Workshop 1

Our Groundwater and Surfacewaters are Connected and We are What We Drink

Hosted by:
Lackawanna County Conservation District

Sponsored by:
Pocono Northeast RC&D Council
Through the C-SAW Program

Funded by: The PADEP

Growing Greener Program

Pocono Northeast
Resource Conservation & Development Council

B.F. Environmental Consultants Inc.
Environmental Scientists, Hydrogeologists, & Environmental Education Specialists
Located in Northeastern Pennsylvania

Project Sponsors (Providing In-kind Support to This Effort)

- Pocono Northeast Resource Conservation & Development Council
  http://www.pnercd.org
- **Lackawanna County Conservation District**
  http://www.lccc.net
- BF. Environmental Consultants Inc
  http://www.bfenvironmental.com

CSAW
Consortium for Scientific Assistance to Watersheds

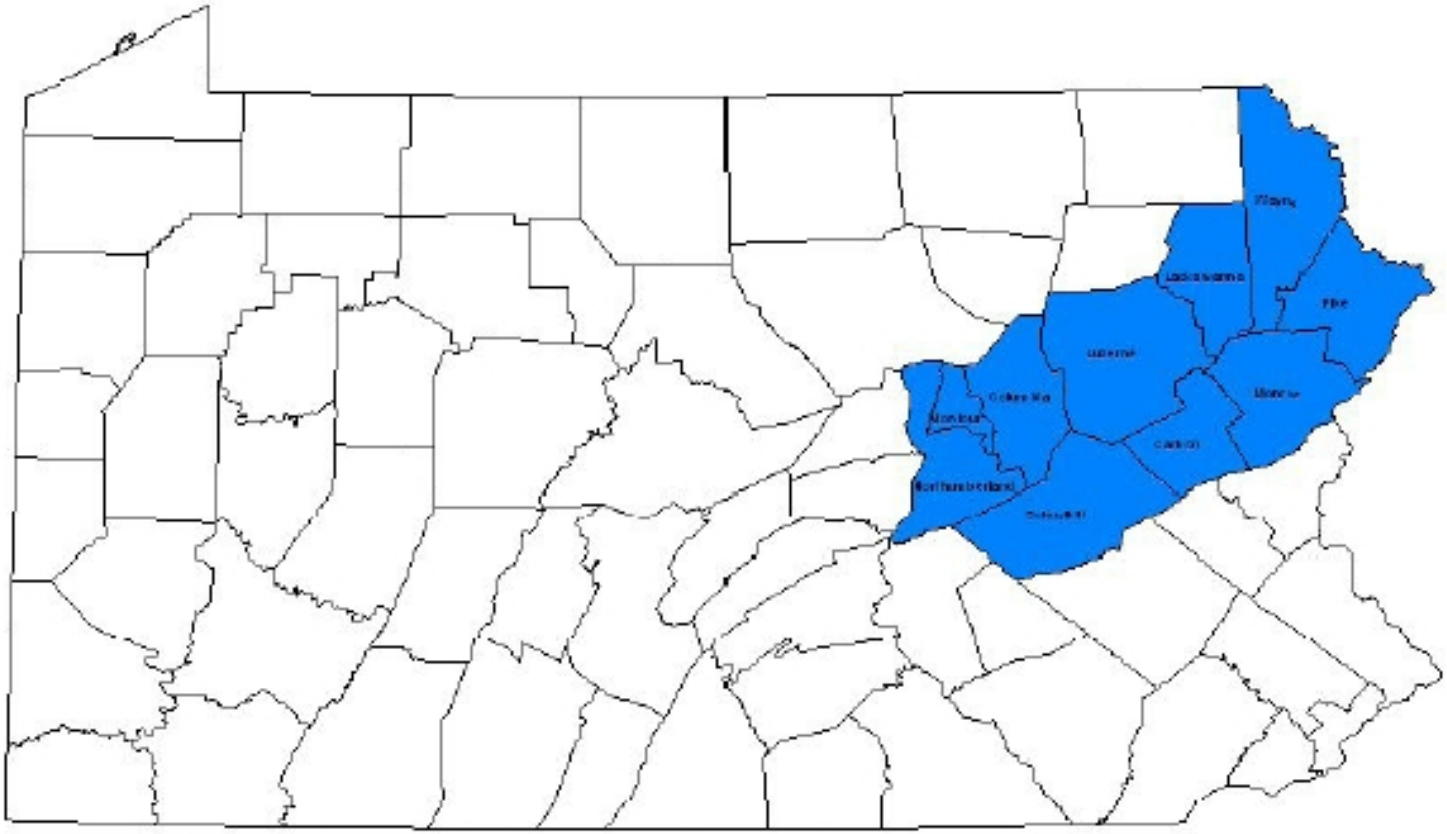
Project Managed by
The Pocono Northeast RC&D Council

- **The Mission:** to enhance and improve the ecological, cultural, and economic characteristics of the area through projects and programs that promote the management, protection, and utilization of the area's resources.
- http://www.pnercd.org

Pocono Northeast
Resource Conservation & Development Council

PNERCD

Coverage Area



Serving the Following Counties in Pennsylvania: Carbon, Columbia, Lackawanna, Luzerne, Monroe, Montour, Northumberland, Pike, Schuylkill, and Wayne

Pocono Northeast
Resource Conservation & Development Council

The Council

- The Council is a nonprofit IRS 501c3 organization .
- The Council Board is composed of concerned citizens and stakeholders that work to improve and promote the management, protection, economic development, and utilization of the area's resources

Pocono Northeast
Resource Conservation & Development Council

PNERCD

C-SAW -Areas of Assistance

- **Watershed Specific Technical Assistance**
  - Includes Oil & Gas Issues
  - Education Programs
  - Watershed Education and Stormwater Management
- **Mentoring** – Intensive long-term assistance
- **Quality Control** and **Quality Assurance**

Consortium for Scientific Assistance to Watersheds

C-SAW Web Site Assistance is Free

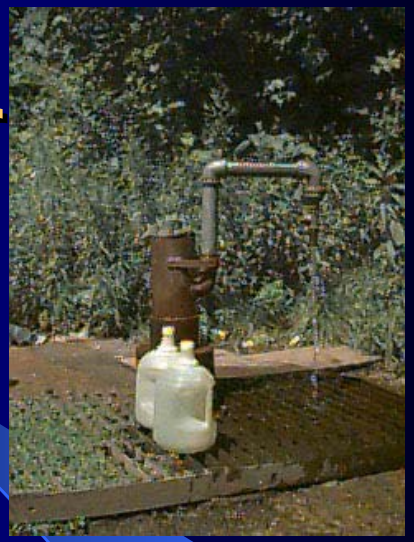
Pocono Northeast
Resource Conservation & Development Council

http://www.pnercd.org

B.F. Environmental Consultants Inc.

- Professional Consulting Services in the areas of water quality, soils, stormwater, geology, aquifer analysis, and land-development.
- Baseline – Chain-of-Custody
- Expert Testimony
- Water Treatment Process/ Product Development
- http://www.bfenvironmental.com

Water-Research Center



Education and Outreach Program funded by

B.F. Environmental Consultants Inc.

