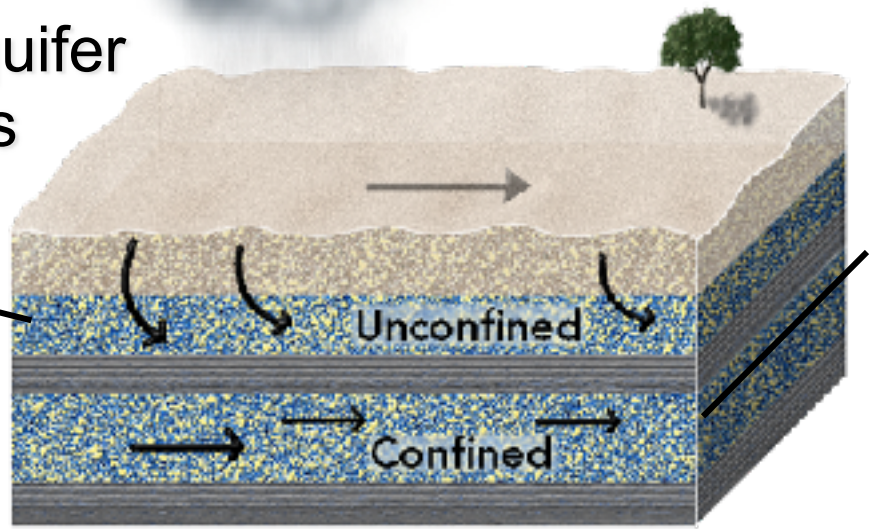
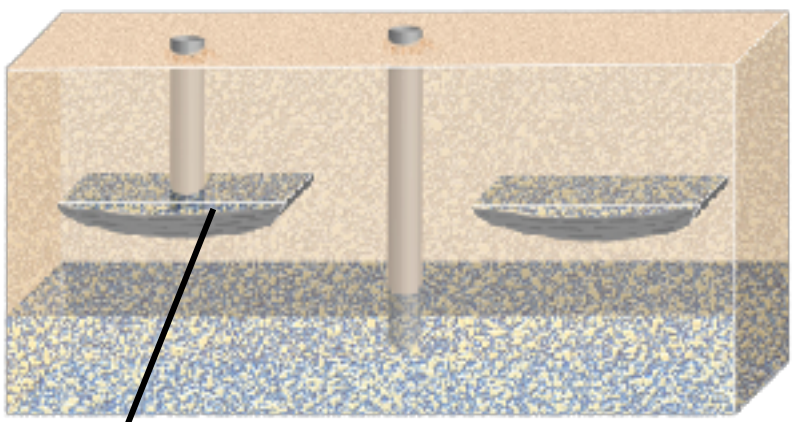
Types of Aquifers

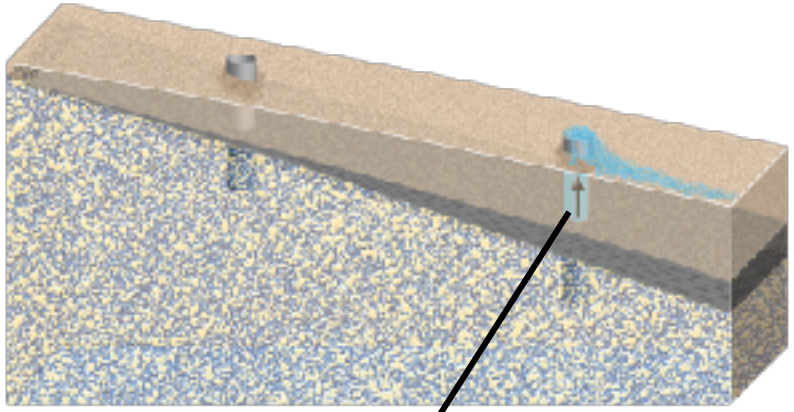
Unconfined aquifer open to Earth's surface and to infiltration



