H5 (Fitts)

1. The perched aquifer should have a low K layer underneath and some unsaturated zone beneath

that. The head in the confined aquifer should be above the top of the aquifer and there should be some confining layer above the aquifer. The water table in the unconfined aquifer should be within the aquifer layer.

2. The flow in the sand layers will be nearly parallel to the layers, and flow in the silt/clay layers will be almost normal to the layers.

3. In an area underlain by low-conductivity materials, the water table will be at or near the ground surface. Where the water table is at the surface there will be streams and wetlands, and these will typically be closely spaced. On the other hand, areas underlain by high conductivity materials will have few, widely spaced streams and wetlands.

4. There are many possibilities here. All it takes is a large aquifer system with long residence times. A couple that come to mind are the Great Artesian Aquifer in Australia and the Dakota aquifer in the northern Great Plains of the U.S.

7. 2.6 in/yr (6.6 cm/yr), 0.59 in/yr (1.50 cm/yr).

8. a) Qb = Qs*(cs – cq)/(cb – cq) The quantity in parentheses above is dimensionless.

9. Scenarios (c) and (d) are most likely to represent long-term average conditions. Pattern (a) requires a consistent loss mechanism (usually an outlet), and pattern (b) requires a consistent source mechanism (usually an inlet).

10. The exceedance probability is about 0.72. The return period of such a flood is the inverse, 1/0.72 = 1.4 yrs.

11. The vertical average linear velocity: −0.48 m/yr, the recharge rate: 0.14 m/yr.

12. There are many contaminant plumes to the southwest of the highest part of the water table, so that is a less desirable quadrant to explore. To the north and southeast are less affected by pollution. It is good to screen wells deep to maximize potential drawdown and yield and to have greater isolation from surface waters which are less clean. Based on the profile, more

permeable materials occur deep in the north, just south of the Sandwich moraine. They also occur in the south, just north of the coast.

H6 (Fitts)

1 a) 1680 lb/ft2 (80400 N/m2)

b) 1734 lb/ft2 (82000 N/m2)

c) It would compress because of the increase in σve.

2. Immediately after starting the pump, the local pore water pressure drops, which does not change the total stress, but it does increase the effective stress. With more time, there is some drainage at the water table, which does decrease total stress some.

3. The water level in the deep, confined well will decline under the high atmospheric pressure. In the unconfined well there is no induced flow or water level change.

4. 0.51

5. Precipitation generally increases saturation in the unsaturated zone and increases the height of the water table, both of which contribute to increased total stress. Pore water pressures tend to increase as water levels rise. Effective stress can increase or decrease depending on the magnitude of the total stress and pore water pressure changes. Slopes become less stable because increases in saturation increase total stress, and increases in pore pressure cause reductions in shear strength.

6. We could inject water under high pressure into a fault zone, which would increase pore pressure, decrease effective stress, and decrease shear strength. This would increase the chance of triggering earthquakes.

7. 1200 lb/ft2 (57500 N/m2), −1.7 in (-4.3 cm).

8. The zone of greatest subsidence coincides with the zone of thickest sediments in the valley (see Figure 6.13). Also, this zone is in the west side of the central valley in the rain shadow of the coast ranges, where there is greater need for irrigation and the associated pumping.

9. α = 1.1 × 10−9 m2 /N.
10. −0.61 ft (-0.19 m)
11. The heads observed in wells reflect the pore pressures in the sandy layers, not in the clayey layers.
13. a) 1.9 × 10−7 m2 /N

b) 6.0 × 10−8 cm/sec
14. a) 1.1 × 10−7 cm/s
b) 220 days.
15. a) 392400 N/m2
b) −0.35 m, the land surface will go down.
c) It could be more if the aquitards above and below the aquifer also compress. It could be less if the compression of clay/silt layers in the aquifer is governed by recompression instead of virgin compression (perhaps the aquifer has experienced such high effective stresses before).
d) 0.11 m
e) 2.7 × 10−3
16. 10.9 ft (3.3 m)
17. The confined aquifer will experience greater drawdown because its storativity is much smaller than the unconfined aquifer's specific yield. A given amount of drawdown liberates much more water from storage in an unconfined aquifer than in a confined aquifer. Not as much drawdown is needed in the unconfined aquifer to draw the well's discharge from storage.
18. a) 2.1 × 10−5 m−1, 4.1 × 10−4
b) 830 m3
19. a) 39240 N/m2
b) −0.11 m
c) 5.9 × 10−4 m−1, 2.6 × 10−2
d) 1.1 × 105 m3
20. 0.0059, 22
21. −1.7 m, Heads would have to drop 1.7 m, on average.
22. Steady flow will occur when the boundary conditions are steady — when the reservoir and tailwater levels are kept steady. Transient flow occurs when these levels fluctuate, such as when the reservoir is drawn down rapidly or when it rises rapidly in a flood.