Outreach Programs

- Environmental and Professional Education and Training for Citizens and Local Municipalities
- Water Quality Help Guides – Information Library
- Community and Business Outreach Programs
- Low Cost – Informational Water Testing Program with National Laboratory
- Citizen Monitoring Programs- Developing Low Cost Water Quality Sensors

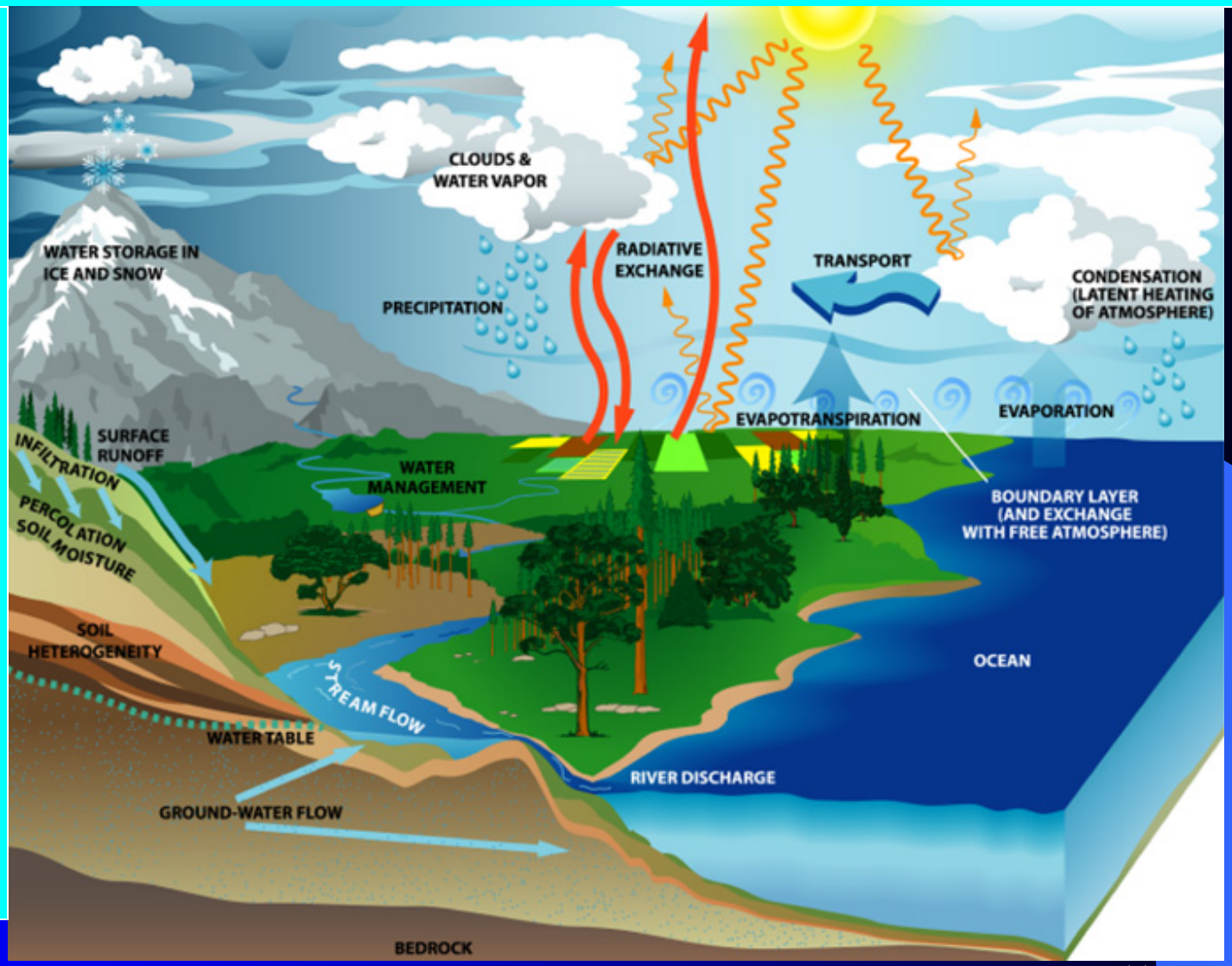
Website: http://www.water-research.net


The
Water
Cycle

Components of the Water Cycle

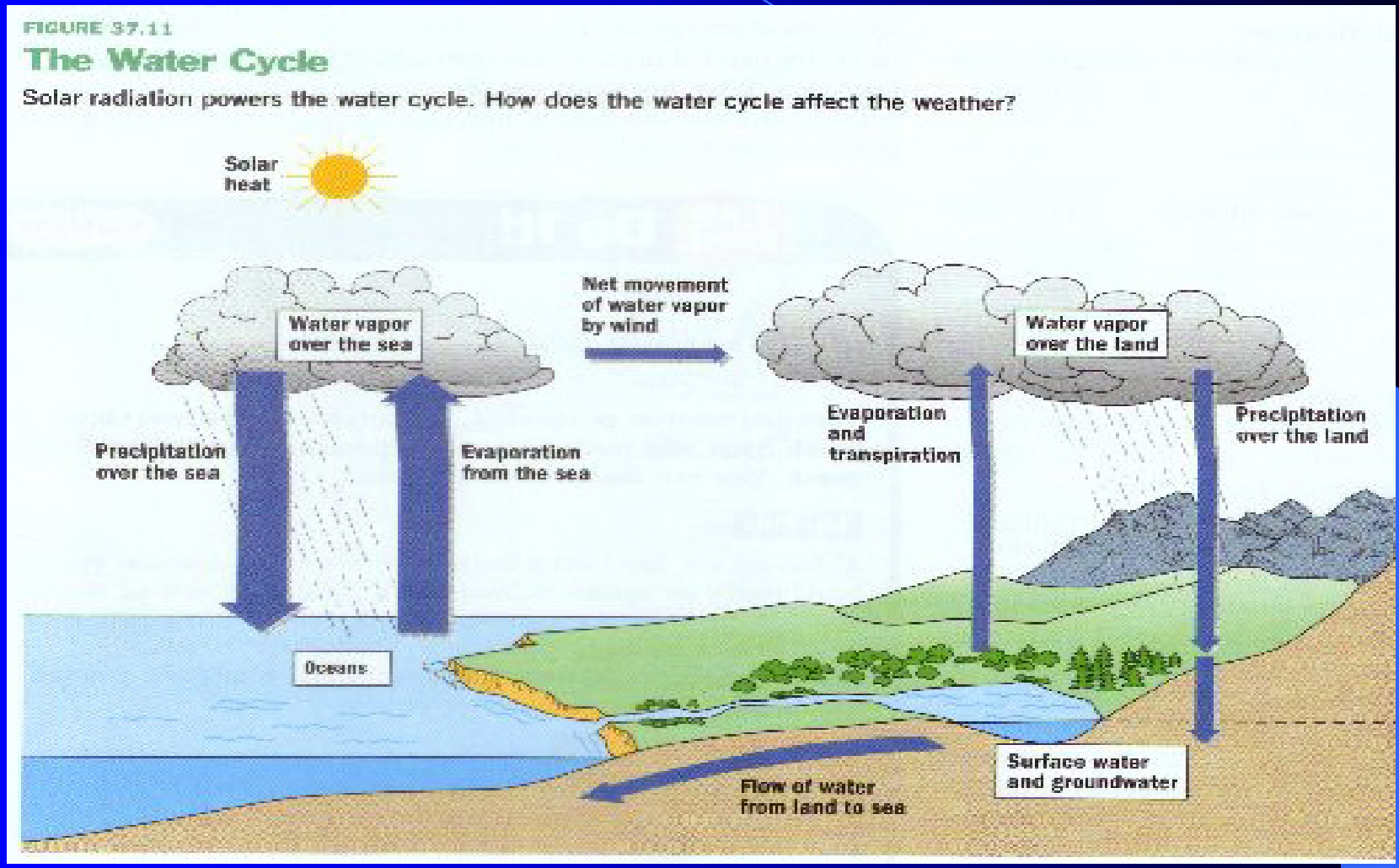
<u>First The Ins</u>
Solar Energy Input
Precipitation
Condensation
Well Injection
Irrigation

