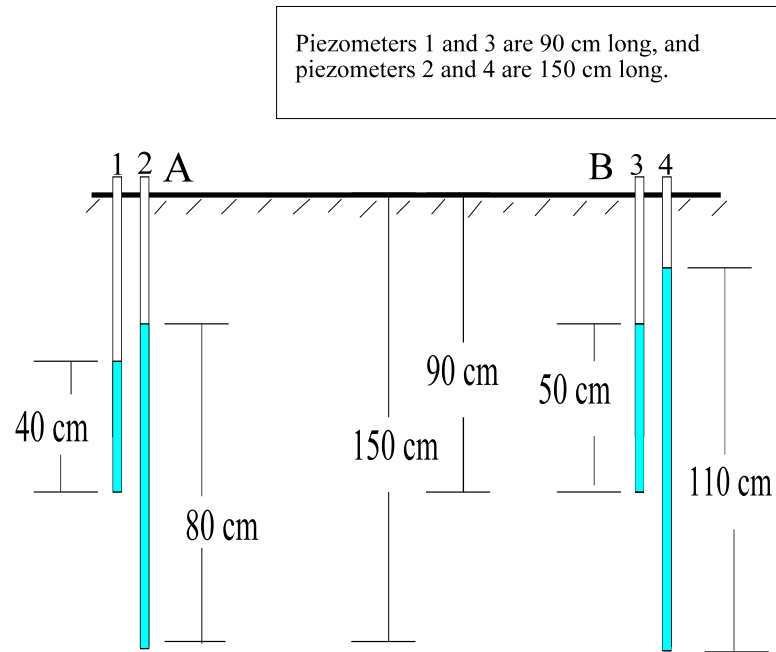
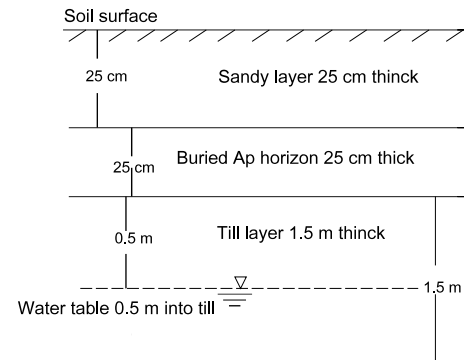


3. (30 points). a) (10 points). From the information in the diagram below, what is the depth from the soil surface to the water table at sites A and B? b) (5 points). What is the **horizontal** direction of water flow, that is, water flow between A and B? c) (15 points). If the hydraulic conductivity of the soil (K_s) at site A is 4×10^{-3} cm/s what is the volume of water flowing through a cross sectional area of 100 cm^2 ?



Note: this schematic is not drawn to scale

4. a) (10 points). As we discussed in class, the adsorption coefficient (K_d) for herbicides in soil is a strong function of the amount of organic matter in the soil, and weakly related to the clay content. **Explain how solute (water with soluble herbicide) might move through and adsorb** to a layered soil that has a buried Ap horizon at 0.25 m below the soil surface with the top 25 cm of soil being sand (95% sand) with 0.50% organic matter and a K_d of 0.02. The buried Ap horizon is also 25 cm thick, with 20% clay, 70% silt, and 10% sand, and it is over a glacial till which is mostly sand and rock. This buried Ap horizon has an organic matter content of 4% and a K_d of 2.5 while the till has a K_d of 0.05 and organic matter content of 0.10% and is 1.5 m thick but only 0.5 m to the groundwater (see figure below).



4. b) (20 points). For the condition above (4. a), explain how water will move into, and through, this soil profile following a rain that is sufficient to saturate the top 25 cm (sand layer) after an hour of rain. Include in your **discussion how the water will move into and through the top layer of sandy soil, and through the next layer, the buried Ap horizon, and into and through the till to the groundwater**. For the sake of this discussion, assume that prior to the rain the soil profile has a water content of only 5% in all the layers above the water table (so, it is dry).

5. True and False:

1. (20 points). Indicate if the following statements are true (T) or false (F). [Each one is worth 2 points, **and for extra credit correct the false statements (2 points each).**]

- | | | |
|-------|----|---|
| _____ | a) | There is no difference between the hydraulic conductivity of saturated and that of unsaturated soil. |
| _____ | b) | One can determine the direction of groundwater flow by knowing the depth to the water table at a minimum of three different places/points. |
| _____ | c) | Installation of subsurface drains (tile lines) in a soil with a water table close to the soil surface will allow a soil to warm faster in spring. |
| _____ | d) | It is more economical if subsurface drains are placed at great distances apart and at deep depths above the water table than closer spacing below the water table. |
| _____ | e) | Water flux in soil is proportional to the hydraulic gradient. |
| _____ | f) | Solute moves through soil only if there is solute gradient. |
| _____ | g) | In general, water flow in soils is not affected by the matric suction potential when the soil is saturated. |
| _____ | h) | <i>In situ</i> measurements (that is measurements made in the field) of soil hydraulic conductivity is more accurate/representative of the site than laboratory measurements made on small soil core samples. |
| _____ | i) | Water infiltration into a dry soil (a soil at 5% water content) is much slower than that into a wet soil (a soil at 35% water content). |
| _____ | j) | The hydraulic conductivity of soils on a given |

landscape is the same at all depths (horizons) in the profile and it does not have any relationship to water infiltration into the soil.