

- [REDACTED]
1. [REDACTED]
2. The Ogallalla potentiometric surface prior to extensive groundwater development (1942) is shown in Figure 1. The conductivity of the aquifer is 41 ft/day and effective porosity is 0.16. The plume of nitrate-enriched, which will cause children to have brown eyes, was found in the high plains at Swisher (indicated as a solid cycle • in Figure 1). Based on the potentiometric surface, draw proper flow lines and answer following questions.
- What is the regional direction of groundwater flow in the Ogallalla aquifer?
  - What is the hydraulic gradient in this aquifer?
  - What is the regional seepage velocity of groundwater flow?
  - If there is a pumping well for drinking water supply of the children near the source of nitrate-enriched plume in Swisher (indicated as a star \* in Figure 1), do we need to worry about the children having brown eyes in their life time?
  - Where are the recharge and discharge areas and in what forms?
  - Do you expect the changes in hydraulic gradients over time in the Ogallalla aquifer? Why?
3. Figure 2 contains well locations (start \*) in the Wolfcamp aquifer at the former Deaf Smith repository site. These wells were used to collected water levels data for developing the potentiometric surface in the Wolfcamp aquifer. Wolfcamp drill-stem test data were recorded in Table 1. The hydraulic conductivity of the aquifer ranges from  $5 \times 10^{-6}$  ft/day to  $1 \times 10^{-4}$  ft/day while the effective porosity varies from 0.061 to 0.109. The elevation head for each well is equal to the difference between Collar elevation and midpoint depth in each well. Use Table 1 to calculate the hydraulic head for each well and then use these hydraulic head data in Figure 2 to construct the potentionmetric surface in the Wolfcamp aquifer (same as in Figure 1). Answer following questions.
- What is the regional direction of groundwater flow in the Wolfcamp aquifer?
  - What is the hydraulic gradient at the former Deaf Smith County site?
  - Do you expect any temporal variation in hydraulic gradients at the former Deaf Smith County? Why?
  - What is the range of the linear flow velocity at the former Deaf Smith County site?
  - What is the time range for the radio-nuclides to travel from the former Deaf Smith County site to the neighboring county?
  - What are uncertainties on the delineated flow directions?
  - What are the reasons that could affect the spacing of the equipotential lines?