<u>The Outs</u>
Evaporation
Transpiration
Infiltration
Percolation
Runoff
Groundwater Flow
Surfacewater Flow
Well Pumping



Water Cycle

The Water Cycle
Powered by the Sun- Solar Power



Precipitation

Types of Precipitation

Natural

Rain

Snow

Ice

Hail

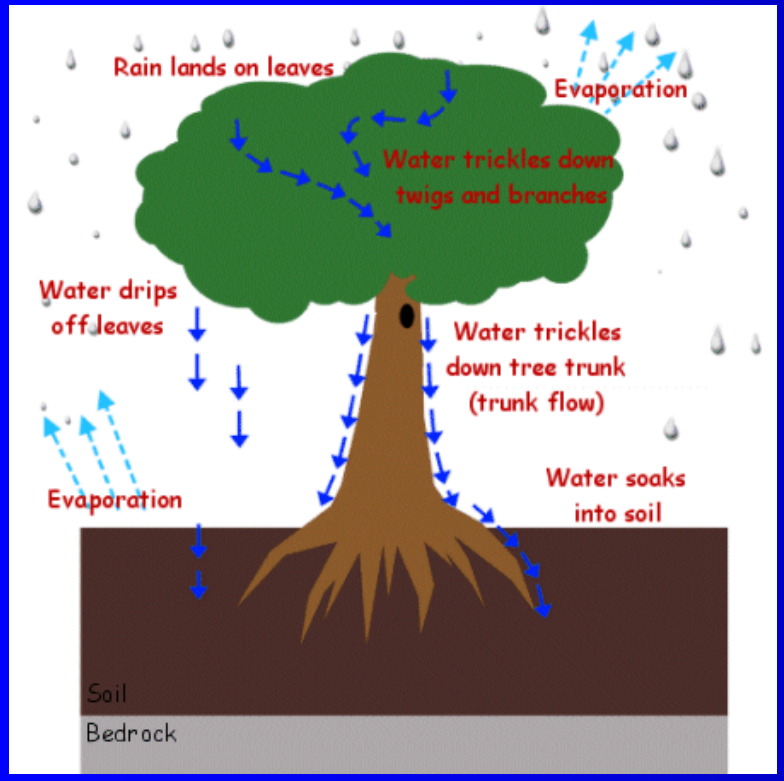
Condensation/ Dew

Man-Made

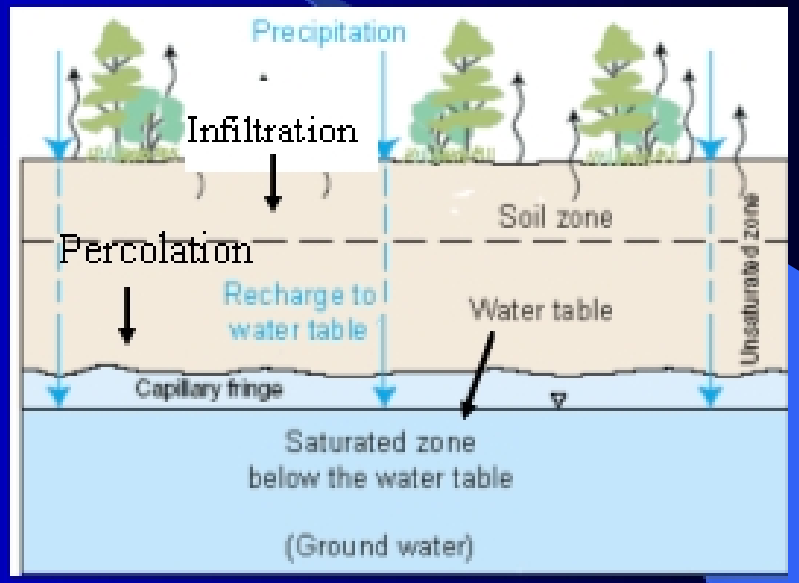
Irrigation

Wastewater Applications

Interception
Infiltration / Percolation



Canopy Interception



Infiltration- Movement Water Into Soil

Percolation - Water Movement Through the Soil

Evaporation / Transpiration Evapotranspiration

Evaporation- Driven by Thermal Gradient and Moisture Difference Sublimation !