Confined aquifer overlain by less permeable materials

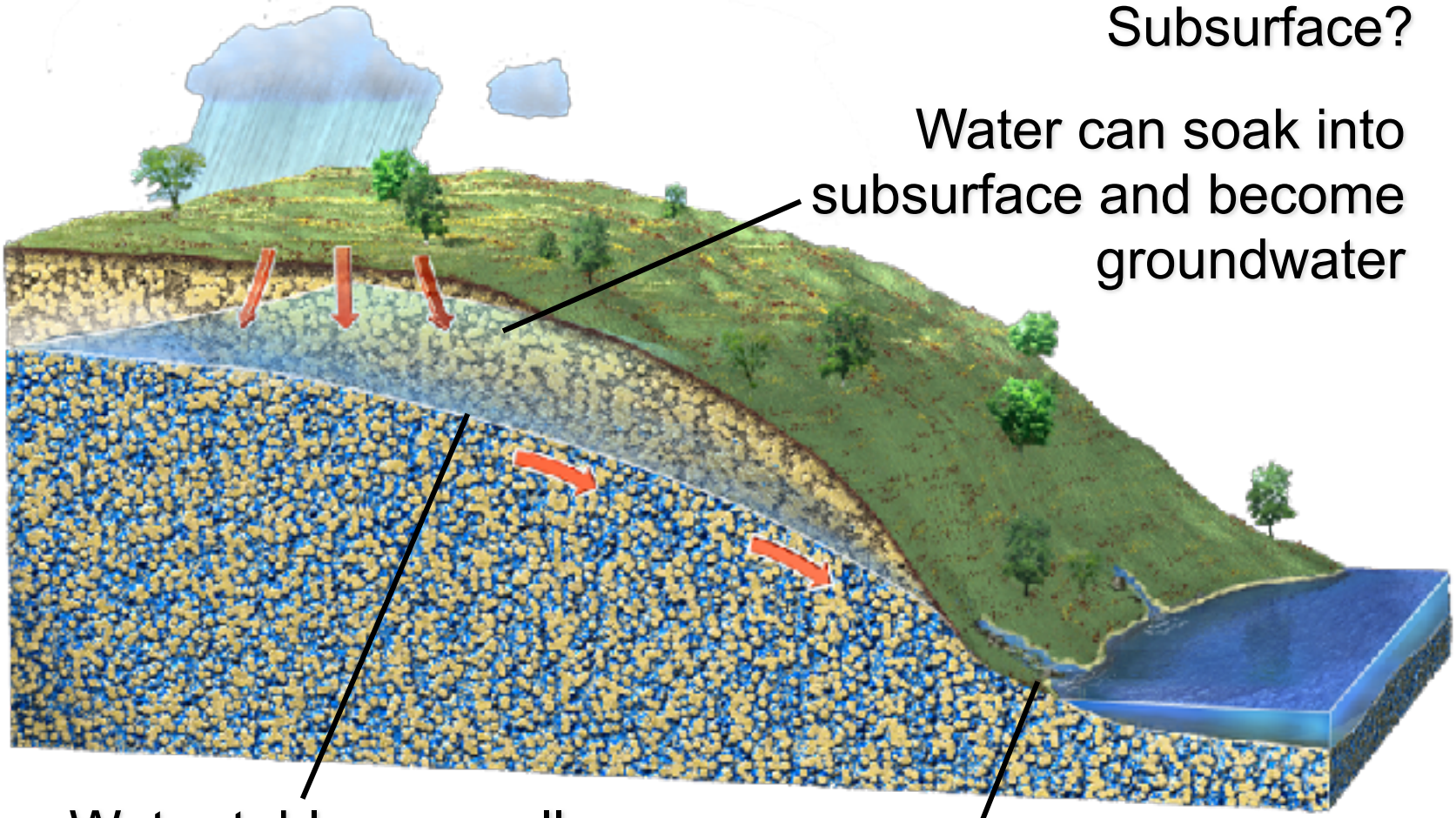


Perched aquifer underlain by low-permeability unit



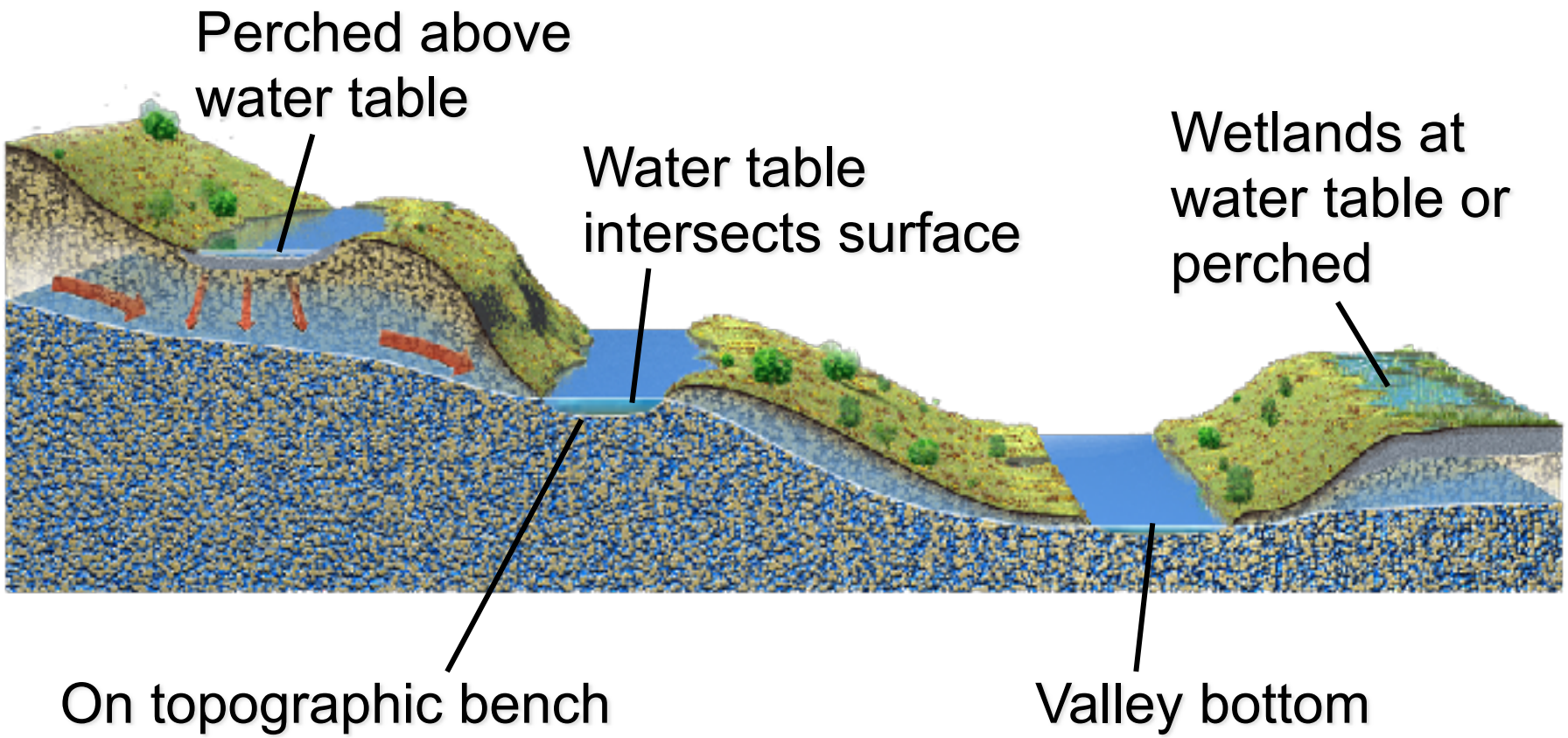
Artesian aquifer: water rises in pipe (maybe to surface)

How Does Water Move Between the Surface and Subsurface?



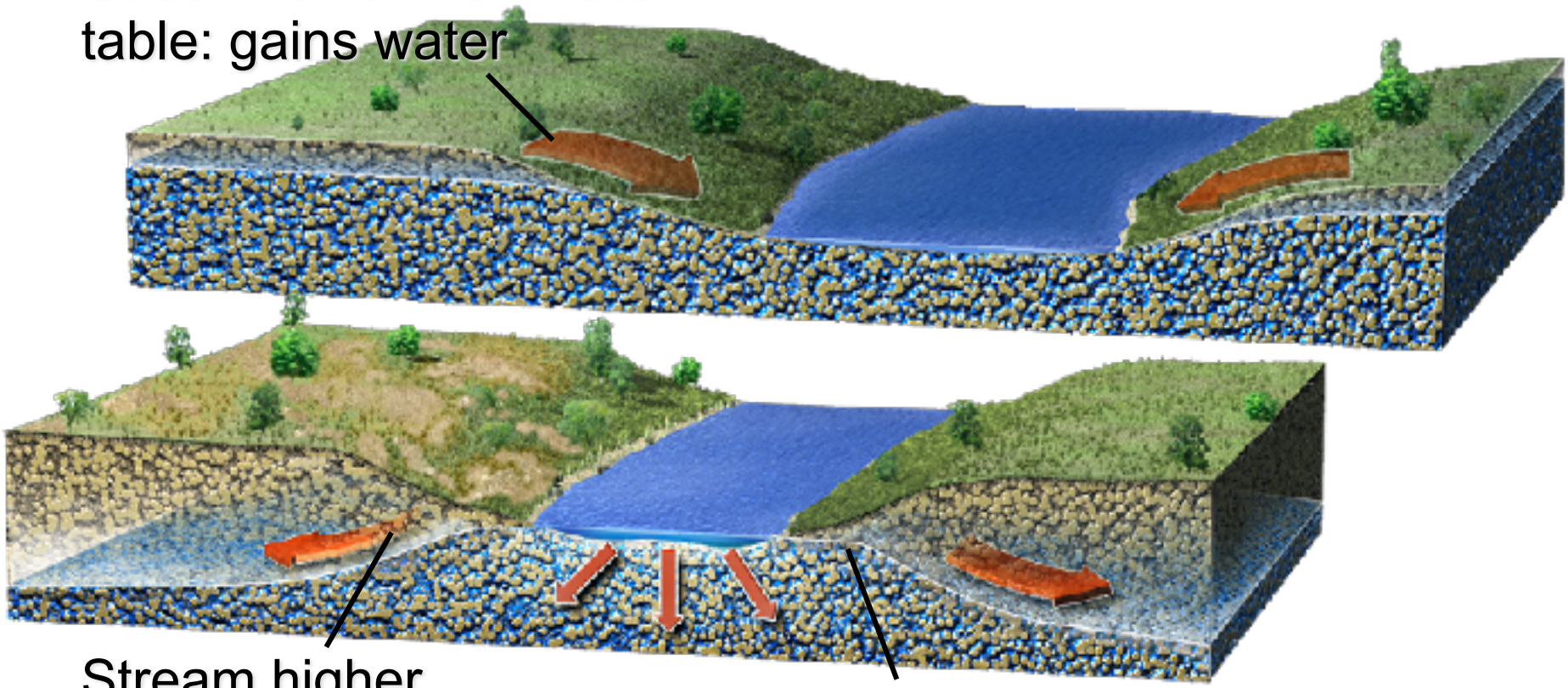
How Are Lakes and Wetlands Related to Groundwater?

