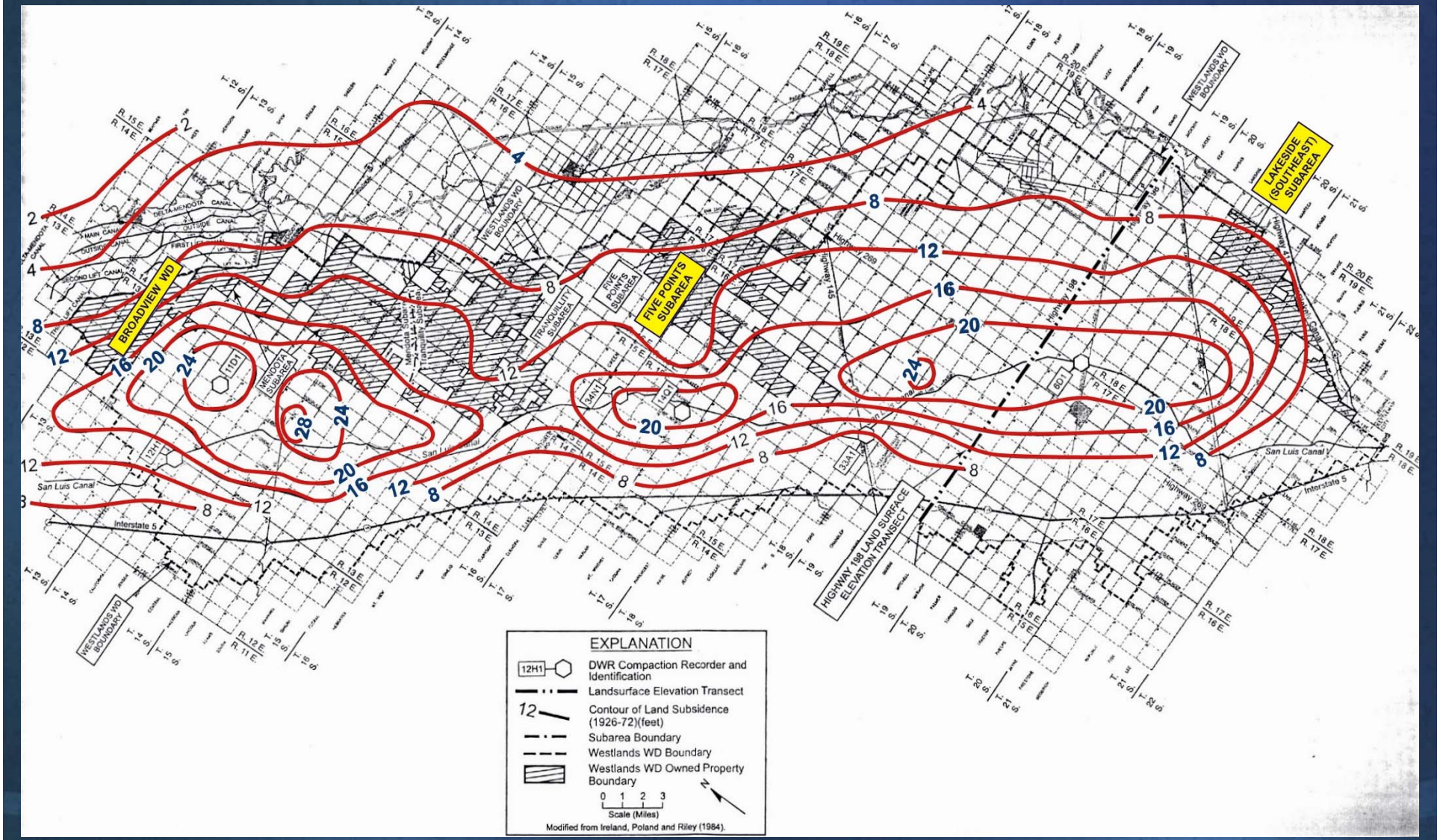
Estimates of Groundwater Overdraft

Early 1970's	Basin 5D	2 million acre-feet per year
Projected 2000	Basin 5D	1.3 million acre-feet per year
2009 (USGS PP 1760)	Central Valley	1.3 million acre-feet per year
Present	San Joaquin Valley	1.5 to 2.0 million acre-feet per year

Subsurface Geologic Cross Section Beneath Five Points Subarea



Land Subsidence in the Westlands Water District (1926-1972)



Irrigation Efficiency

- $\frac{\text{Consumptive Use of Applied Water}}{\text{Applied Water}} = \_\_\_\_ \%$
- Low Values: 40 to 50%
- High Values: 90%

- Depends on topsoils and method of irrigation
- Commonly:
  - 80 to 90% for drip irrigation
  - 65 to 70% for sprinkler irrigation
  - 40 to 50% for furrow and basin irrigation

