

# The Names We Have for Water: *“Adjectival Water”*

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*Water has many names, depending on --  
its mineral content:*

**soft water**



**fresh water**



**salt water**



**barackish water**



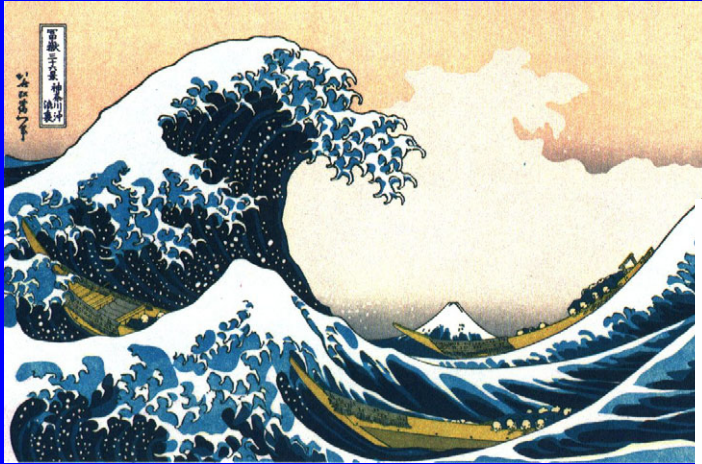
**hard water**





*Water has many names, depending on --  
its physical appearance:*

**rough water**



**still water**



**low water**



**calm water**



**high water**



*Water has many names, depending on --  
how we wear it:*

**rose water**



**toilet water (eau de toilet)**



***“Natural spray”***



# Water has many names, depending on -- how we drink it:

**bottled water**



**carbonated water**



**tonic water**



**branch  
water**