Observe the settings of lakes compared to the water table

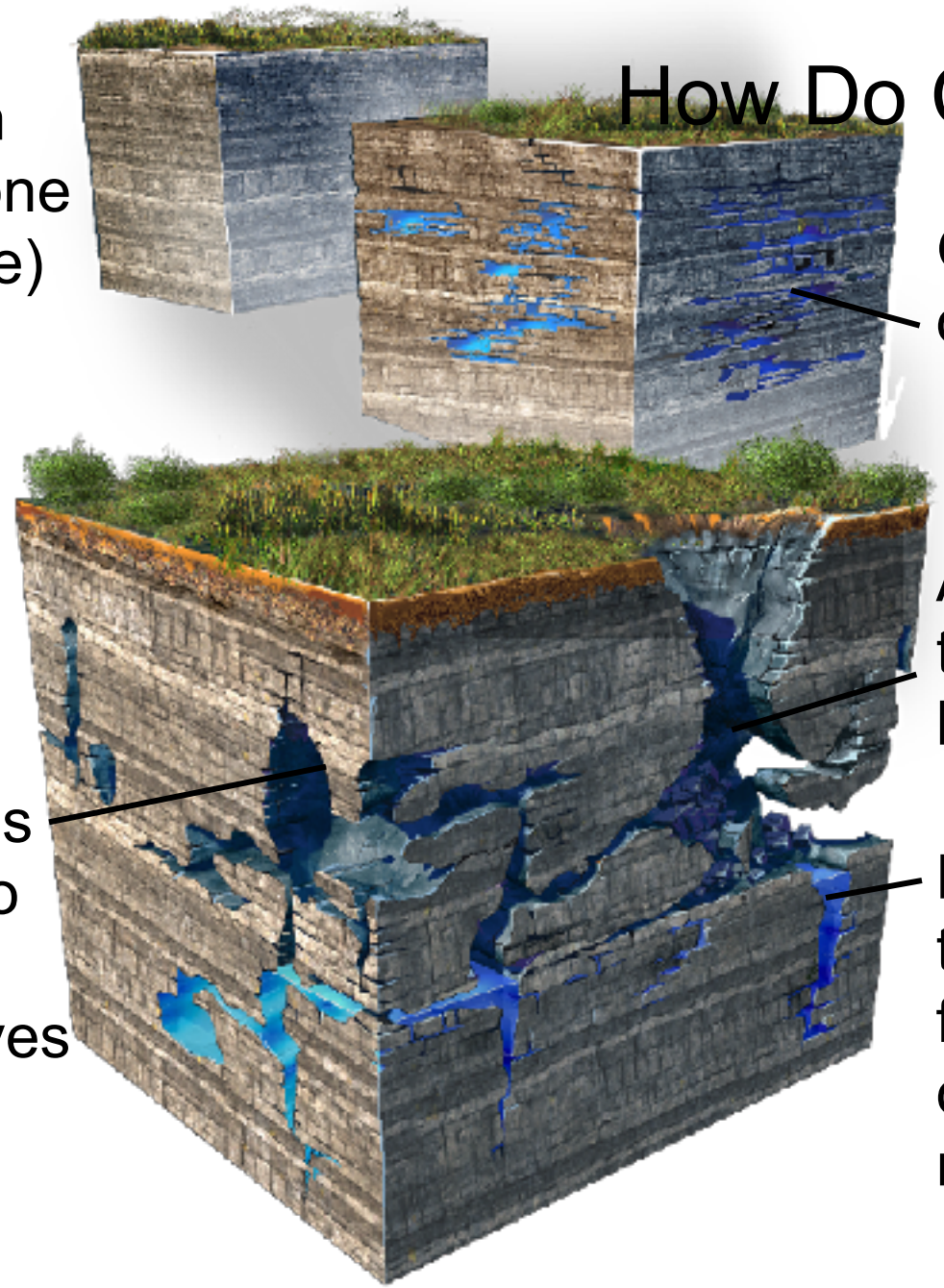


How Do Streams Interact with Water Table?

Observe how each stream relates to water table and flow of groundwater



How Do Caves Form?



What Features Accompany Caves?

Roof collapse can form sinkhole on surface

Dripping water evaporates, precipitates calcite

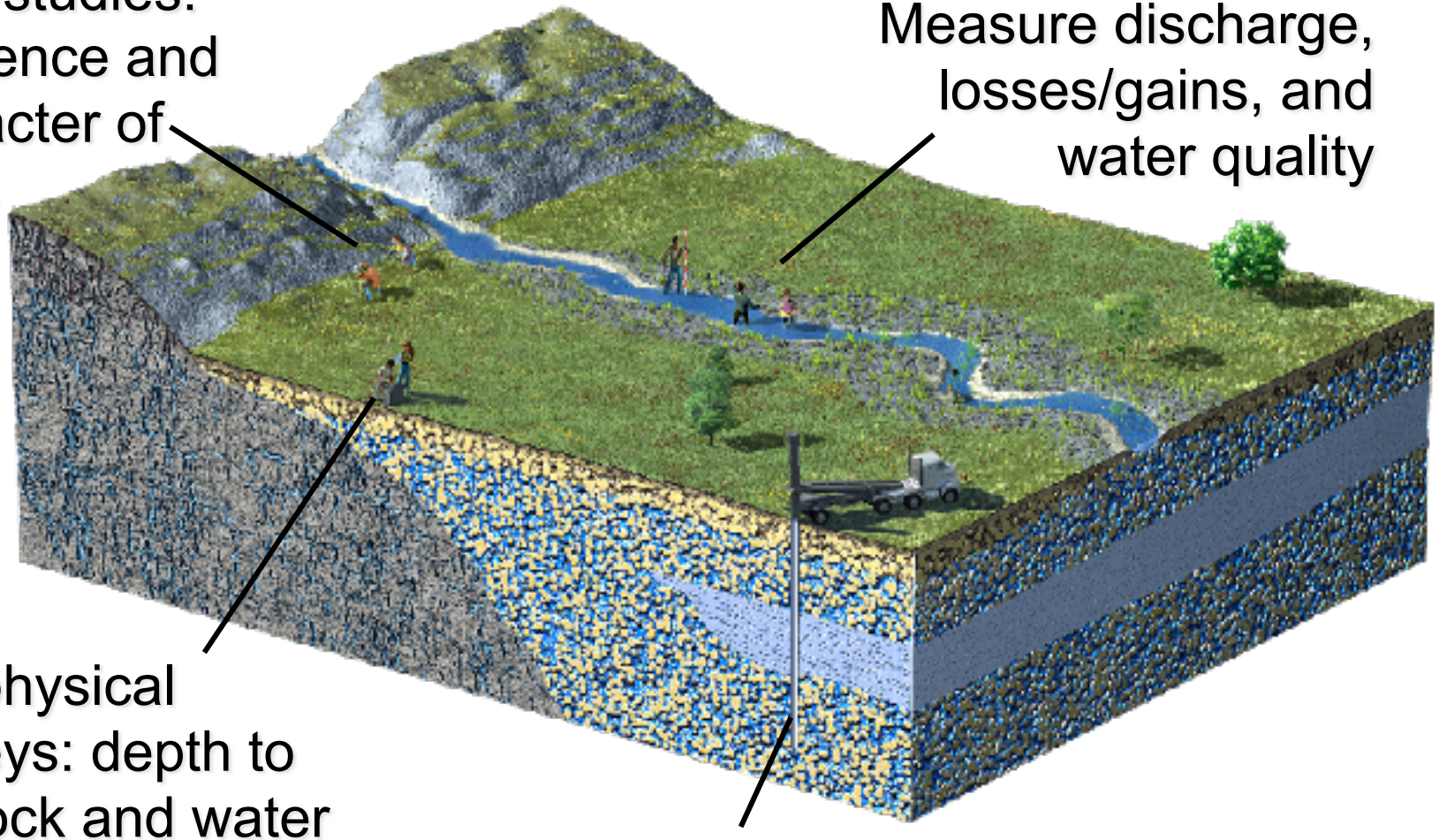
Cave formations on roof, floor, and walls

Surface with sinkholes, limestone pillars, disappearing streams = *karst topography*

How Do We Study Groundwater?