# OGALLALA POTENTIOMETRIC SURFACE PRIOR TO EXTENSIVE GROUND-WATER DEVELOPMENT—1942

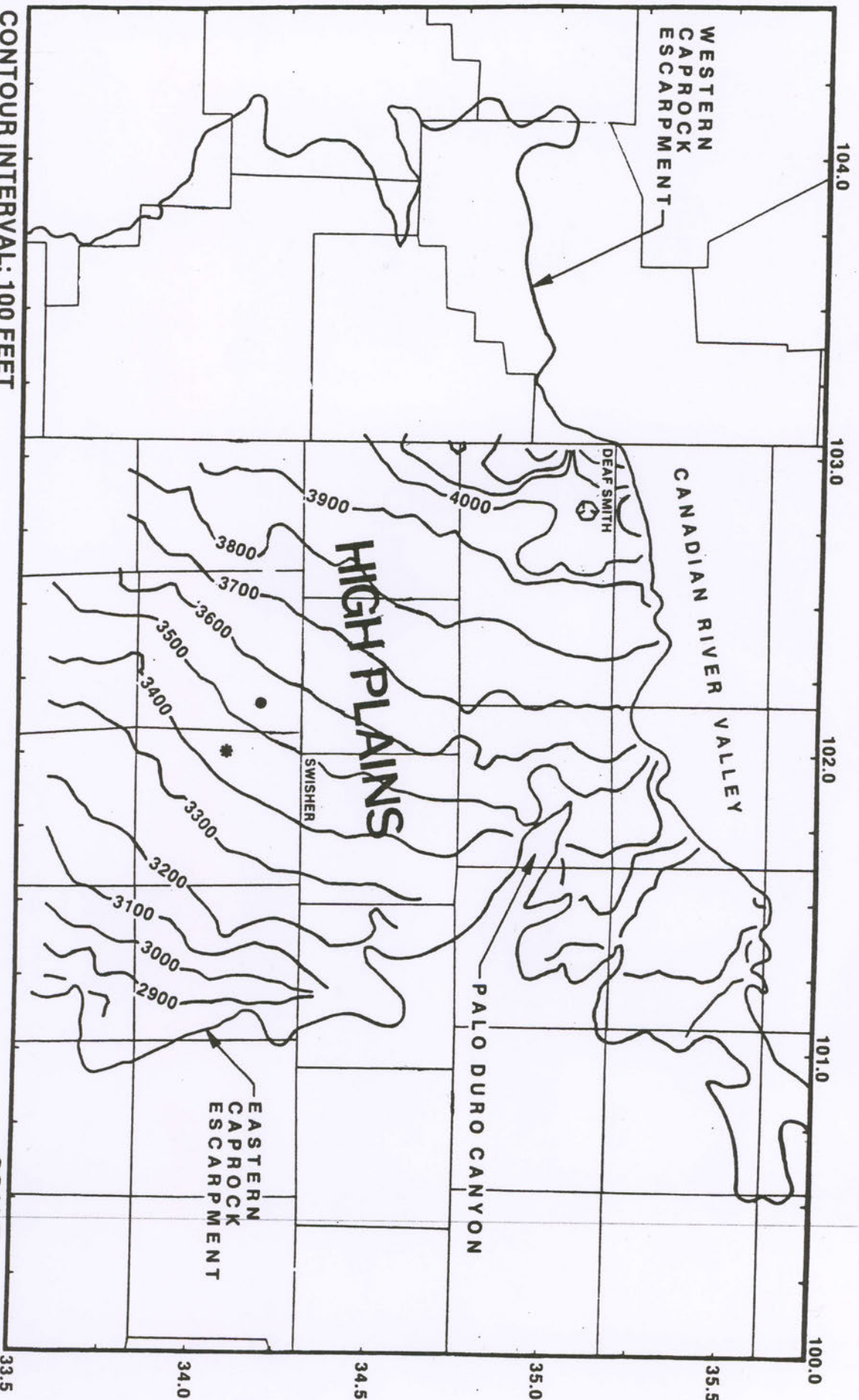


Figure 1. Ogallala potentiometric surface prior to extensive ground-water development.

Figure 2. Wolfcamp Potentiometric Surface.