**tumwater**



*Water has many names, depending on --  
how we eat it:*

*According to “Dr. Science,”  
sno-kones are made of...*

*“ground” water*



# Water has many names, depending on -- where we find it:

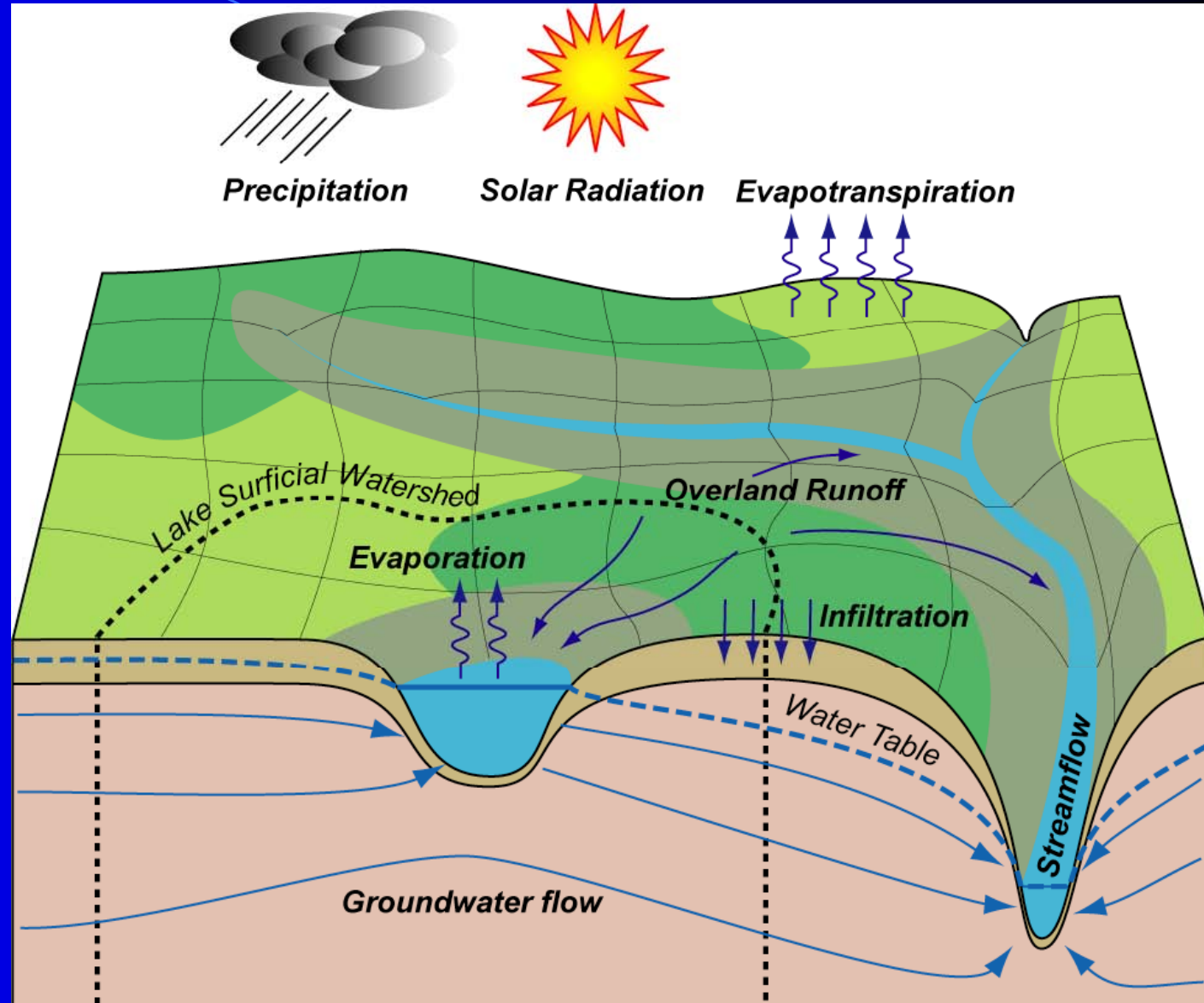
**atmospheric  
water**

**surface water  
(streams, lakes,  
& wetlands)**

**biotic water**

**soil moisture**

**ground water**





*But in the end --  
it is all WATER ...*

*... part of the same  
continuum called the  
water cycle...*

*... with critical  
connections between the  
various pools:*

*e.g., atmospheric water,  
surface water, and  
ground water*





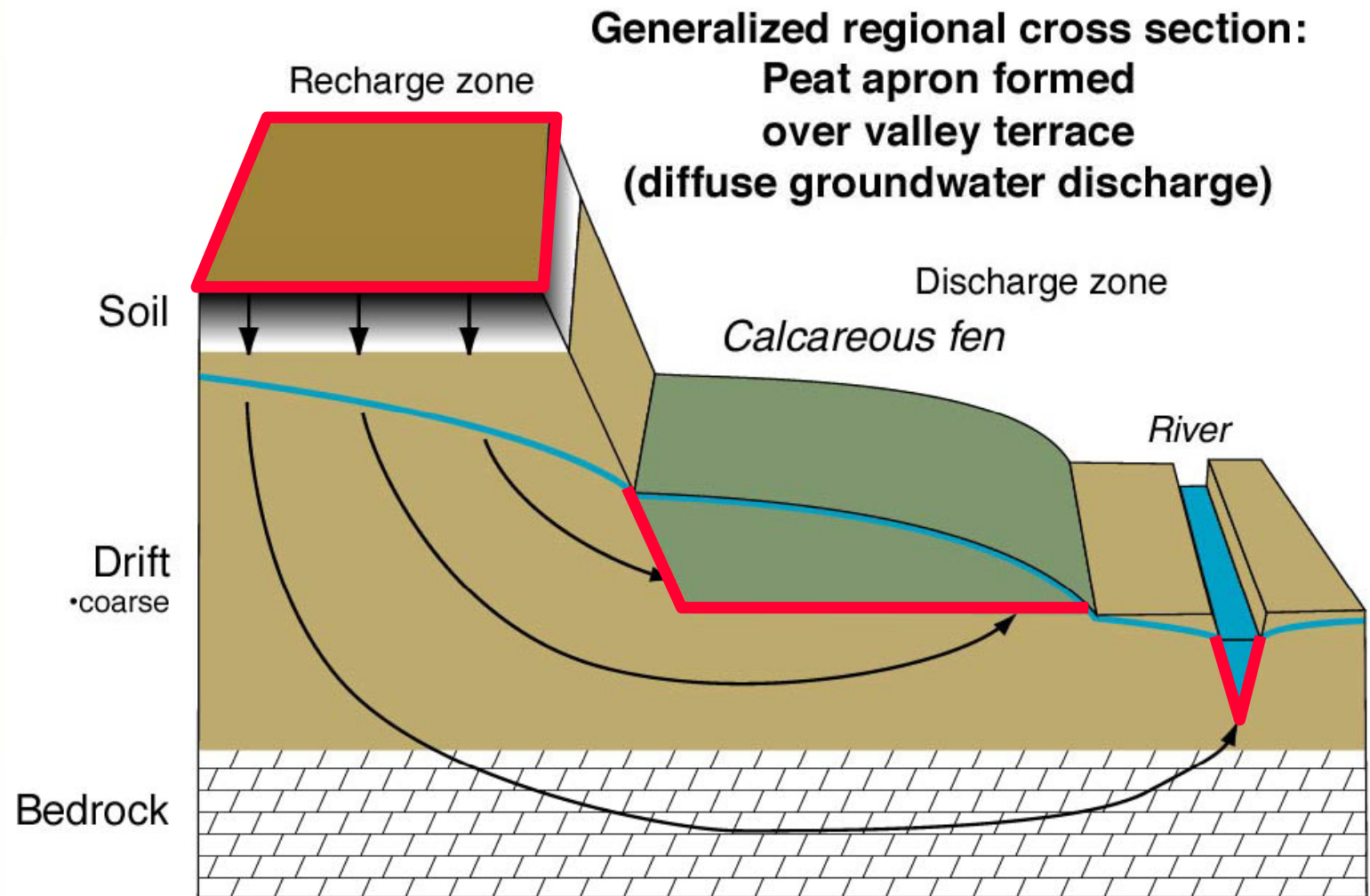
*Why are atmospheric, surface, and ground water critically connected -- chemically?*

