
A spring on the wall of the Grand Canyon.

Lecture 13c – Groundwater interactions with surface and ocean

Learning Outcomes

- Be able to describe and explain the differences between aquitards, unconfined aquifers, confined aquifers, and advantages/disadvantages of wells dug into either

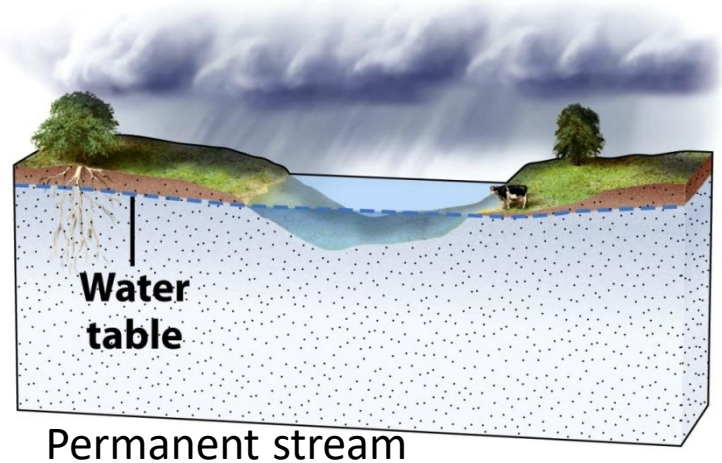
- Be able to explain how and why groundwater moves and draw flowlines on a cross-section of a drainage basin

- Be able to describe and explain what occurs when the water table intersects with the ground surface and what geologic arrangements might lead to springs occurring

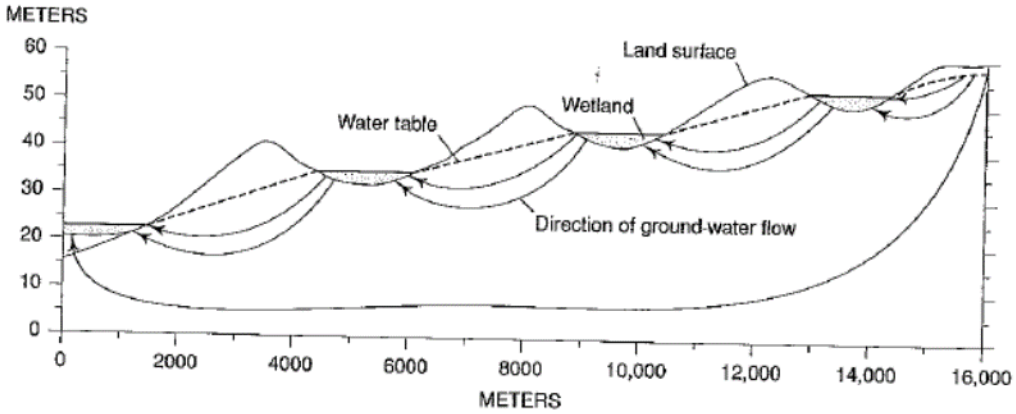
- Be able to draw/describe/explain/carry out simple calculations related to the freshwater/saltwater interface near the ocean

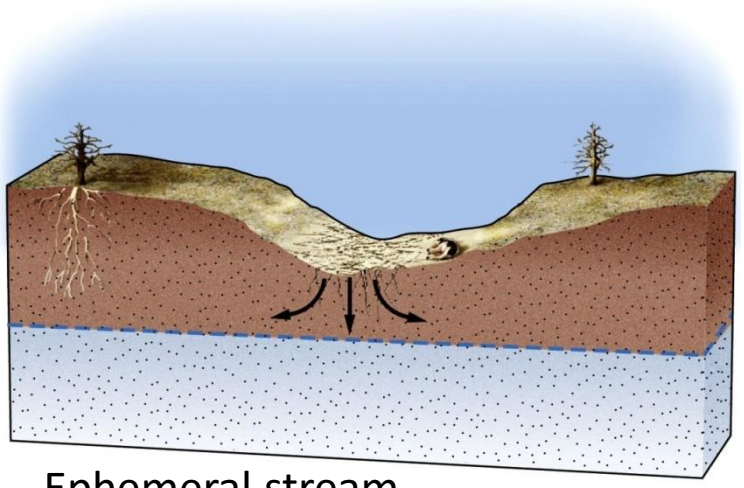
Groundwater/surface water interactions

- Lakes, springs, streams, and wetlands occur where the water table is at or above ground level