Field studies: sequence and character of rocks

Measure discharge, losses/gains, and water quality

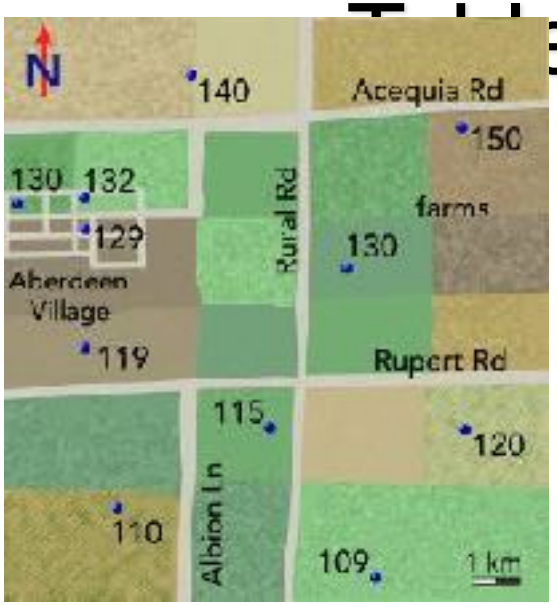


Geophysical surveys: depth to bedrock and water

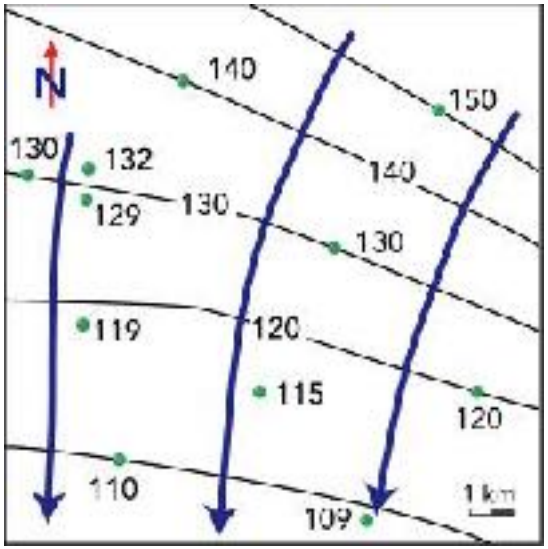
Drilling: verify geology, depth to water table, provide samples, pump tests

How Do We Depict the Water Table?

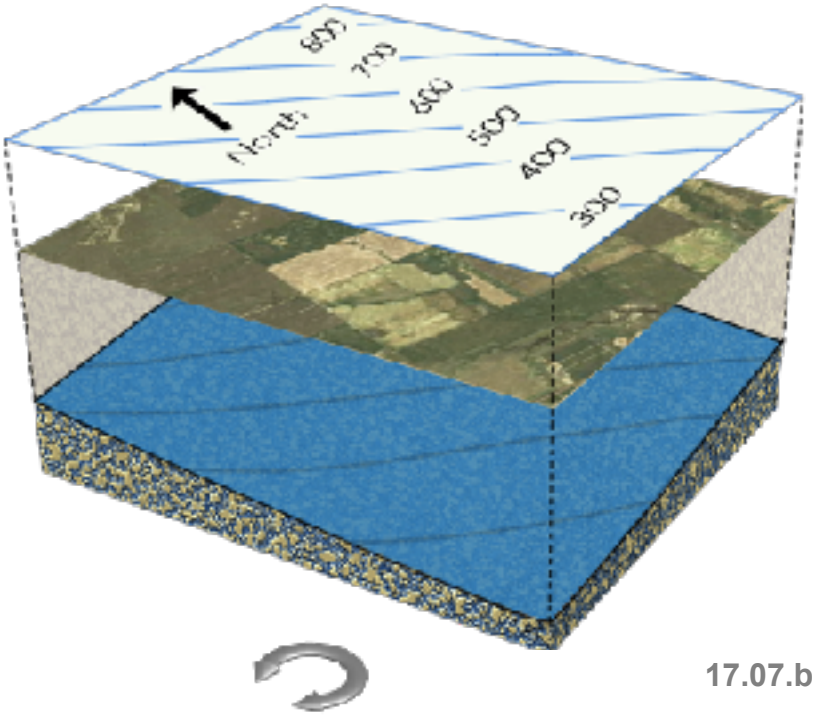
Numbers show elevations of the water table: *what is the pattern?*



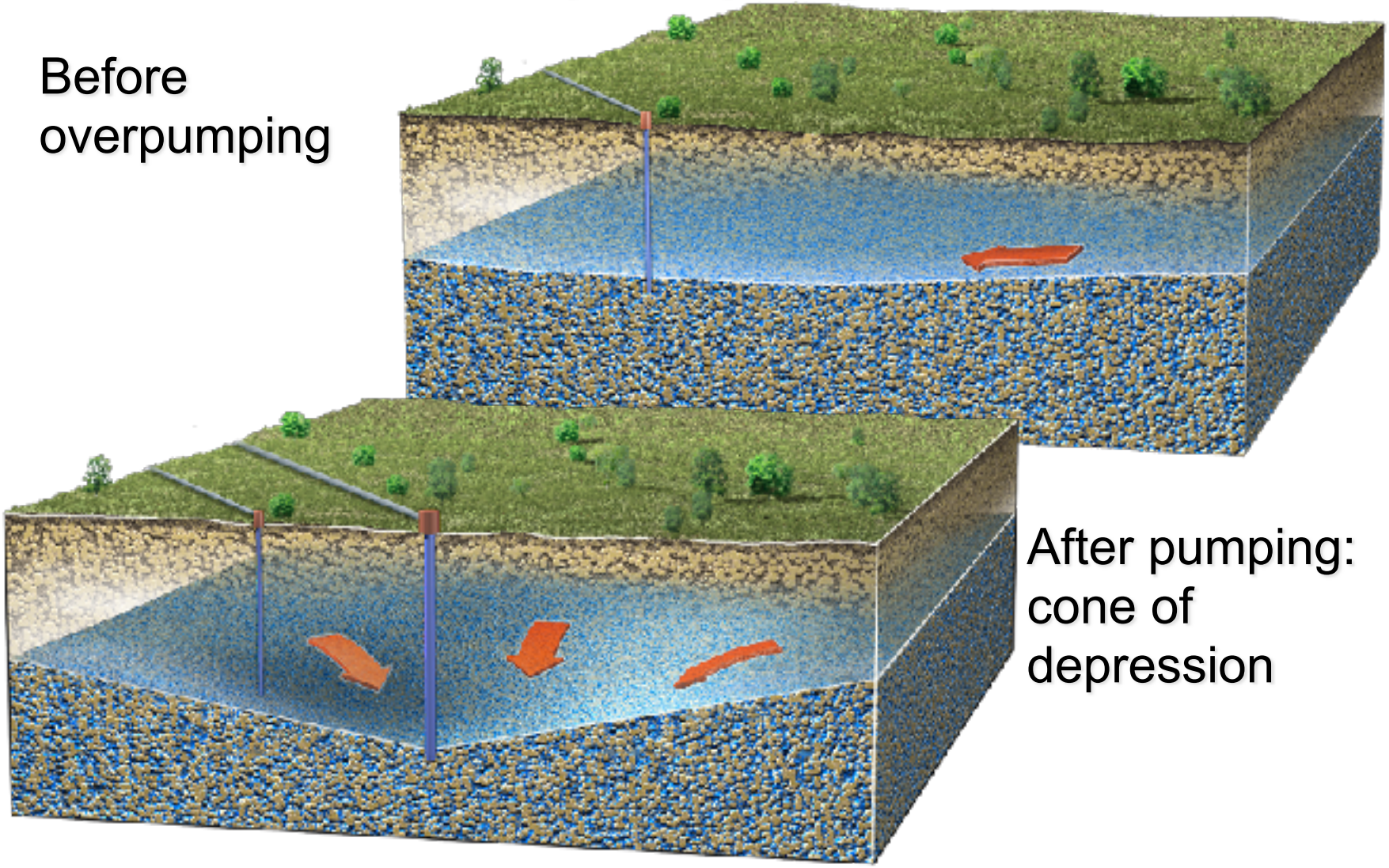
Contour: water table at same elevation; blue arrows show flow