**The interfaces are large and chemically significant**

***Carbon is critical --***

**(a) along discharge interfaces in affecting redox-sensitive reactions such as denitrification**

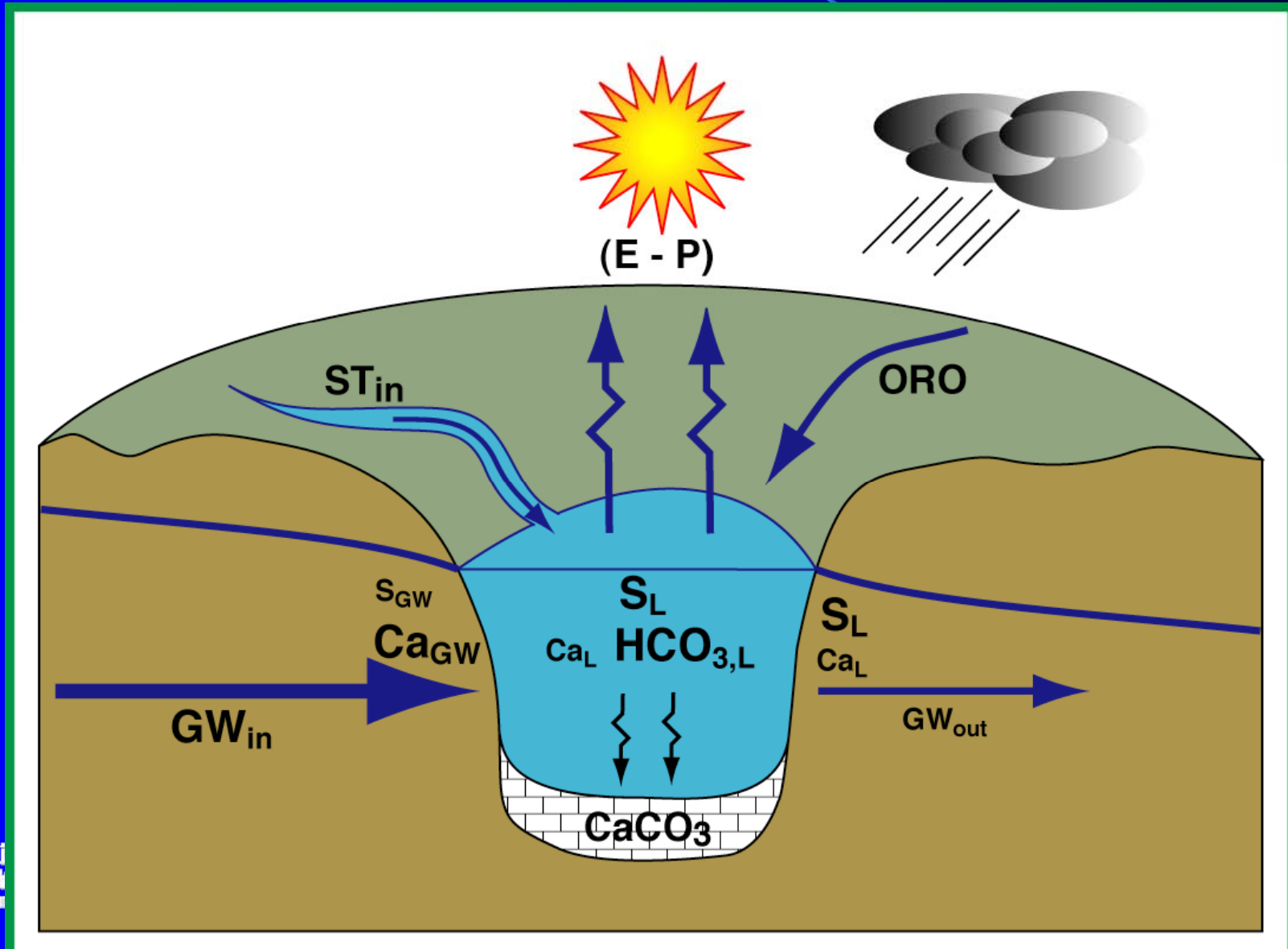
**(b) along recharge interface in soil atmosphere affecting acidity of percolate and ability to dissolve  $\text{CaCO}_3$**



Why are surface water and ground water critically connected -- **chemically**?