Impact of Different Irrigation Efficiencies

- **Low irrigation efficiencies in areas with surface water supplies resulted in large amounts of recharge of low salinity water, spread out over large areas.**

- **High irrigation efficiencies result in less recharge from irrigation and higher increases in salinity for the shallow groundwater.**

Sustainable Groundwater Pumpage

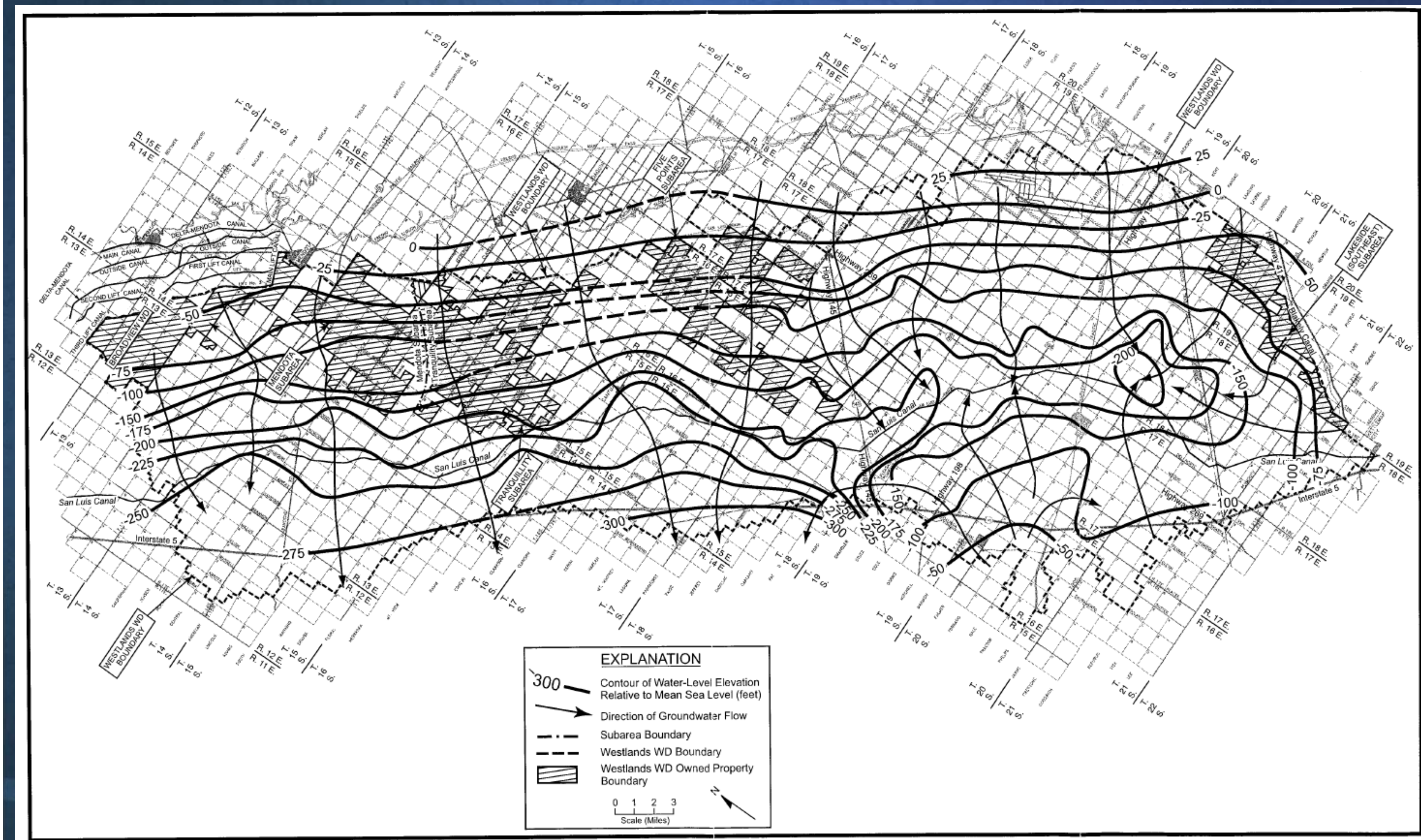
- Compare the amount of surface water available to the consumptive use of applied water.
- If the surface water is greater than the consumptive use, water levels will rise and there will normally be groundwater outflow.
- If the surface water is less than the consumptive use, water levels will fall and groundwater inflow will be enhanced.
- If the surface water and consumptive use are equal, groundwater levels will be stable.
- The groundwater aquifer should be considered a storage space for surface water, and not a source of water supply itself.