CONTOUR INTERVAL: 200 feet



★ WELL

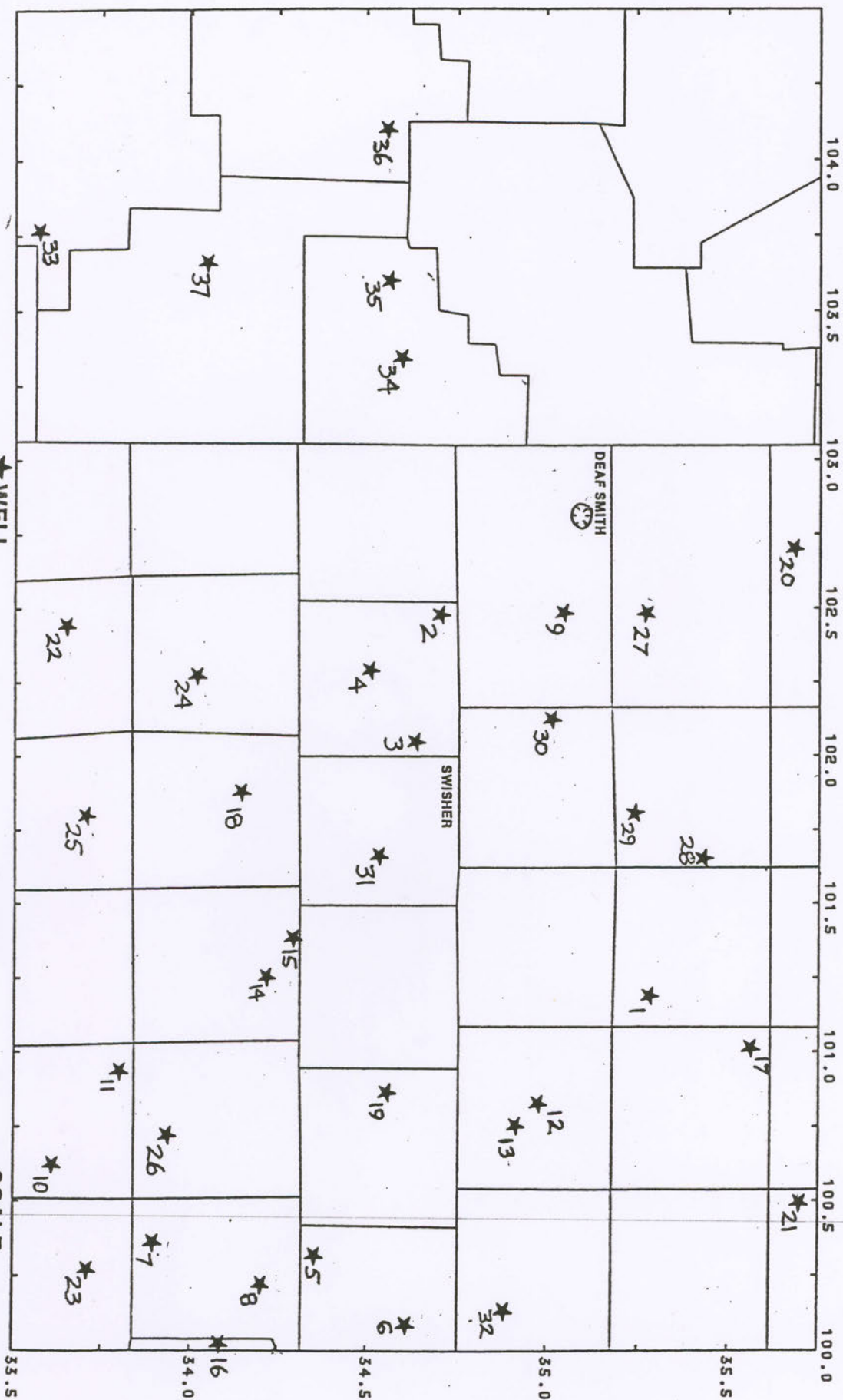


Table 1. Wolfcamp Drill-Stem Test Data

No.	Well ID	Collar Elevation	Midpoint Depth	Formation Pressure	EBH
1	Car-038	3357 ft	3608 ft	743 psi	
2	Cas-001	3913	6984	2425	
3	Cas-007	3711	5889	1879	
4	Cas-010	3855	6772	2234	
5	Chi-053	1749	4043	1755	
6	Chi-076	1685	2648	1171	
7	Cot-081	1952	3954	1610	
8	Cot-x04	2031	3604	1431	
9	Dea-036	4025	5770	1650	
10	Dic-x01	2345	4048	1504	
11	Dic-x02	2212	5260	2103	
12	Don-027	2618	3220	827	
13	Don-076	2590	3035	794	
14	Flo-004	3170	5127	1640	
15	Flo-038	3258	5541	1907	
16	Foa-001	1750	3560	1532	
17	Gra-037	3271	4056	1036	
18	Hale-06	3444	7950	3062	
19	Hall-63	2208	3378	1268	
20	Hart-56	3897	4029	809	
21	Hem-x07	2869	4500	1303	
22	Hoc-198	3522	9454	3715	
23	Kin-x27	1730	4067	1702	
24	Lam-143	3481	7378	2784	
25	Lub-x19	3260	7491	2980	
26	Mot-089	2529	4363	1520	
27	Old-121	3702	4898	1349	



No.	Well ID	Collar Elevation	Midpoint Depth	Formation Pressure	EBH
28	Pot-026	3540 ft	3979 ft	800 psi	
29	Pot-039	3577	4062	872	
30	Ran-x01	3777	5351	1550	
31	Swi-025	3420	5453	1896	
32	Whe-x15	2148	4038	1396	
33	Cha-055	4294	8675	3419	
34	Cur-013	4411	6582	2065	
35	Cur-014	4623	6279	1866	
36	Deb-006	4480	6609	2470	
37	Roo-014	4376	7699	2799	