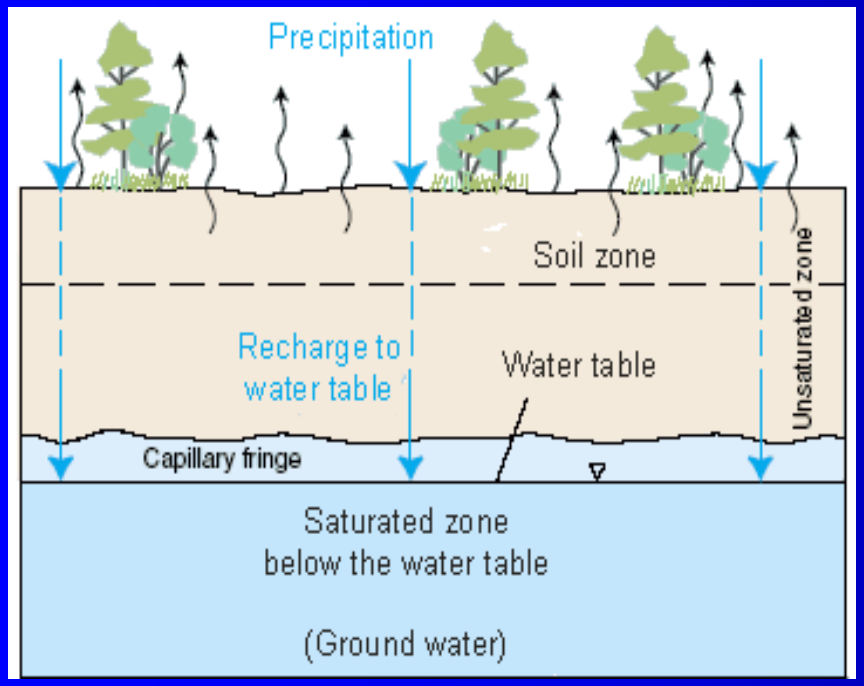
Runoff / Overland Flow

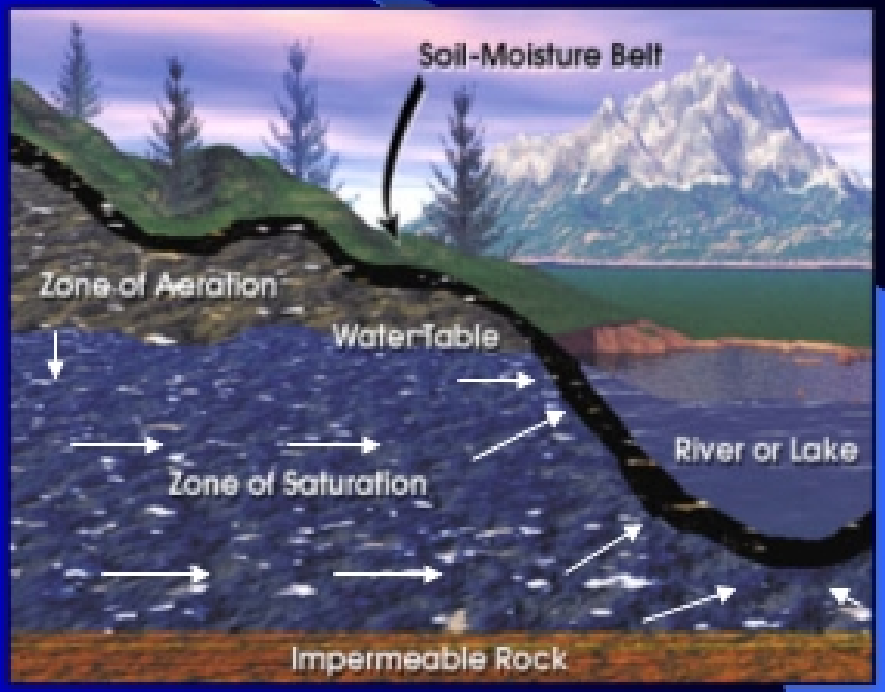
Uncontrolled Runoff
Causes Erosion

Low Infiltration
Causes - Overland Flow- Loss
Organic Material

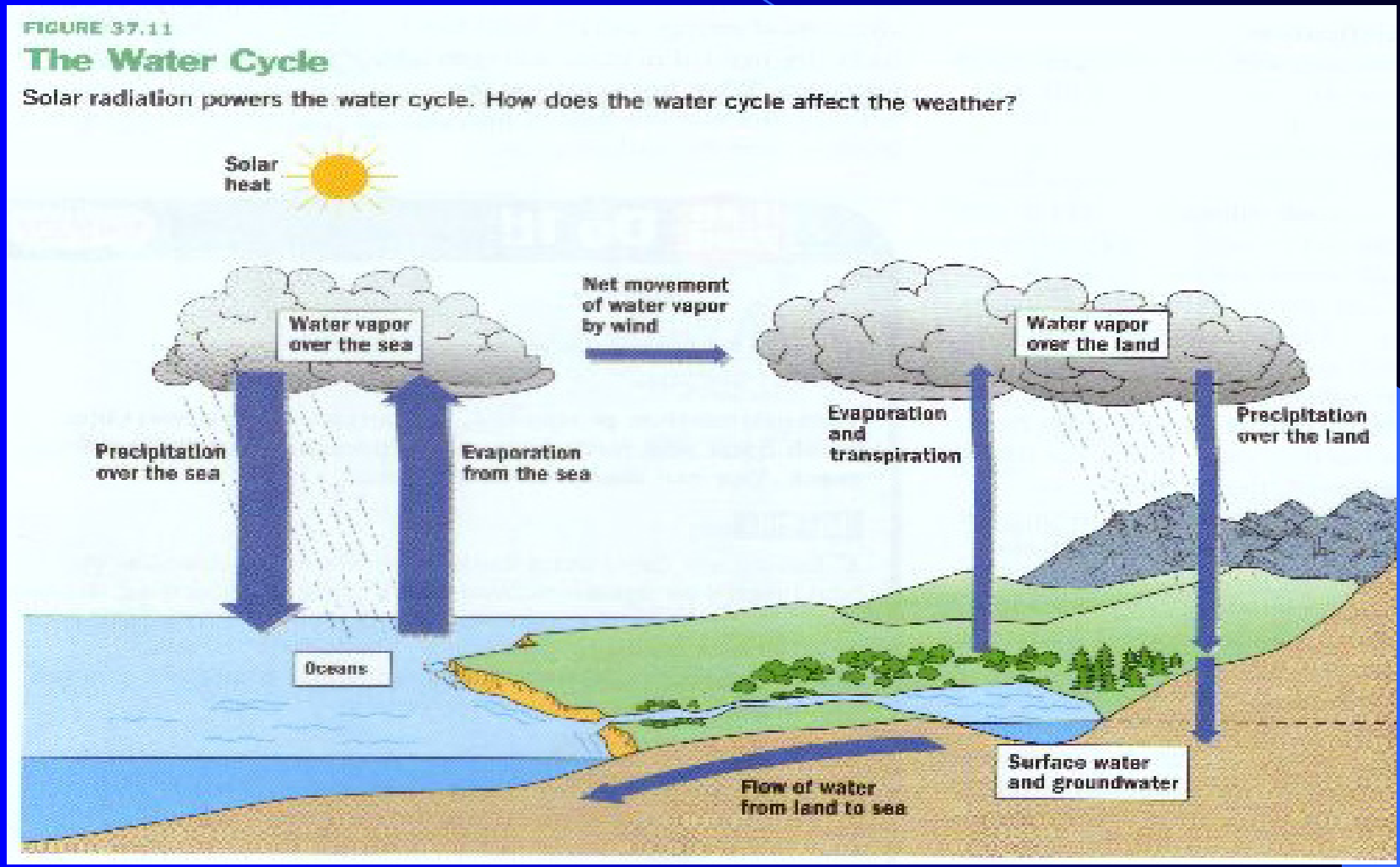
When Rainfall Rate Exceeds Infiltration Runoff is Generated