Permanent stream

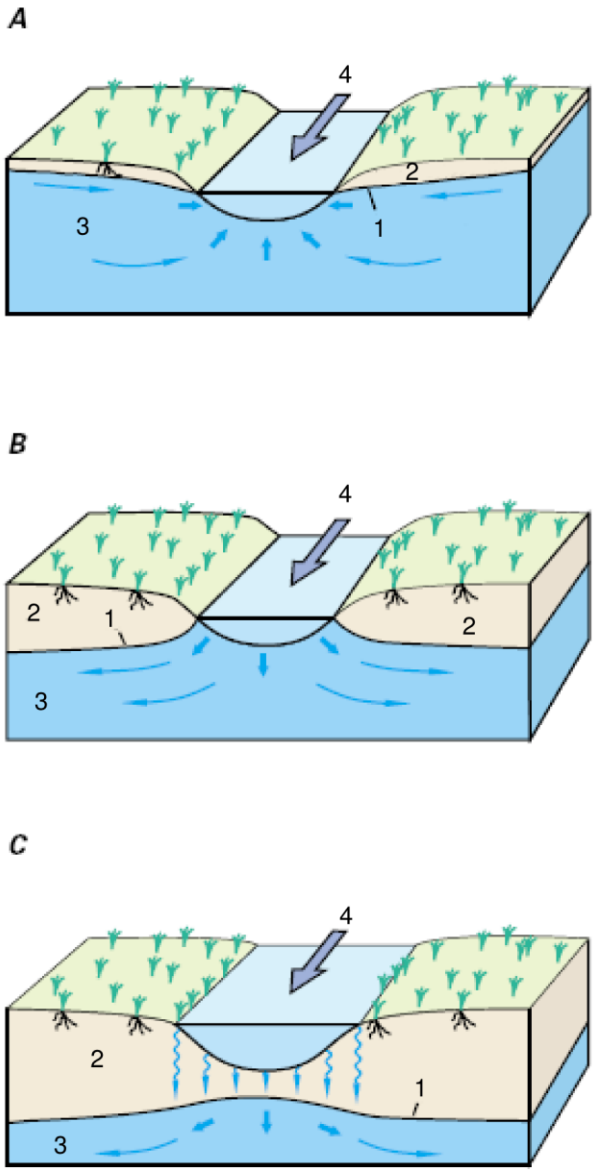



Ephemeral stream

Groundwater, streams and lakes

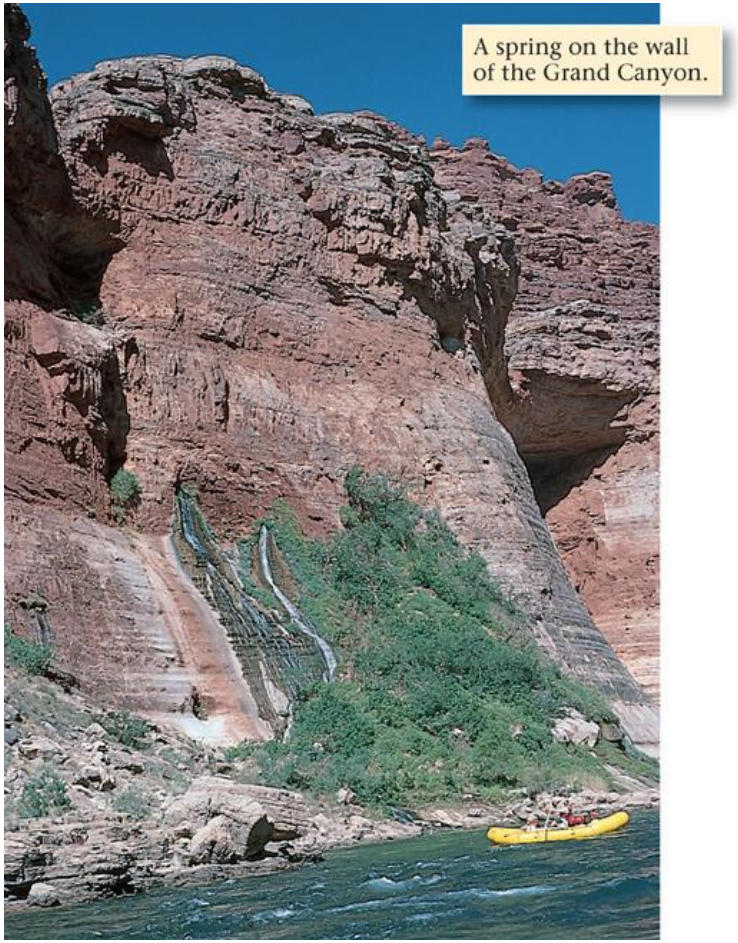
Streams and lakes can be:

- gaining where discharge increases due to net groundwater inflow
- losing where discharge decreases due to net flow out into groundwater

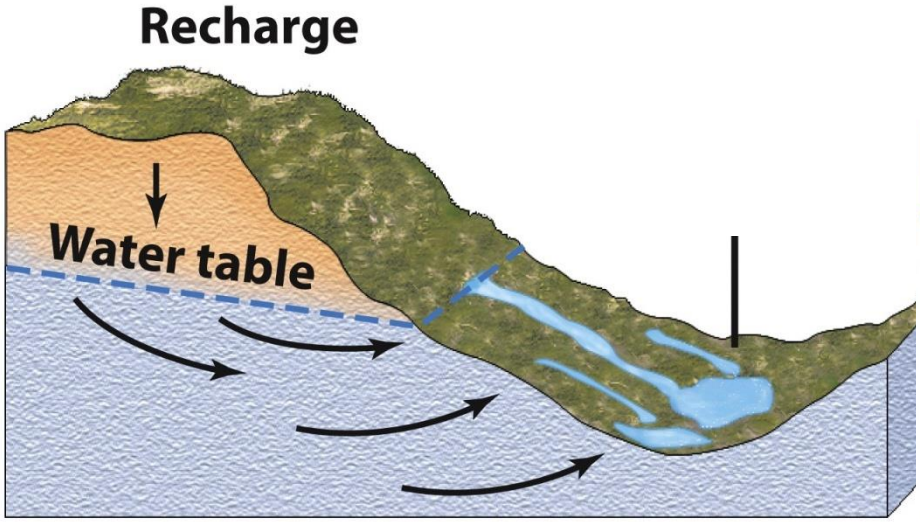


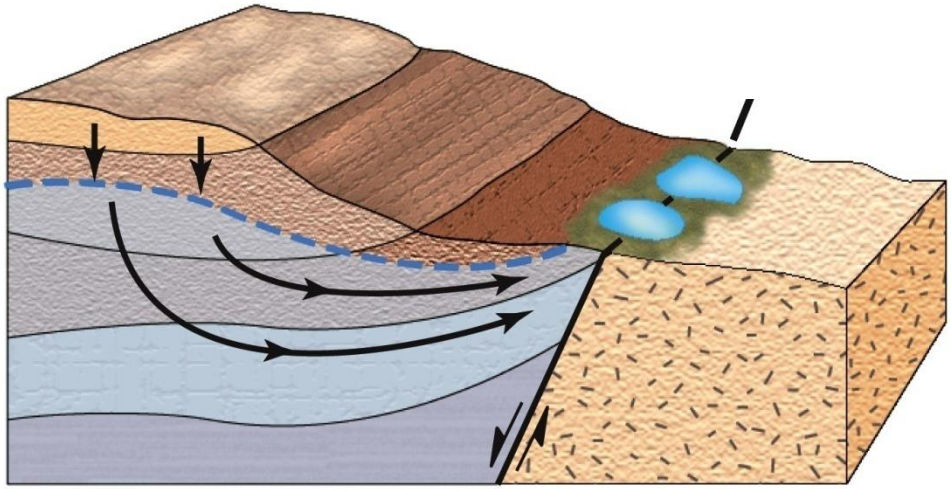
Groundwater and springs

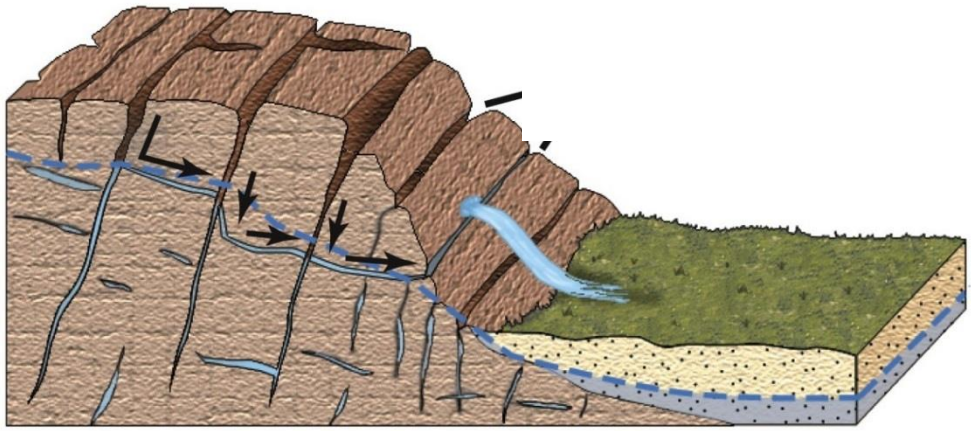
- Springs are locations of natural groundwater discharge
  - Springs are marked by…