Compare water table to other features



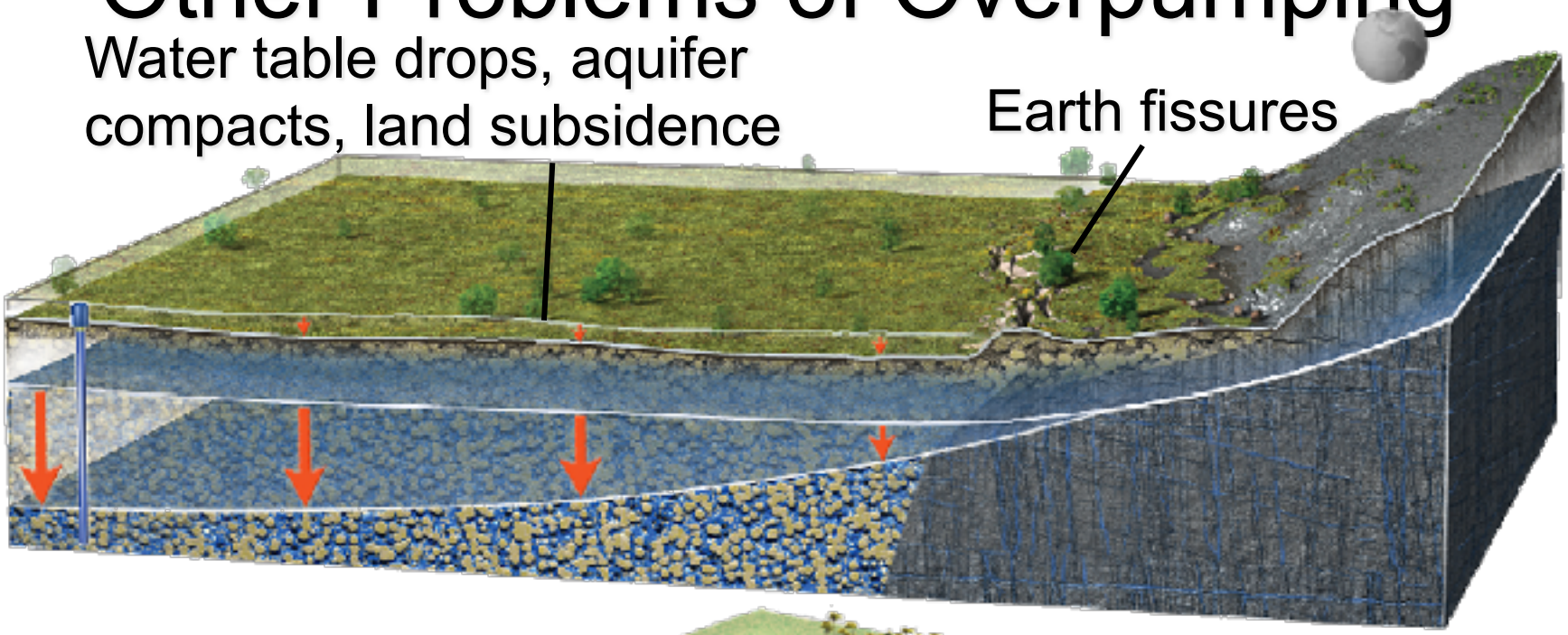
Effects of Overpumping Groundwater



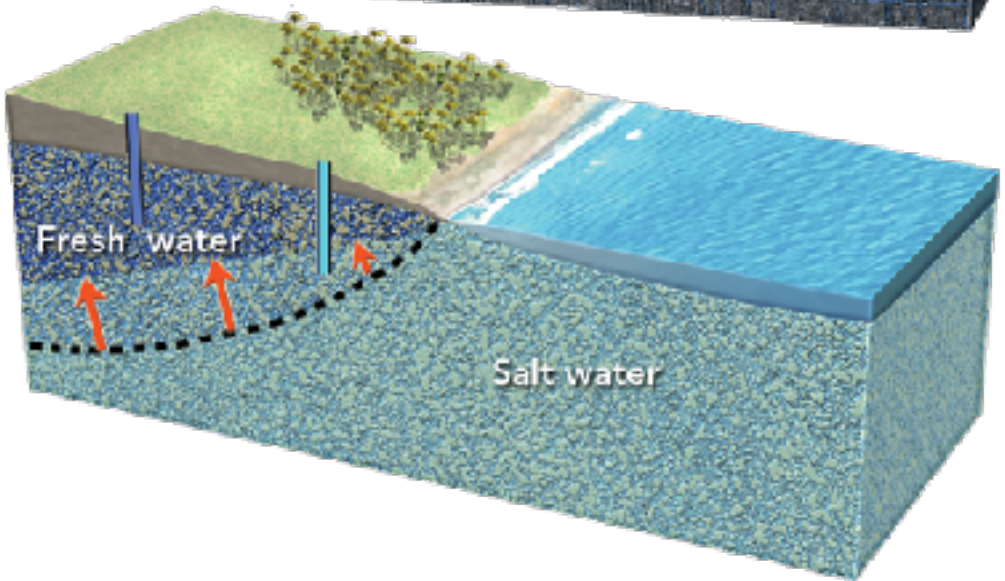
Other Problems of Overpumping

Water table drops, aquifer compacts, land subsidence

Earth fissures



Along coast: freshwater floats on saltwater, so draw in saltwater



