TOTAL SYSTEM PERFORMANCE ASSESSMENT
FOCUS TOPIC: DILUTION

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DOE ANALYSIS APPROACH

- Two Calculational Models (Stirred Tank and Advection-Dispersion) Used to Estimate Dilution Factor (DF)
- Stirred Tank Model
  - Mixing Zone: 50 m (Assumed)
  - Darcy Flux: 2 m/yr (Unpublished Report)
  - DF a Function of q_{uz}
- Advection-Dispersion
  - Line Source
  - Dispersivity-Scale Coefficients
  - DF Function of q_{uz} and Path Length

NRC/CNWRA ANALYSIS APPROACH

- Two Calculational Models (Same as TSPA-95) Used to Calculate DF Estimates
- Stirred Tank Model
  - Mixing (Fracture) Zone: 10 m Estimated from USGS Reports*
  - Darcy Flux: $0.1 \leq q_{sz} \leq 1.0$ m/yr Estimated from Field Data**
  - DF a Function of q_{uz} (TSPA-95 and IPA Phase 2 Values)
- Advection-Dispersion Model
  - Line Source (Same as TSPA-95)
  - Constant Dispersivities ($5\ km$: $\alpha_T = 10m$; $30\ km$: $\alpha_T = 60\ m$)
  - DF Function of q_{uz} and path length

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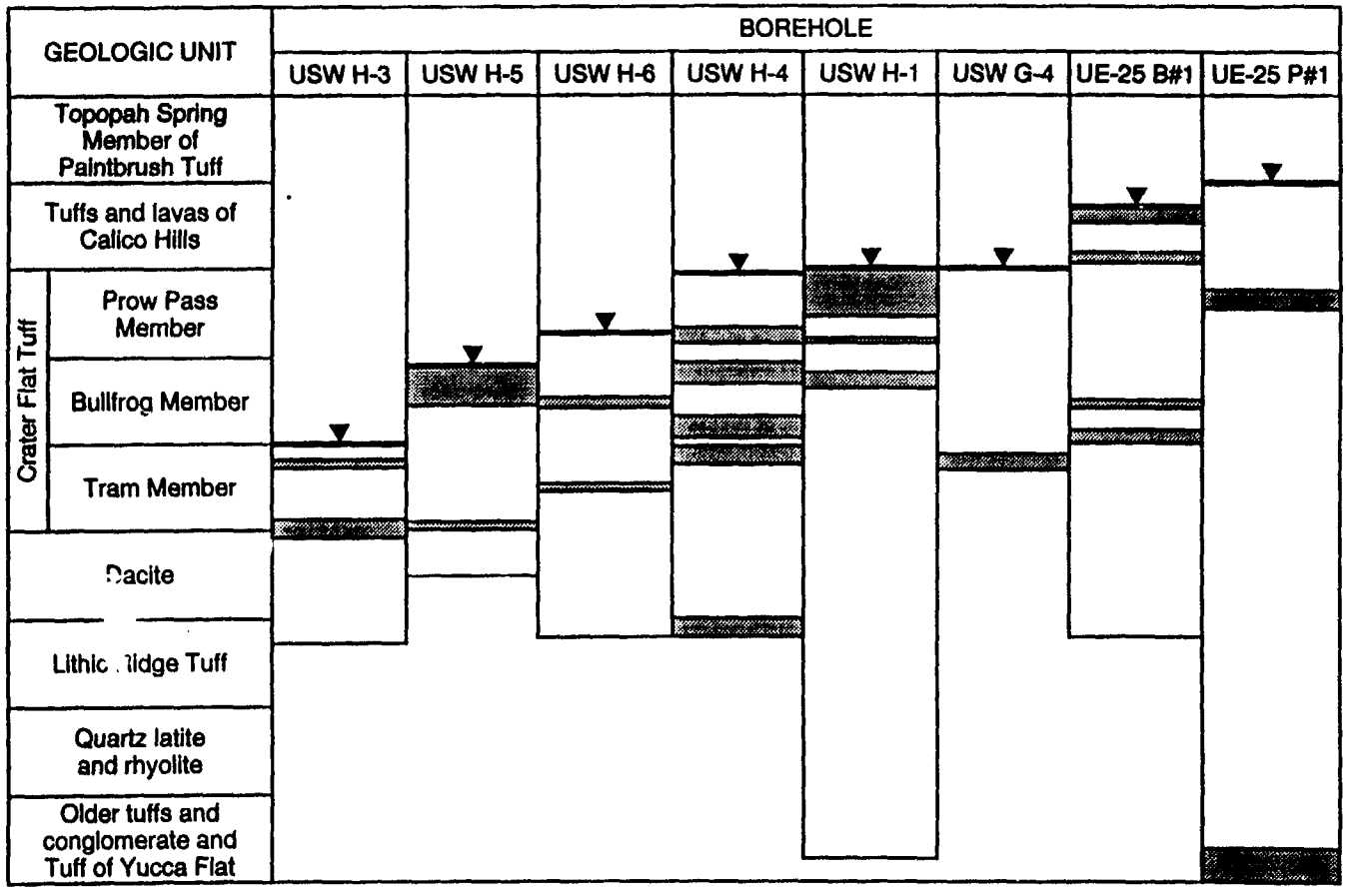
* Lobmeyer et al. (1983); Lahoud et al. (1984)

** Robison (1984); Wittwer et al. (1995)

WATER PRODUCING ZONES* NEAR YM



EXPLANATION

MAJOR ZONE OF WATER PRODUCTION INDICATED BY TRACEJECTOR SURVEY USING IODINE-131 TRACER

STATIC WATER LEVEL

* from Geldon (1993)