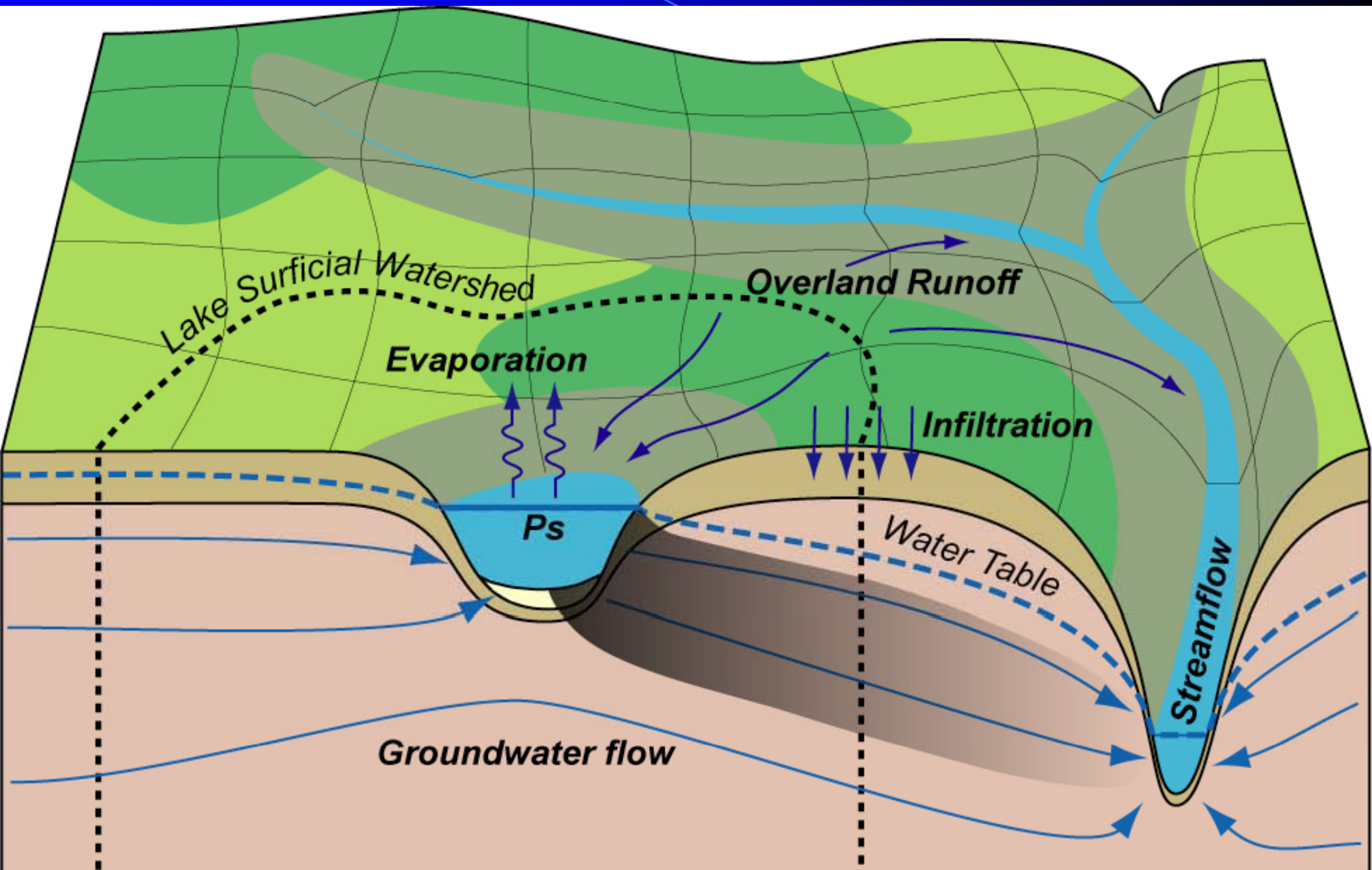
**Sometimes, small fluxes can be critically important**

*For closed-basin lakes in arid climates:  $GW_{out}$  may be a small part of the lake-water budget -- but it is a major control on lake salinity*



Why are surface water and ground water critically connected -- **chemically**?