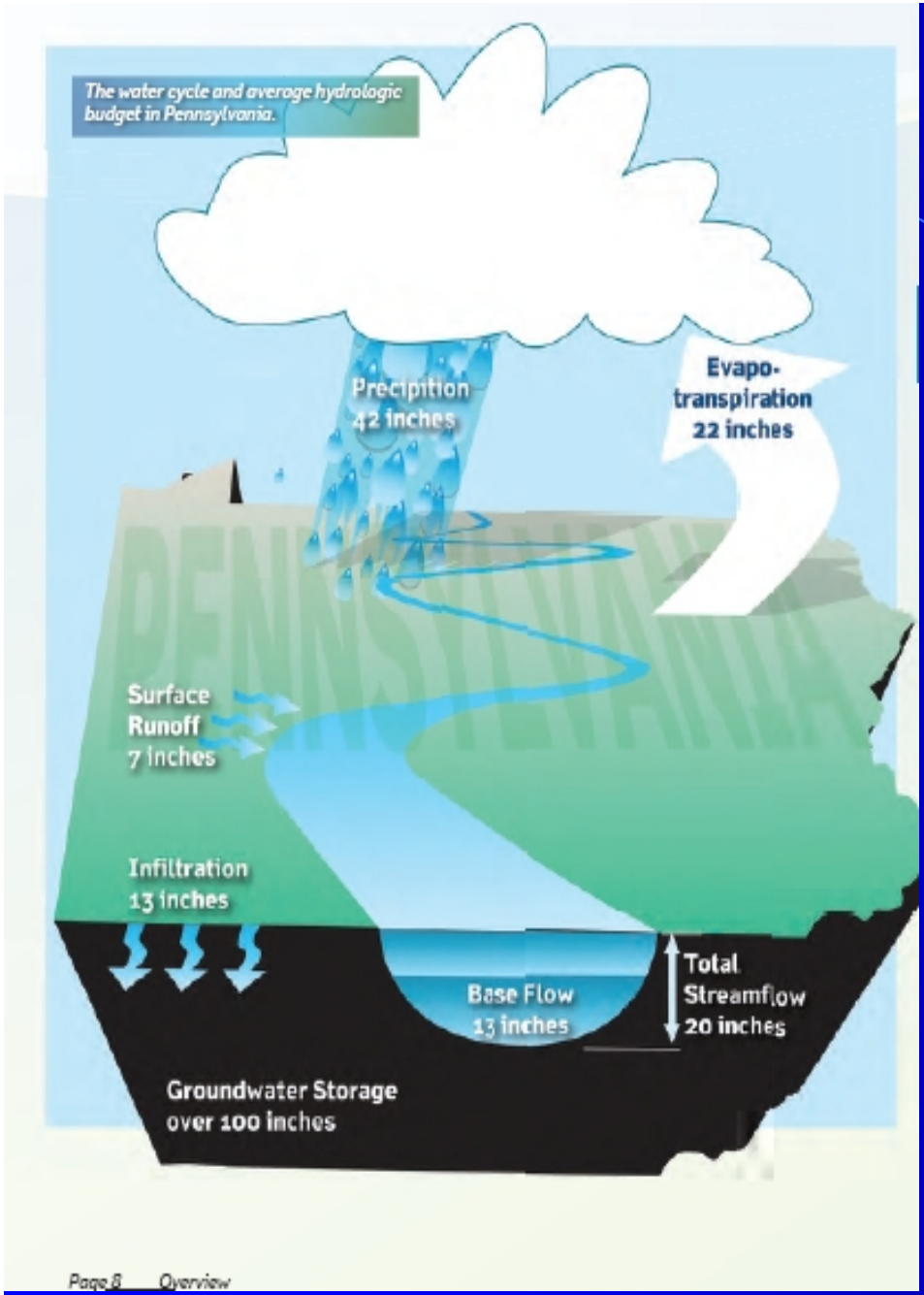
Groundwater
Zone of Saturation





The Water Cycle
When We Put this All Together for PA





Water Budget for PA

In

Precipitation – 42 inches

Out

Evapotranspiration – 22”

Total Streamflow – 20”

Baseflow – 13”

Surface Runoff – 7”

Therefore, 65% of streamflow is groundwater discharge.