Sustainable Groundwater Pumpage

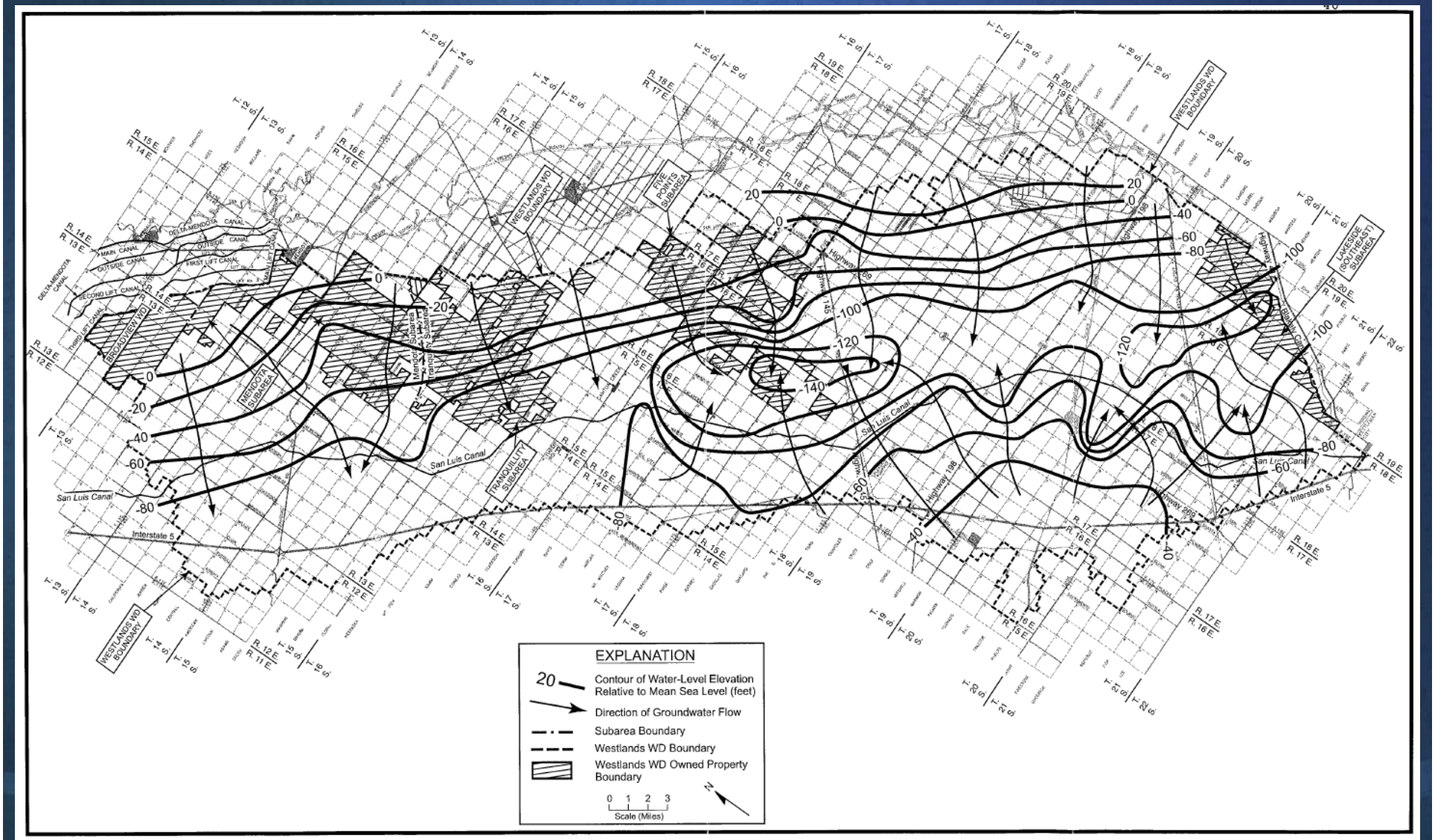
One interpretation:

- **If one has no surface water and is not next to a river that is a losing stream, then all of the groundwater pumpage is generally not sustainable.**
- **The only sustainable groundwater pumpage is where there is adequate surface water to balance the consumptive use, unless there is sustainable groundwater inflow to create a balance.**

Water-level Elevations in Lower Aquifer Wells in December 1965



Water-level Elevations in Lower Aquifer Wells in November-December 1993



Determining Groundwater Flow

Use Darcy's Law: Q = T I L

Q: amount of groundwater flow

T: transmissivity

I: hydraulic gradient

L: width of flow

"I" is determined from shallow and deep zone groundwater maps.

"T" is determined from aquifer tests.

Note: Groundwater modeling is not considered an accurate approach to determine transmissivity.