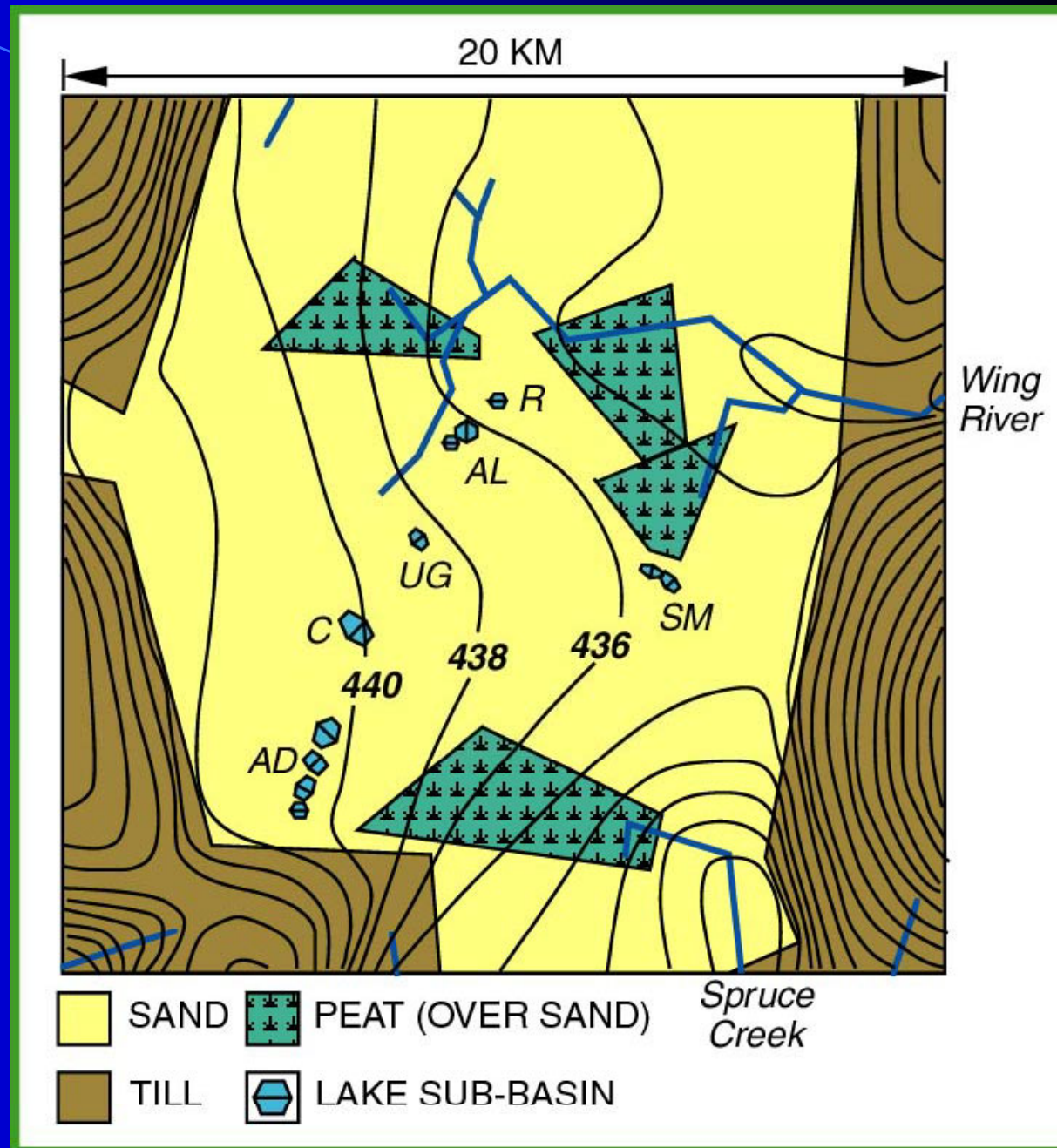
**Water readily mixes by turbulence and dispersion**





## Why are surface water and ground water critically connected -- **physically**?

- Recharge and discharge drive the ground-water flow system -- and these functions occur across the interfaces of aquifers
- Surface-water bodies form the boundary conditions of the ground-water flow field
- Consequently, ground water is the **foundation** of many surface-water bodies
  - Ground-water altitude determines occurrence of perennial lakes, wetlands, & streams
  - Ground-water discharge determines base flows