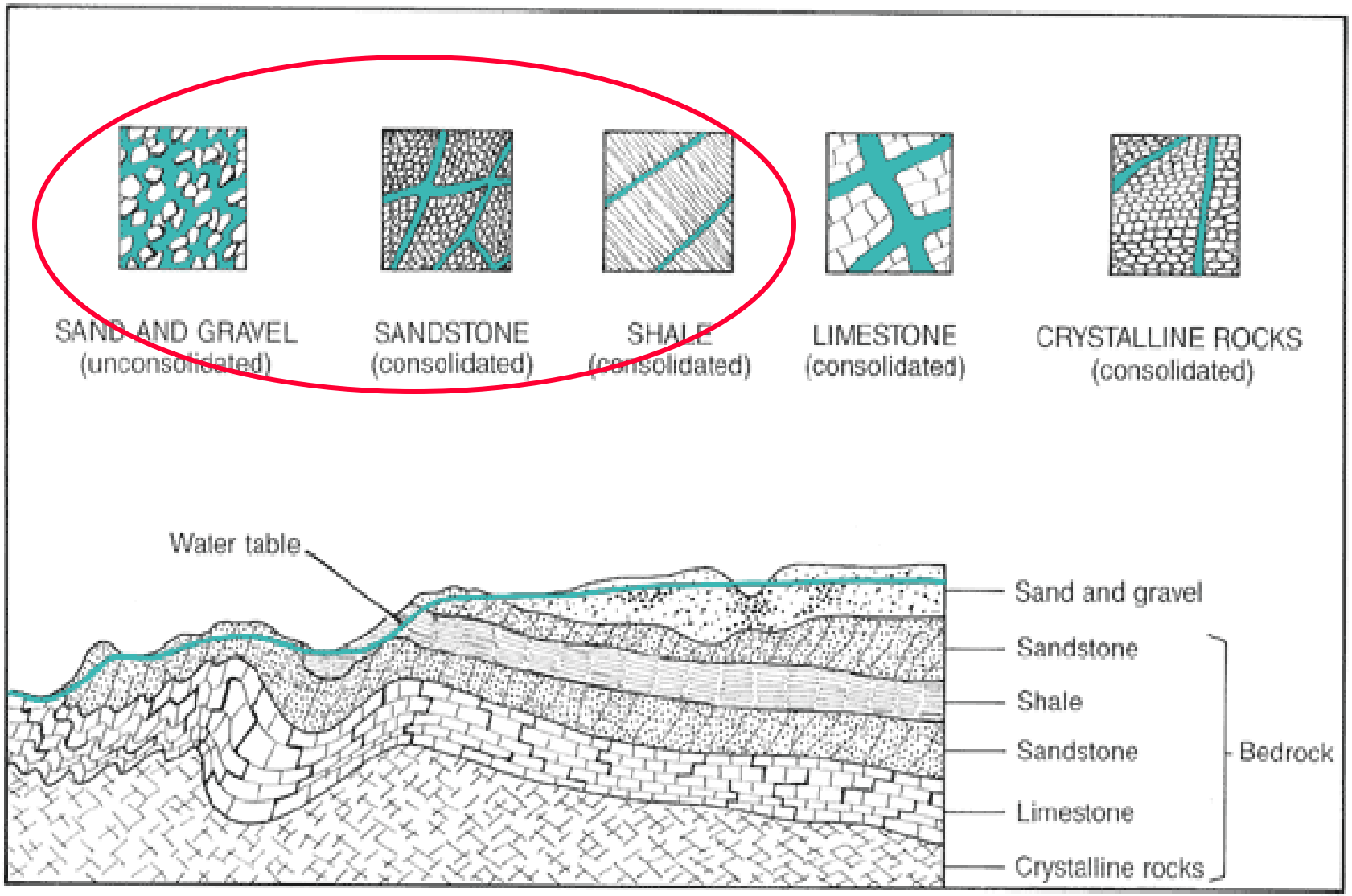
Other

Storage in Groundwater

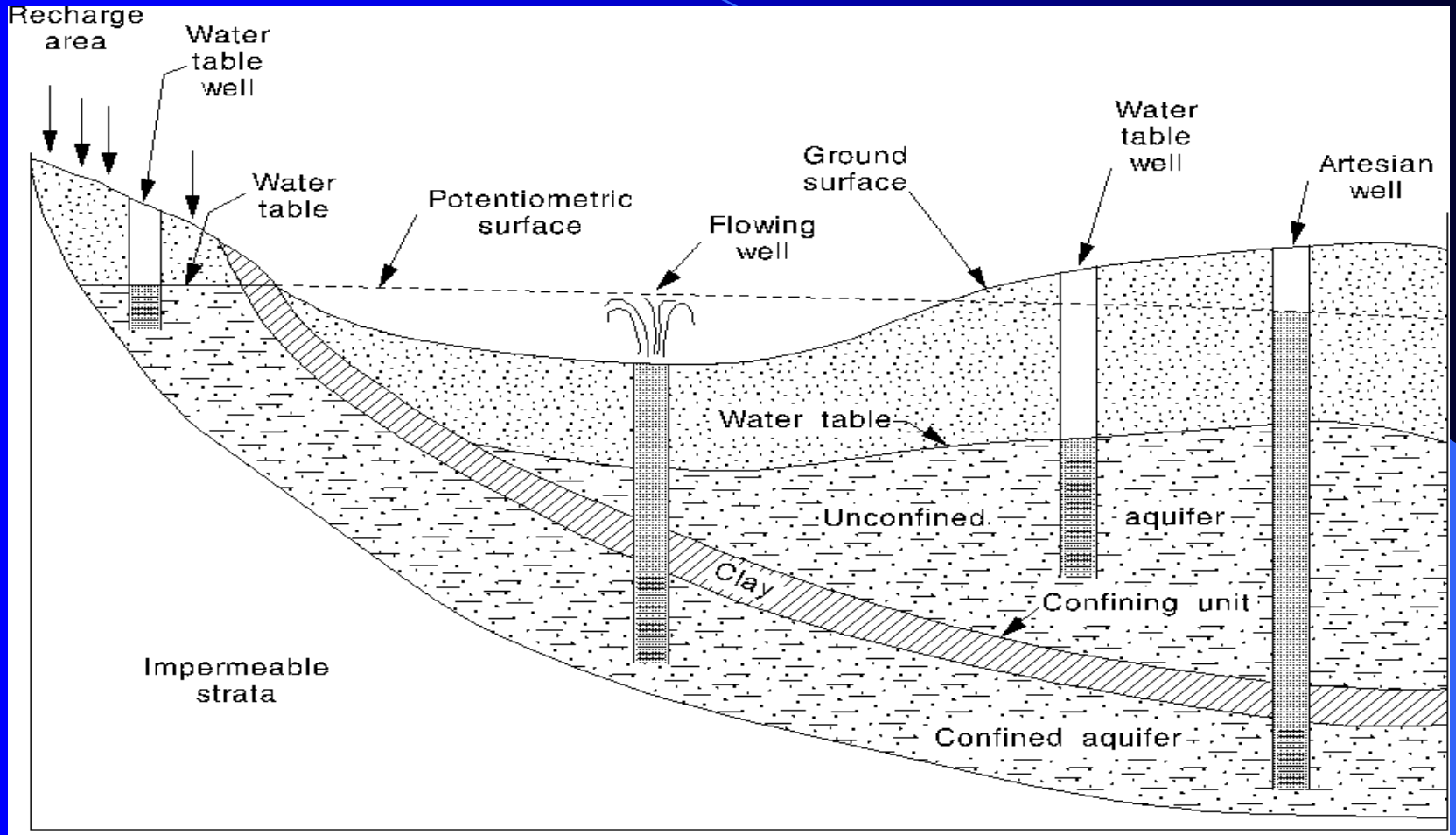
Aquifers over 100 inches*

* This is our “Water” Cushion.