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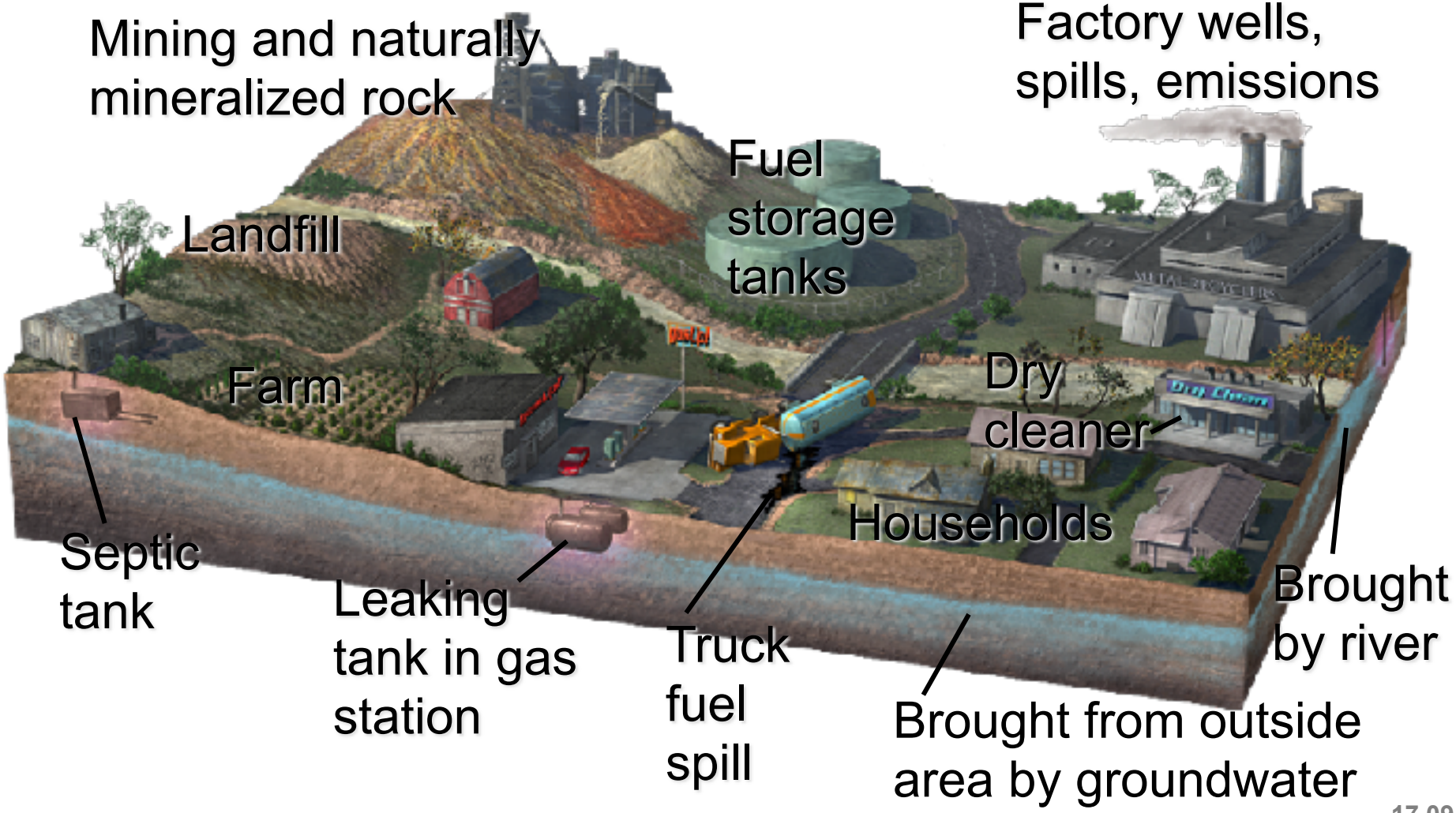
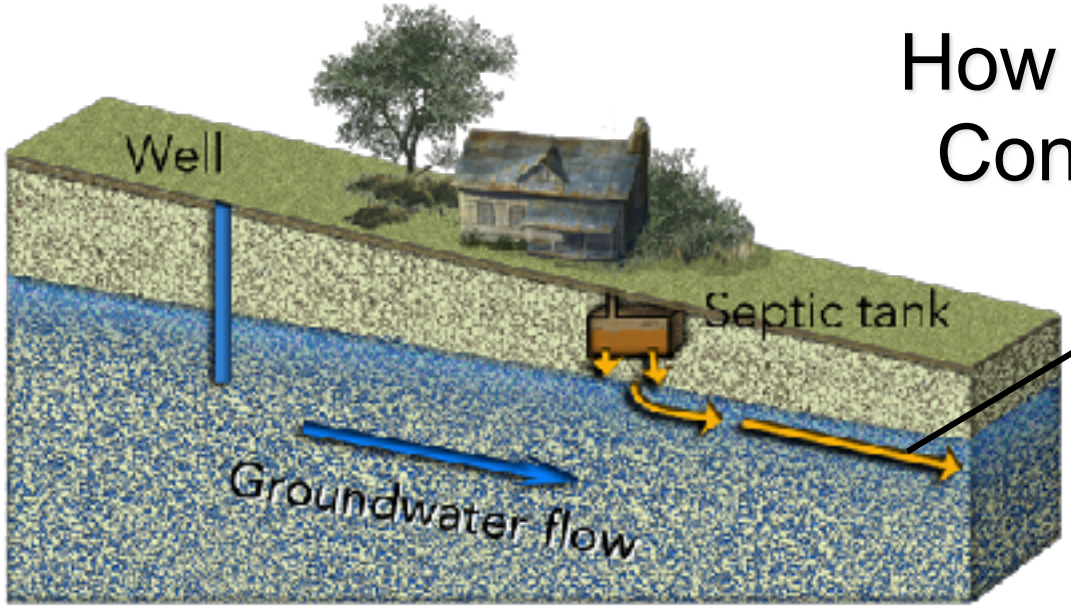
How Can Water Become Contaminated?

Identify possible sources of surface water and groundwater contamination

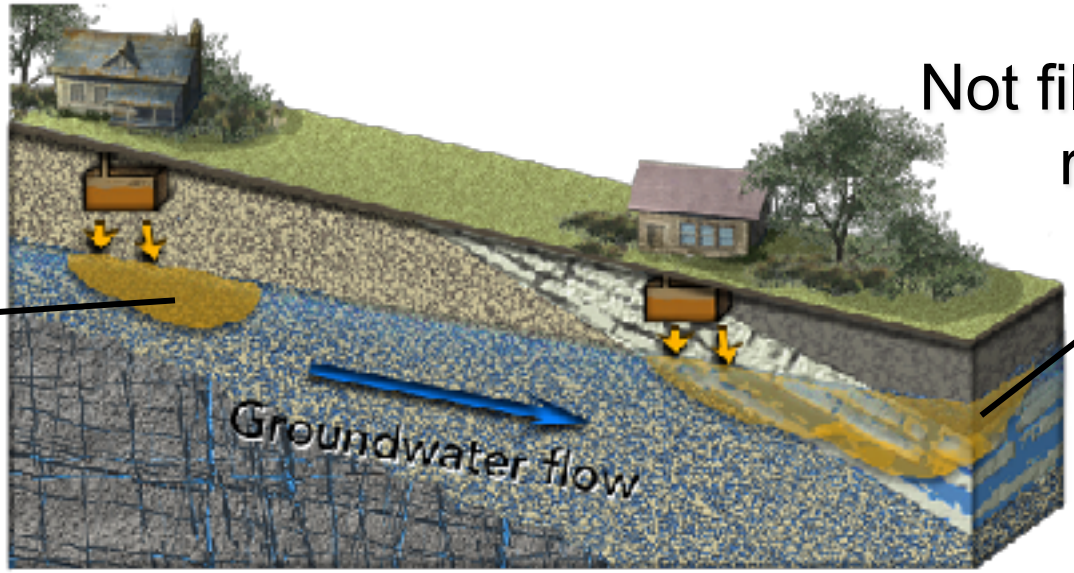


How Does Groundwater Contamination Move?