    - Hydrophilic vegetation
    - Perennial wetlands
    - Saturated soils
    - Non-freezing ground
    - Streamflow

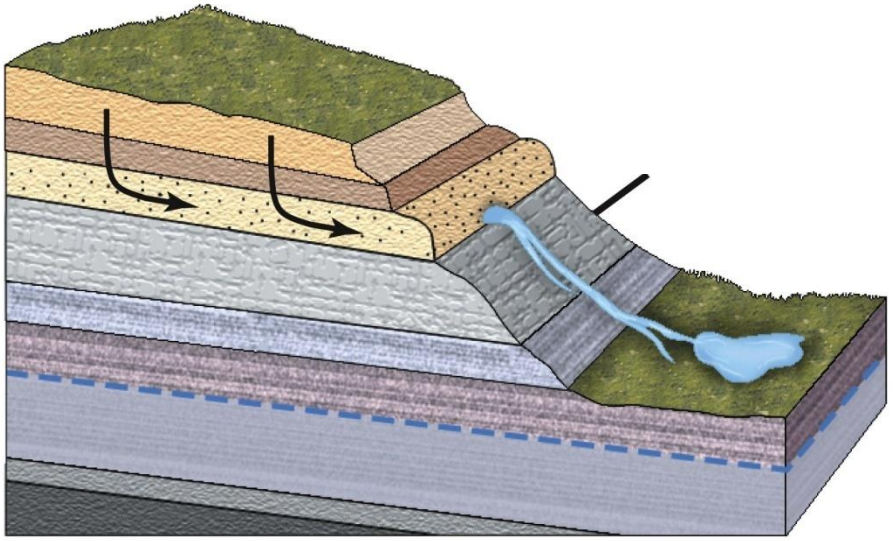


Groundwater and springs









Groundwater and oceans

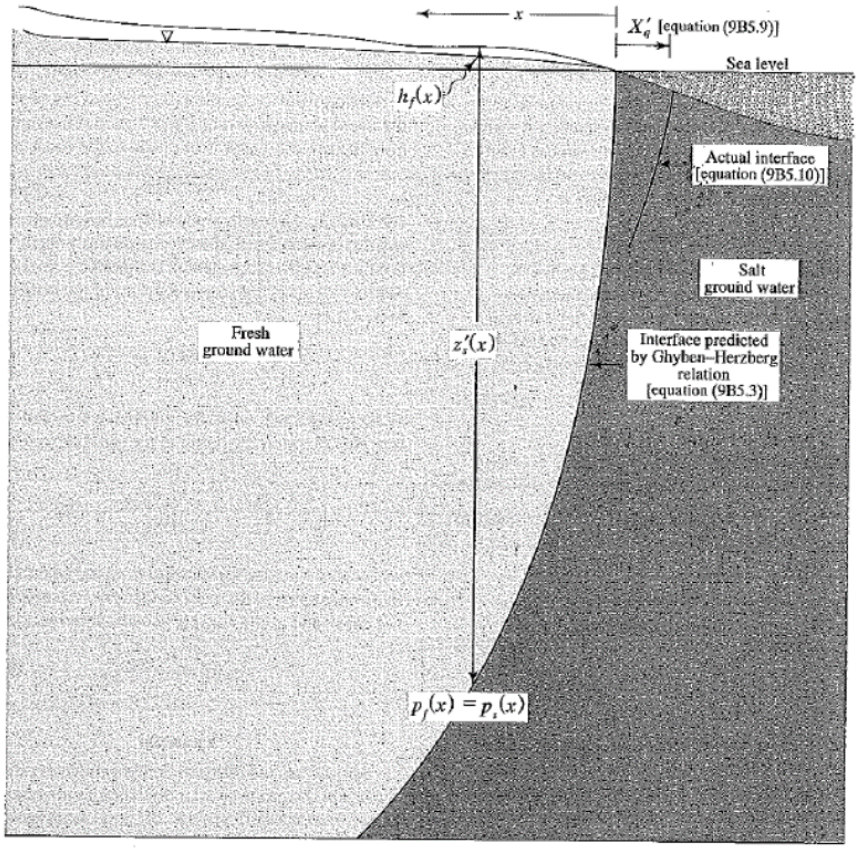
Where groundwater meets ocean a freshwater/saltwater interface occurs. Simple approximations can be used to predict behavior:

$$z_{s(x)} = 40\ h_{f(x)}$$

Where $z_{s(x)}$ = depth of interface below sea level at distance x inland
$h_{f(x)}$ = elevation of water table above sea level at distance x inland

$$q_{GW} = R * X$$

Where q_{GW} = average discharge per length of coastline
R = net recharge rate
X = distance inland to water table divide



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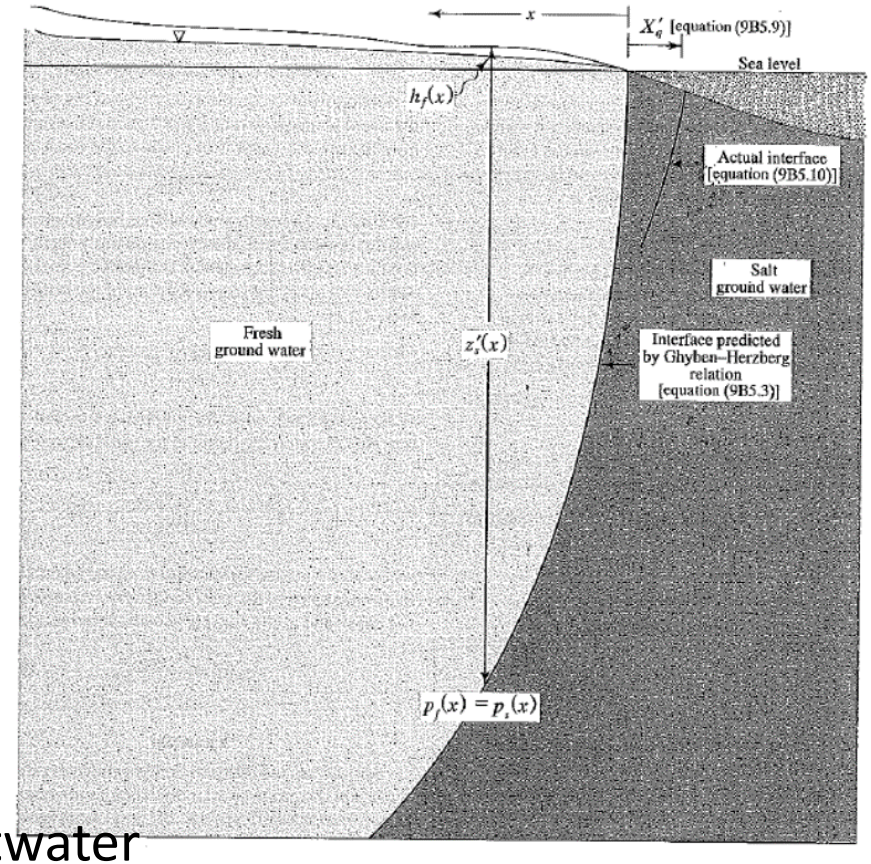

What is the depth of the freshwater/saltwater interface below sea level if the water table is 2m above sea level at that location?

a) 20 m b) 80 m c) 160 m