Primary Aquifers in PA

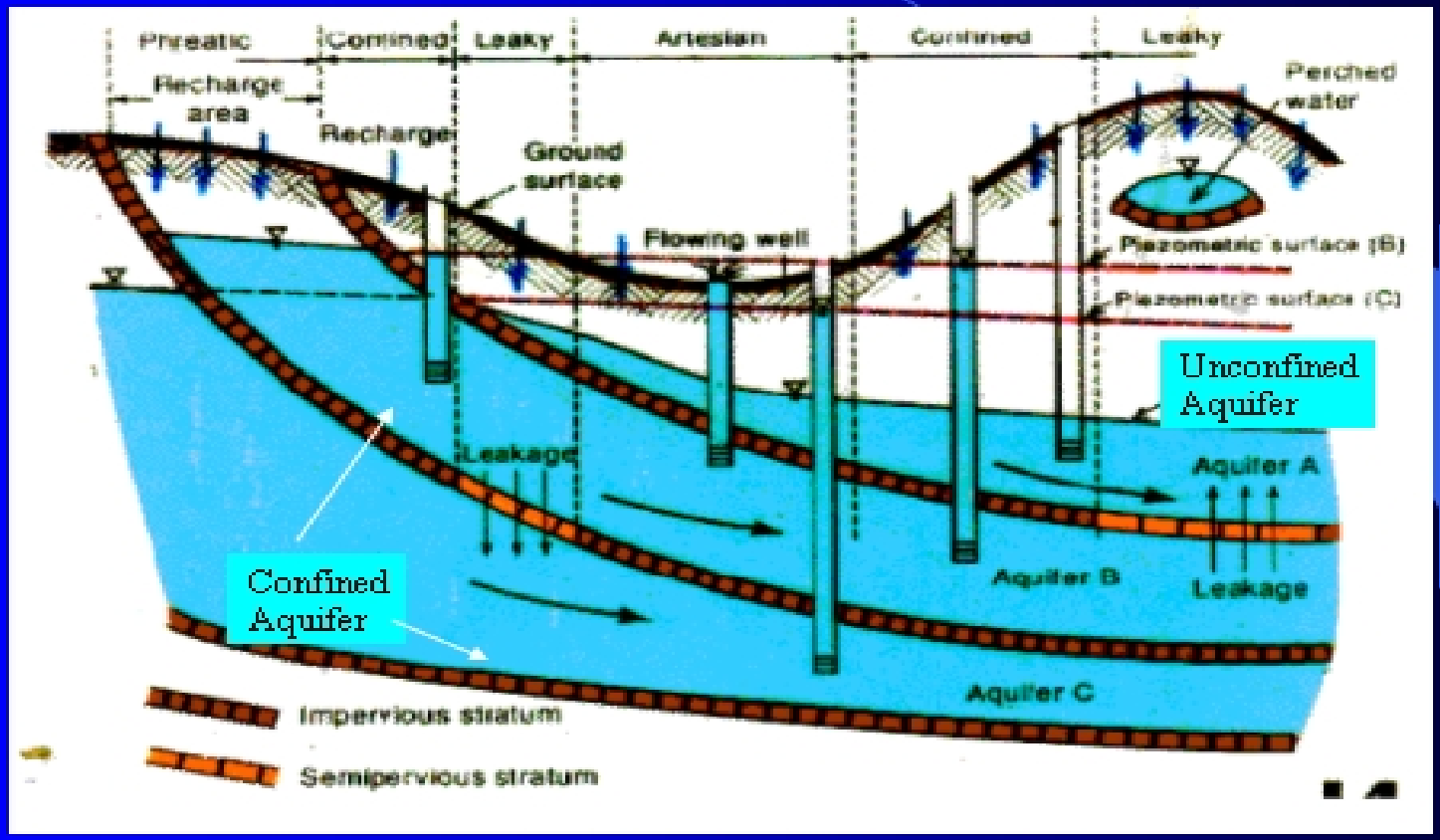


Well Geology

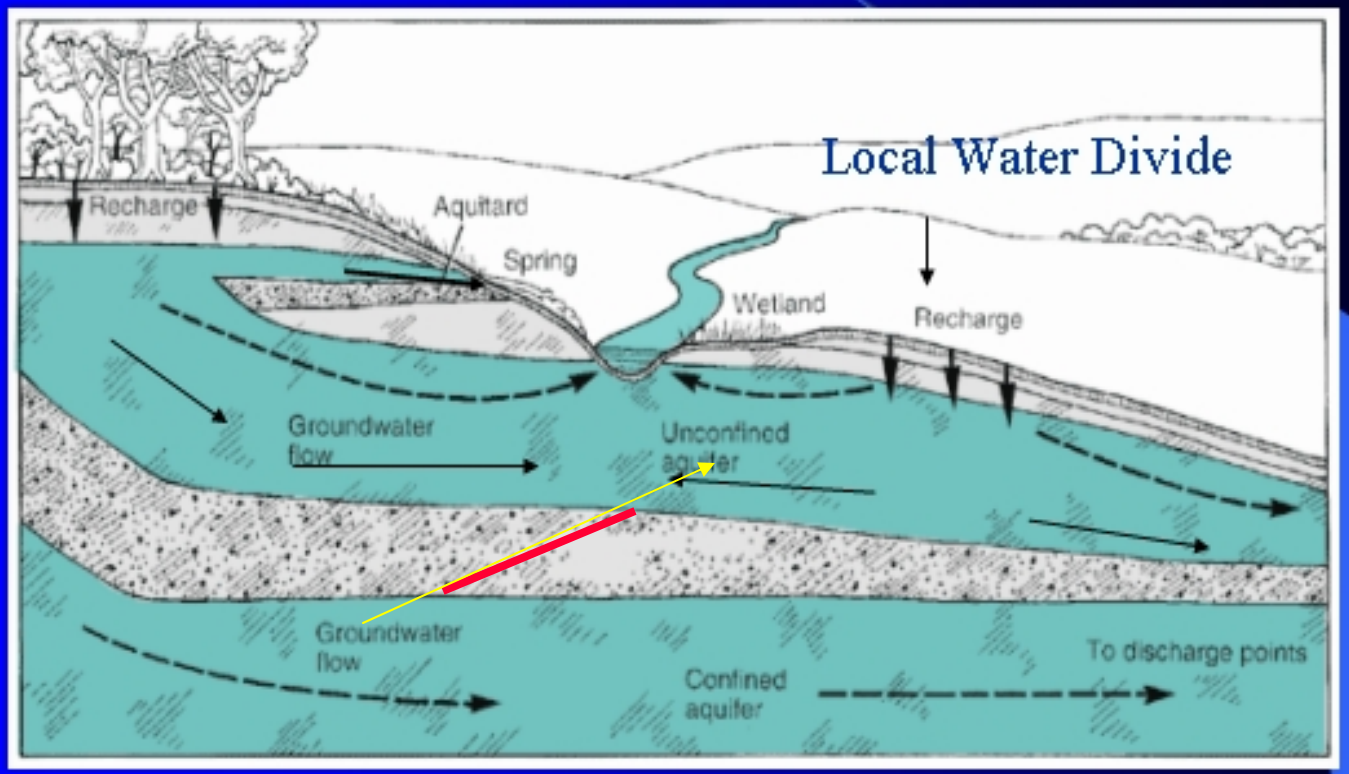


Unconfined and confined ground-water conditions.