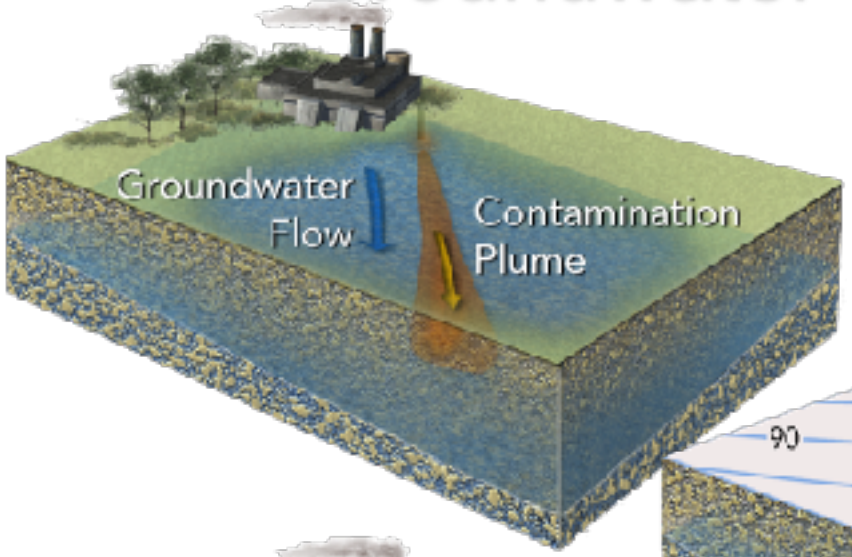
With groundwater down water table

Can be filtered if flows slowly, like through sands

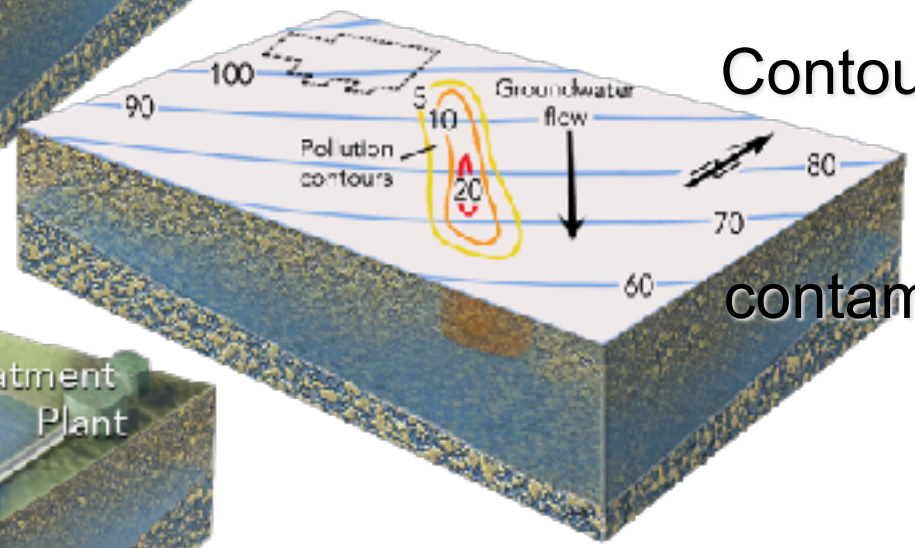


Not filtered if flows rapidly, like in limestone caves

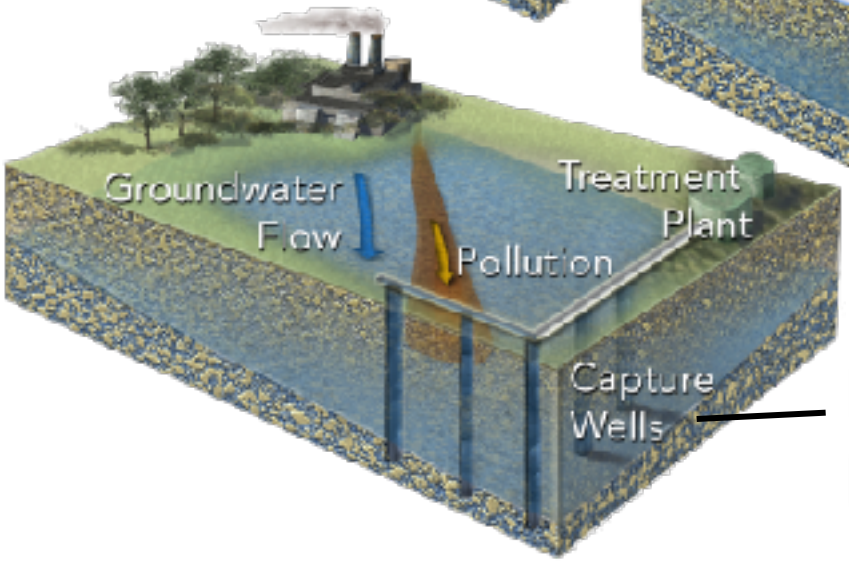
How Do We Track and Remediate Groundwater Contamination?