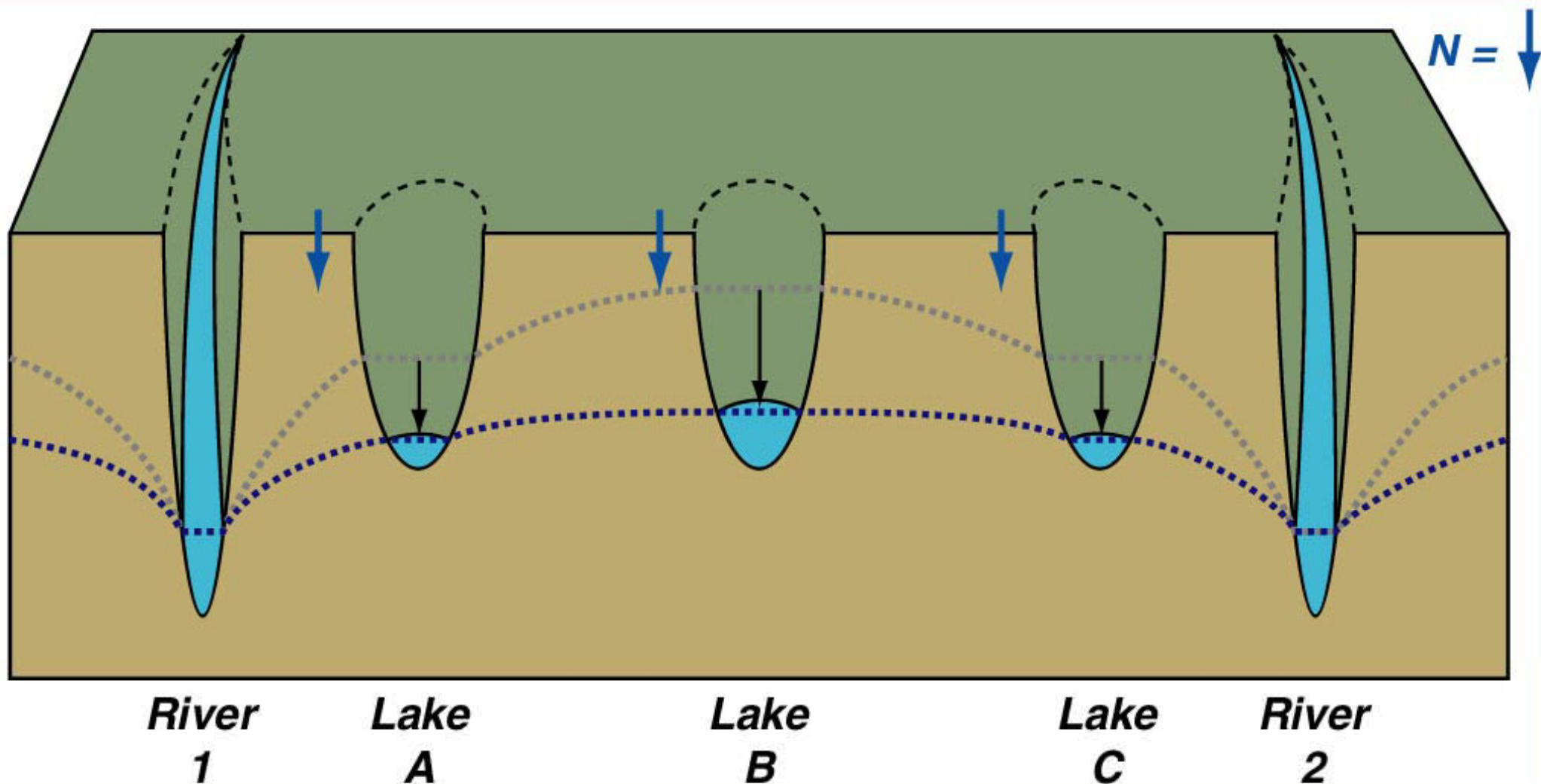
Surface water and ground water critically connected -- **physically**:

**Water-table altitude dependent on:**

- Recharge /  $K$
- Geometry of system

Ground water sustains:

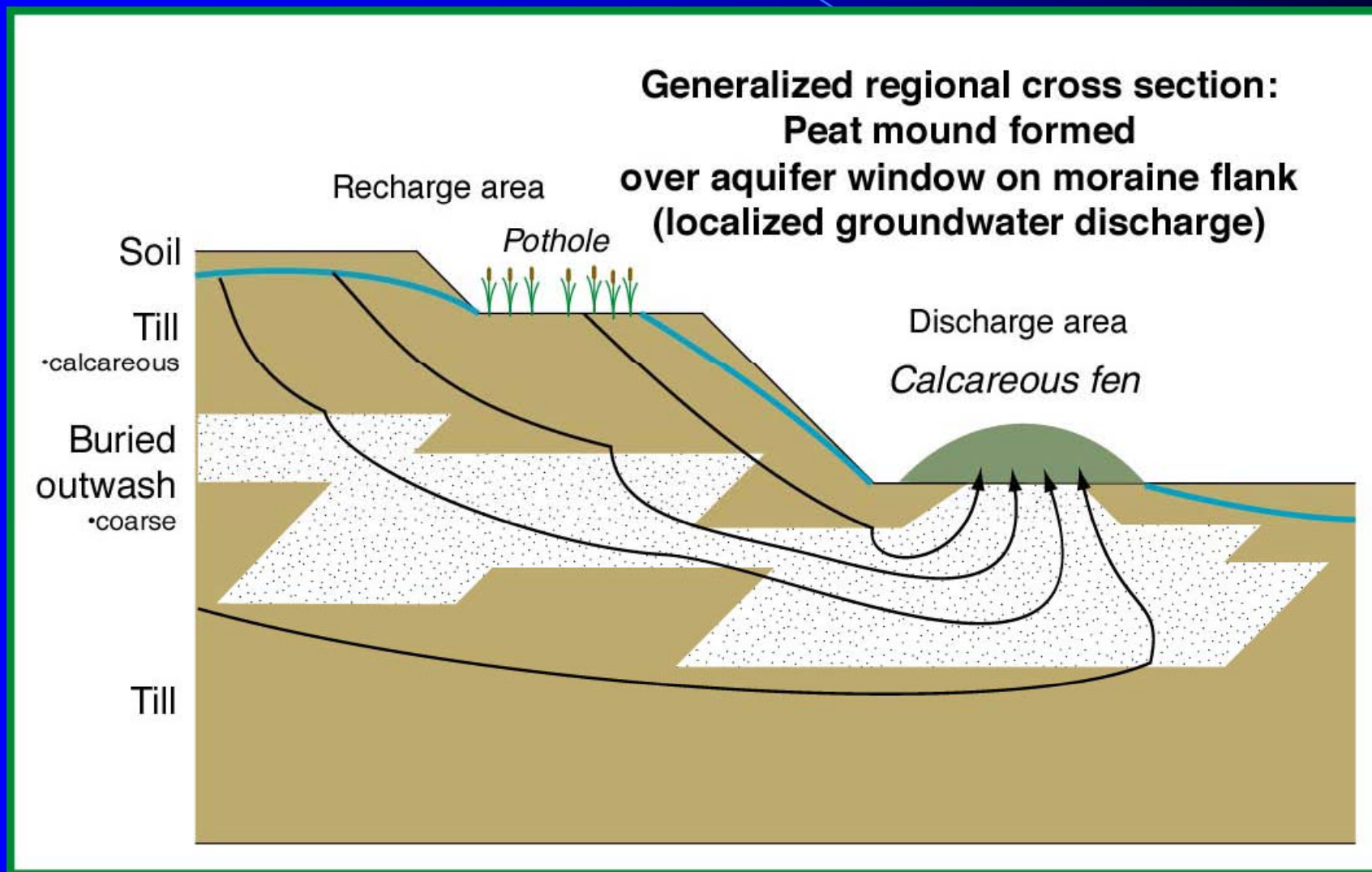
- **closed-basin lake levels**



Surface water and ground water critically connected -- **physically**:

Ground water sustains:

-- **springs and rare wetlands**





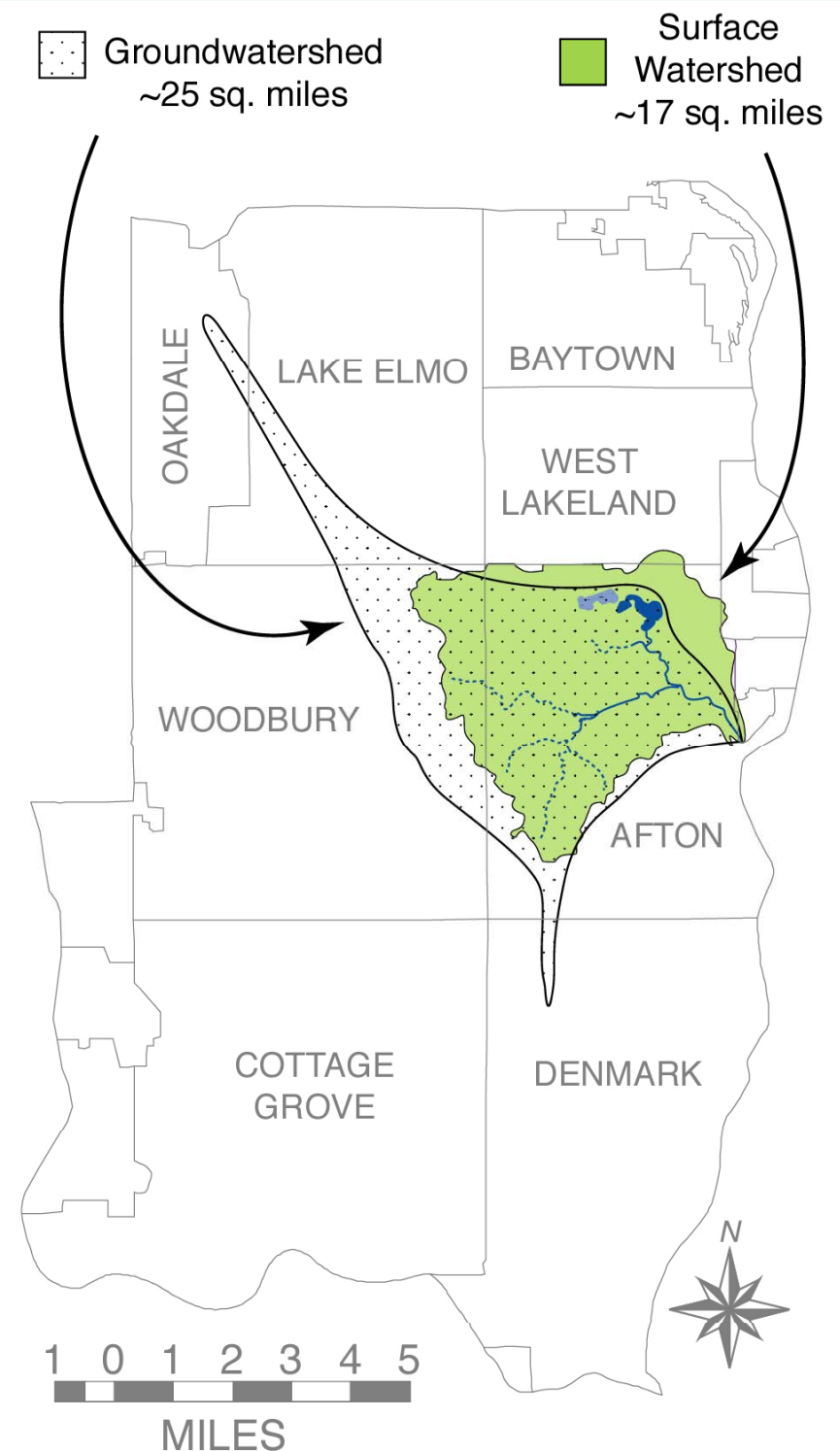
Surface water and ground water  
critically connected -- **physically**:

Ground water sustains:

-- **stream baseflow**  
(n.b., trout streams  
such as Valley Creek):

**$BF = \text{Recharge} * \text{Area}$**

With Stu Grubb, EOR / GeoMatrix;  
much expanded modeling by Ray  
Wuolo, Barr Eng.



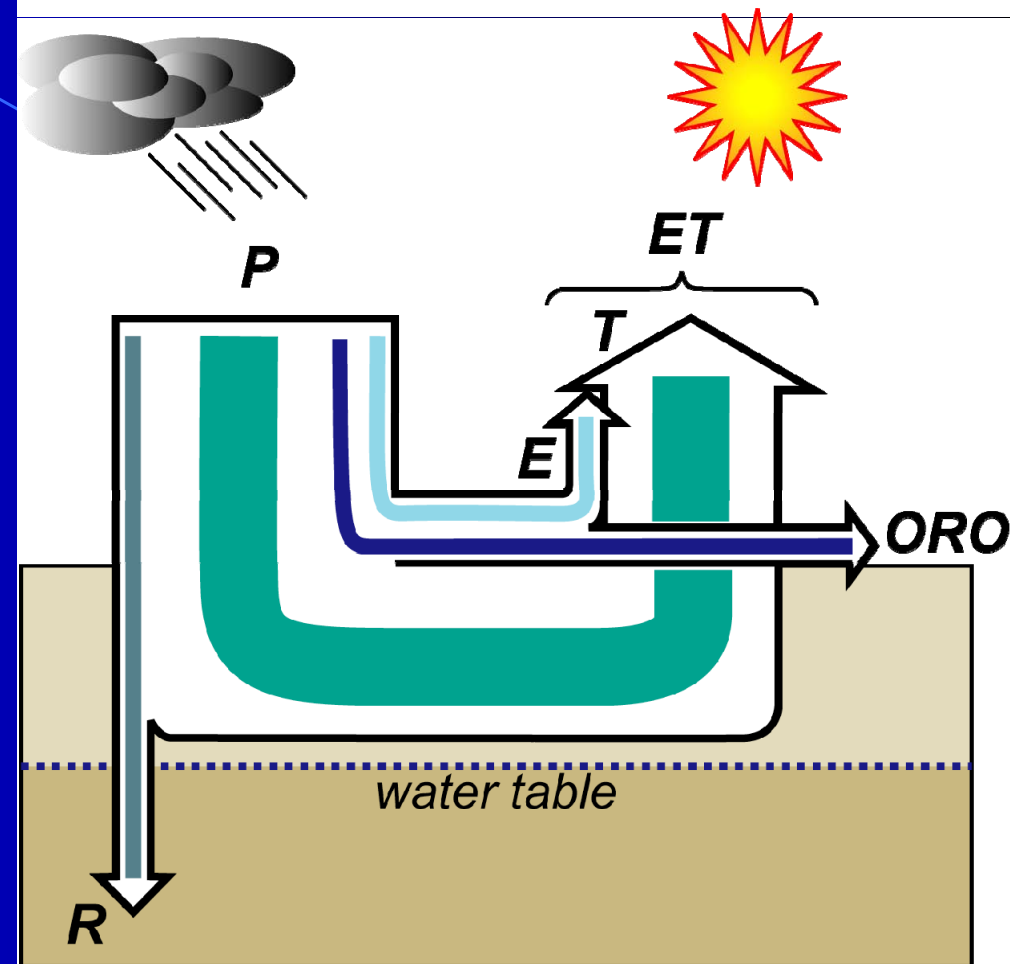
Why are surface water and ground water critically connected -- physically?

Recharge is commonly a **small residual** of much larger  $P$  and  $ET$  values.

Consequently:

- ground water is a limited resource
- a small change in either  $P$  or  $ET$  results in a BIG change in  $R$ ...

## Land-Surface Water Balance



$P$  = precipitation  
 $R$  = groundwater recharge  
 $E$  = evaporation  
 $T$  = transpiration  
 $ET$  = evapotranspiration  
 $ORO$  = overland runoff

# *The Names We Have for Water: **Conclusions***

- The connections between ground water and surface water are critical...
  - Chemically
  - Physically
- Management of surface-water resources requires an understanding of ground-water resources.