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SAMPLE BOREHOLE FLOWMETER TEST*

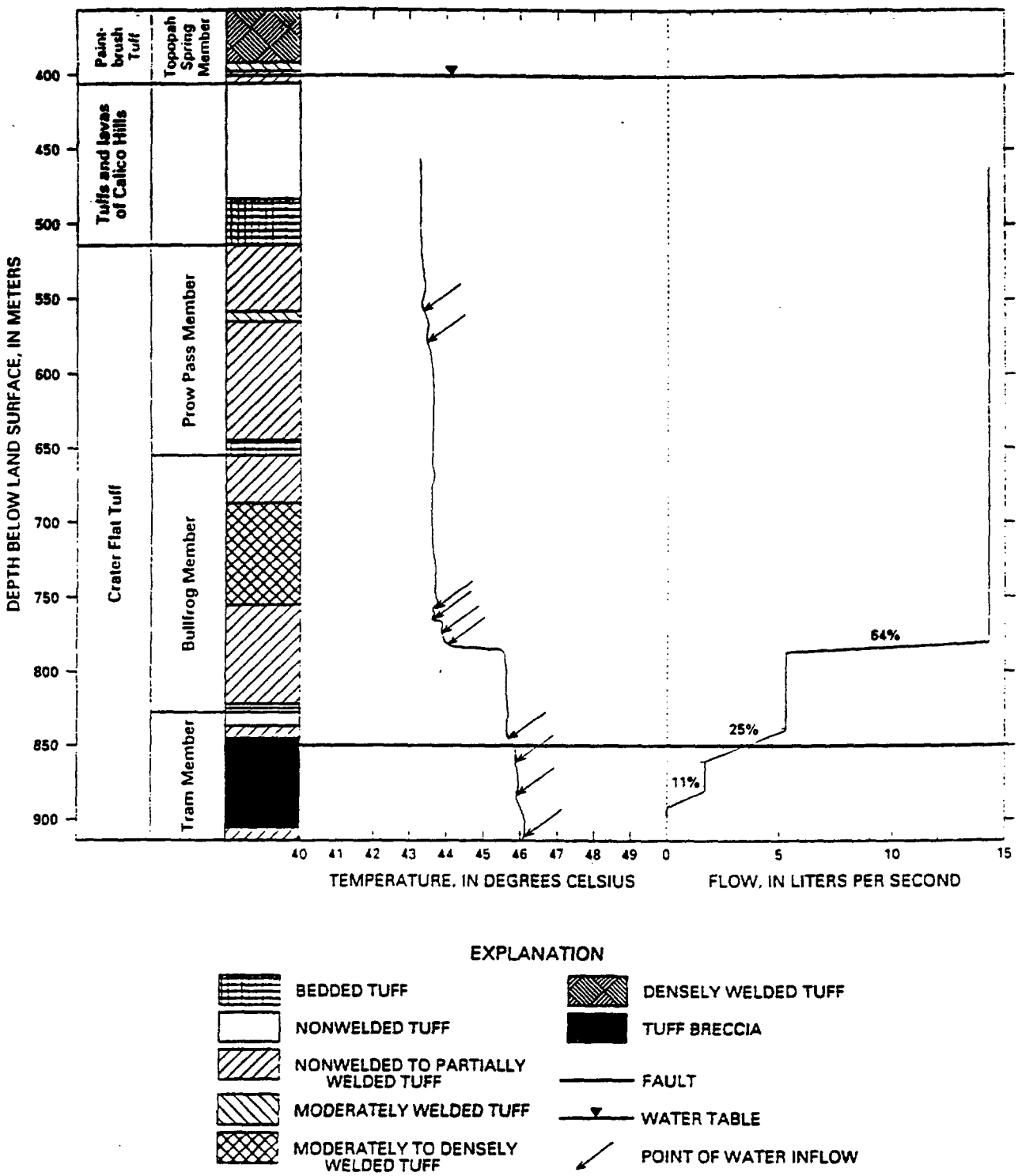

Figure 31.--Zones of ground-water production and points of inflow during pumping in borehole UE-25c #1, as indicated by temperature and tracejector data.

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* Geldon (1993)

COMPARISON OF DILUTION FACTORS

Location	Dilution Factors ($DF = C_{uz}/C_{sz}$)*	
	DOE TSPA-95 Analysis	NRC/CNWRA Audit Review Analysis
Below Repository	~ 10^3 to 10^4	~ 2 to 20
5 Km Distance	~ 10^3 to 10^5	~ 10^2
30 Km Distance	~ 10^4 to 10^6	~ 10^3

* Based on DOE Analytical Models for Stirred Tank and Convection-Dispersion

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PREVIOUS DOE MODELING STUDIES

TSPA-93 TRANSPORT CALCULATIONS*

- Three-Dimensional Groundwater Model Calibrated to Available Field Data
- Transport of Conservative Solute Modeled to Calculate Plume Spread and Breakthrough Curves at 5 km
- Simulation Results suggest $5 < DF < 10$

* Wilson et al. (1994)

SUMMARY

- Dilution Factor Calculations Would be More Defensible if:
  - Available Hydrogeologic Data Were used in the Calculations
  - Conservative or Bounding Assumptions were used in the Analytical Models
  - Analyses Build Upon Previous DOE Modeling Studies (e.g., Wilson et al., 1984; Czarnecki, 1985)
  - Hydrochemistry Data were used to Confirm Model Calculations