Spreads out due to diffusion and mixing, forming *contamination plume*

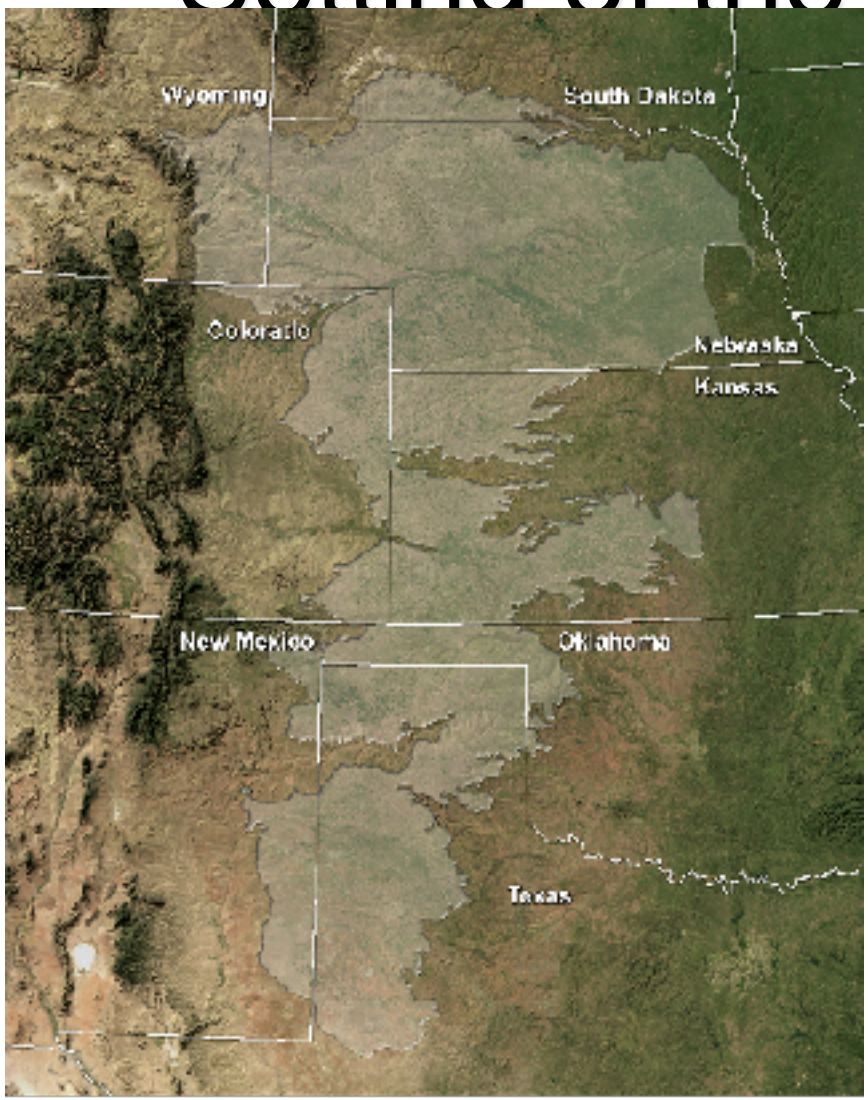


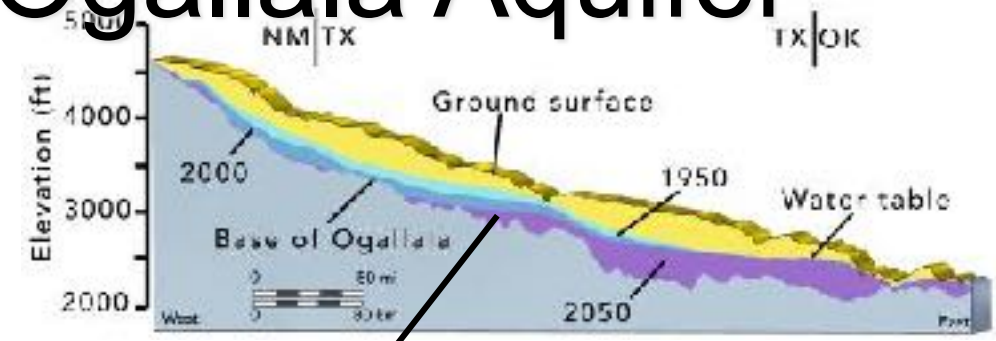
Contour water table and contamination



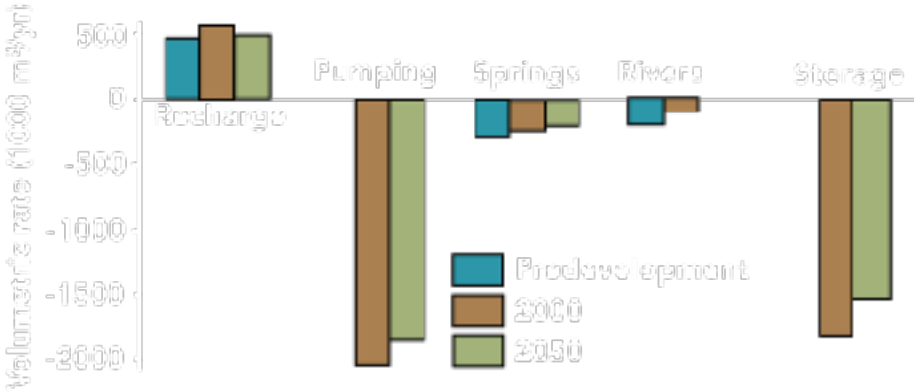
Drill wells to intercept plume, pump and treat water

Setting of the Ogallala Aquifer

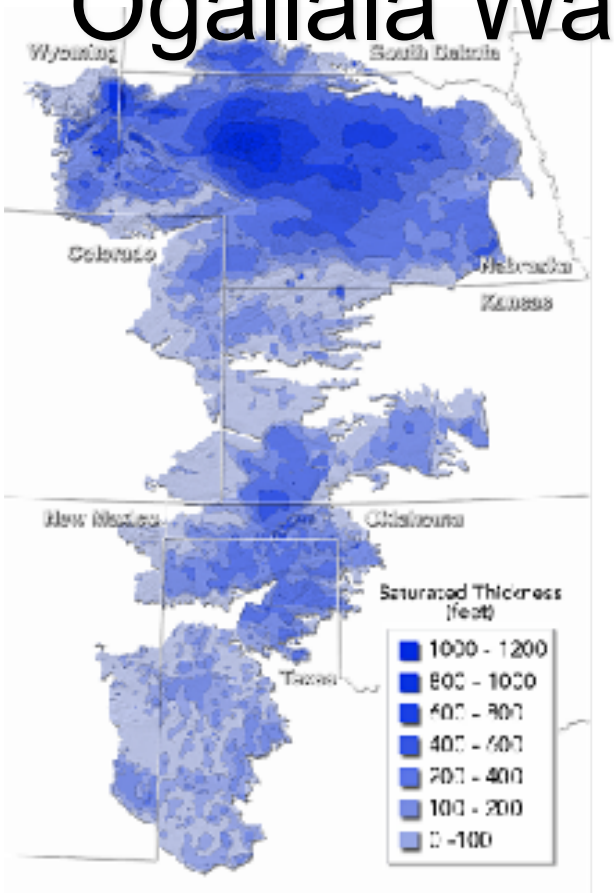




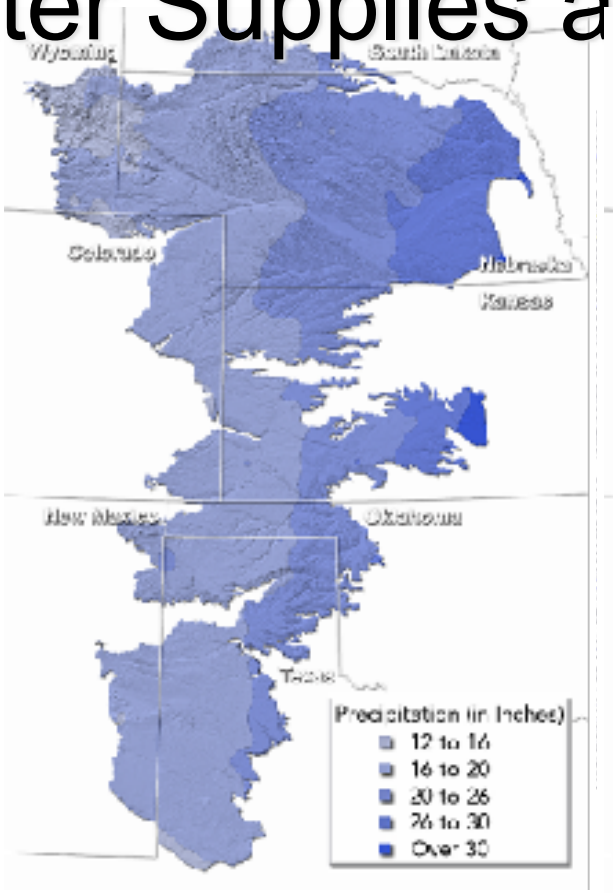
Unconfined aquifer; water levels dropping in south; some parts may run dry (graphs below)



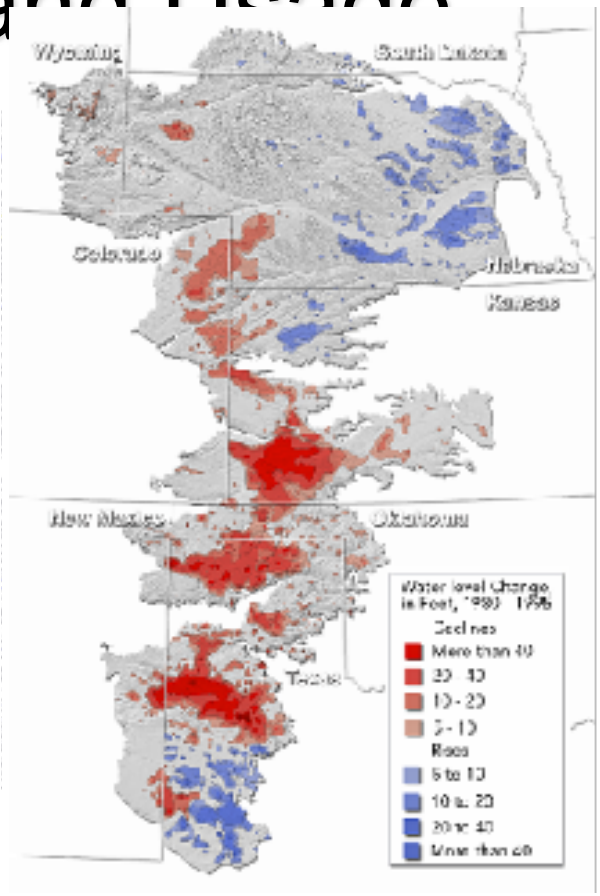
Ogallala Water Supplies and Usage



Thickest in north



More rain in east



Water table decline greatest in south (Kansas & Texas)

Investigation: Who Polluted Water in This Place?

Stratigraphic Section

Basin Fill—Unconsolidated sand and gravel in the lower parts of the valley

Upper Sandstone—Well-sorted, permeable sandstone

Upper Shale—Impermeable, with coal

Sinkerton Limestone—Porous, cavernous limestone

Middle Shale—Impermeable shale

Lower Sandstone—Permeable sandstone

Lower Shale—Impermeable shale

Basal Conglomerate—Poorly sorted with salty water

Granite—Sparsely fractured; oldest rock in area.

Investigation Data Table

Well	Elev. WT	mg/L
A	110	0
B	100	0
C	105	0
D	110	20
E	120	10
F	115	0
G	120	0
H	120	50

Well	Elev. WT	mg/L
I	130	30
J	125	0
K	120	0
L	130	0
M	140	50
N	140	0
O	140	0
P	140	0

Spring	mg/L
S1	50
S2	0
S3	0
S4	0

River	mg/L
R1	0
R2	20
R3	0
R4	0

River	mg/L
R5	0
R6	0
R7	5
R8	5