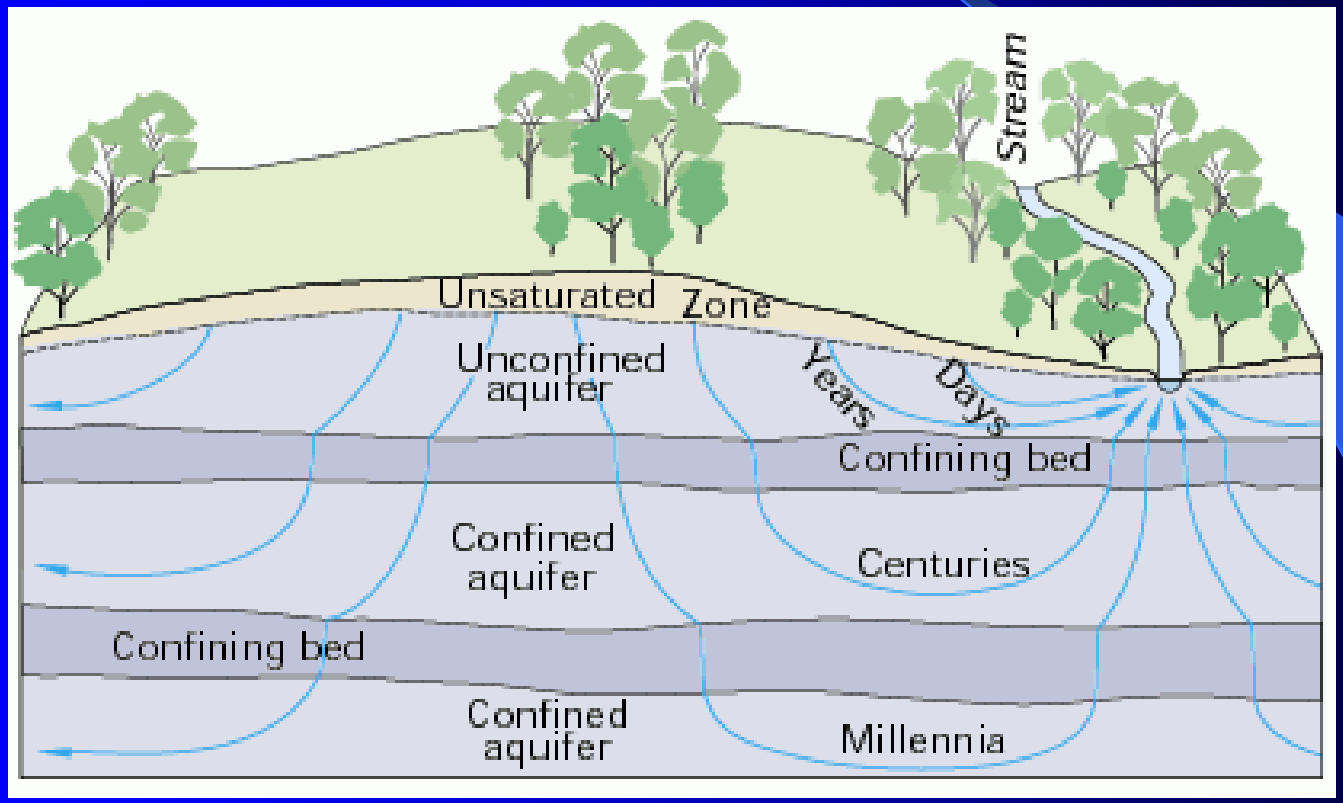
Groundwater Flow and Aquifers



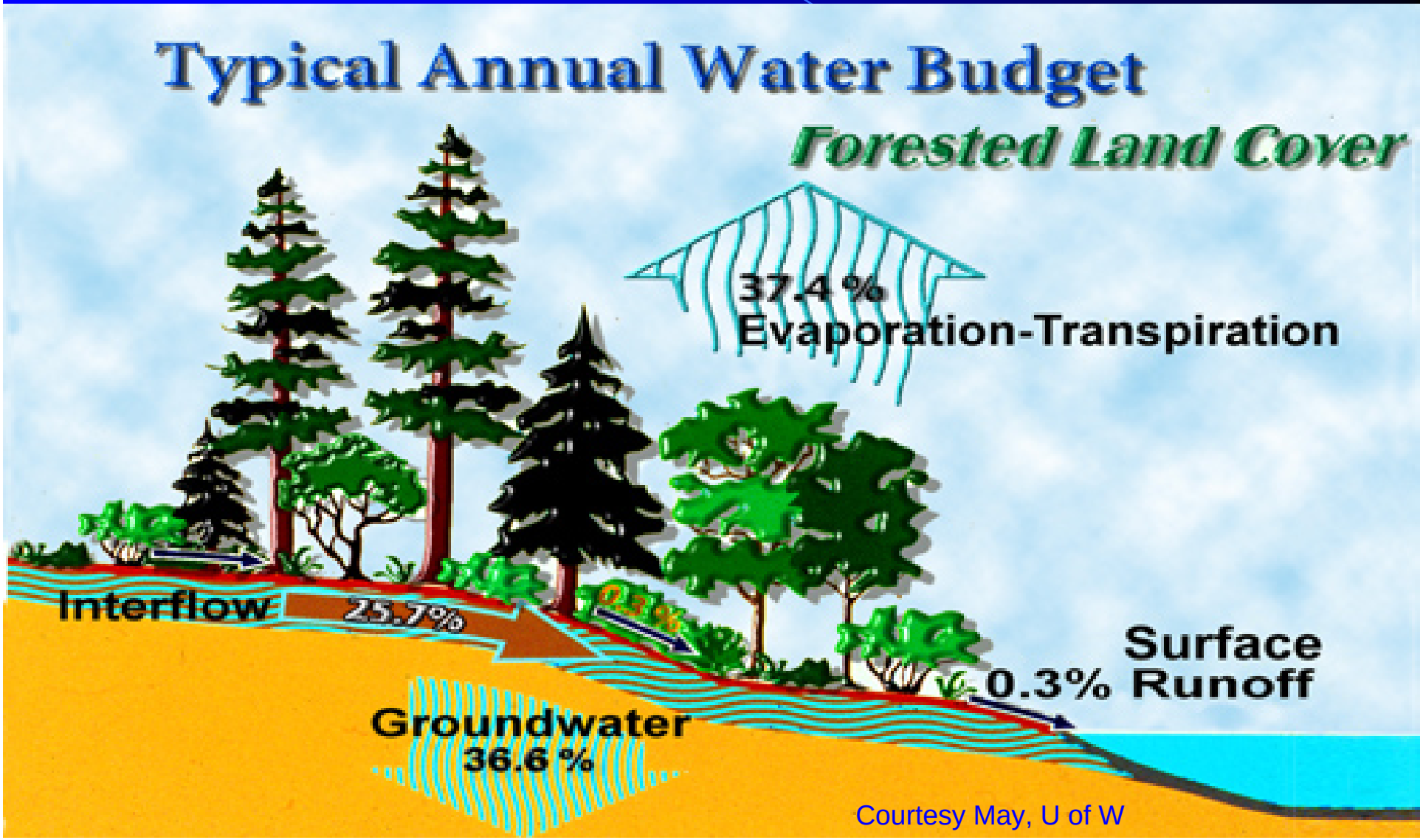
Surface Water & Groundwater
They Are Related and Connected !



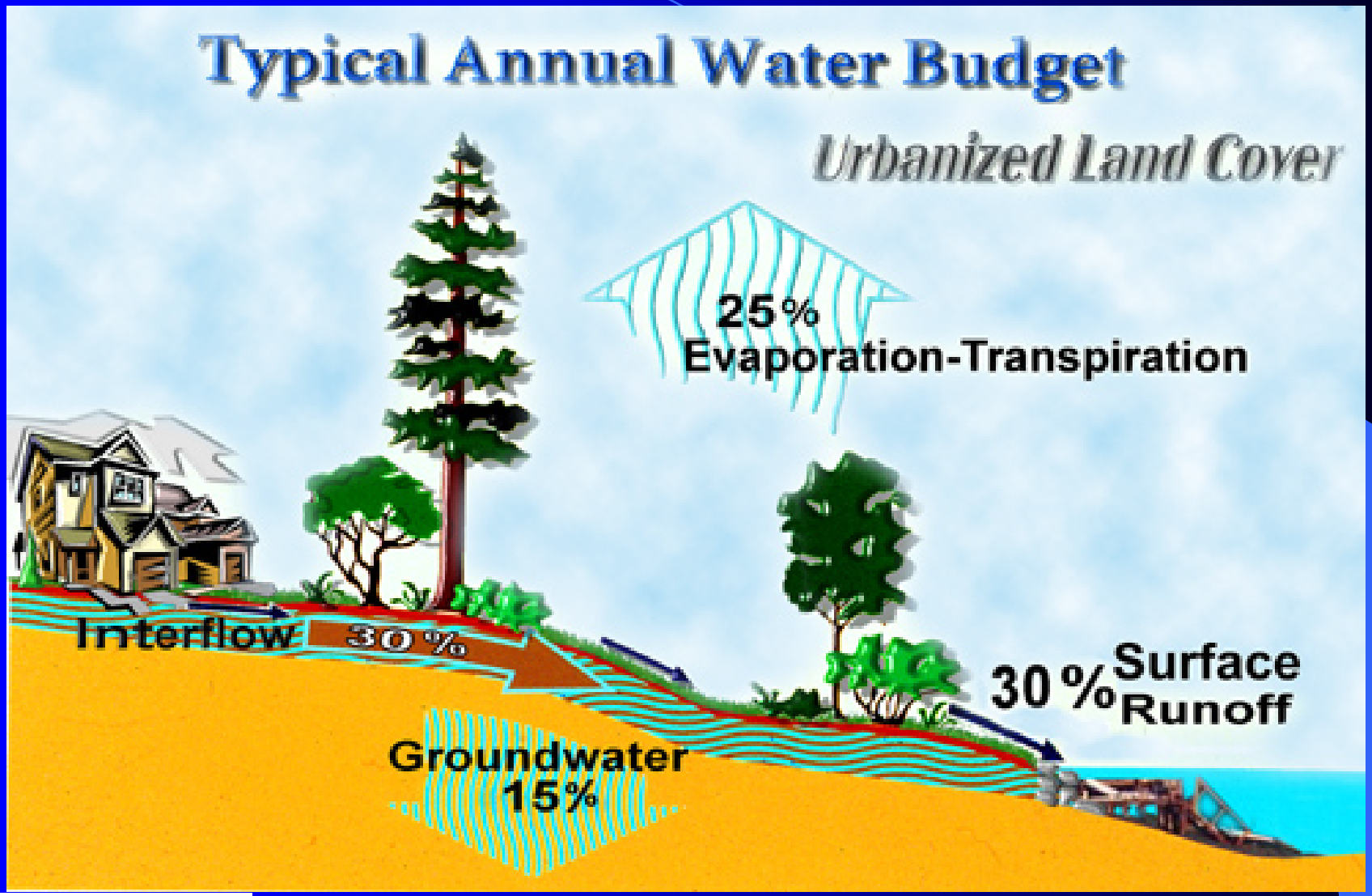
Groundwater Moves - Slowly feet per year



Hydrology Under Natural Conditions



Developed Conditions



Pocono Northeast
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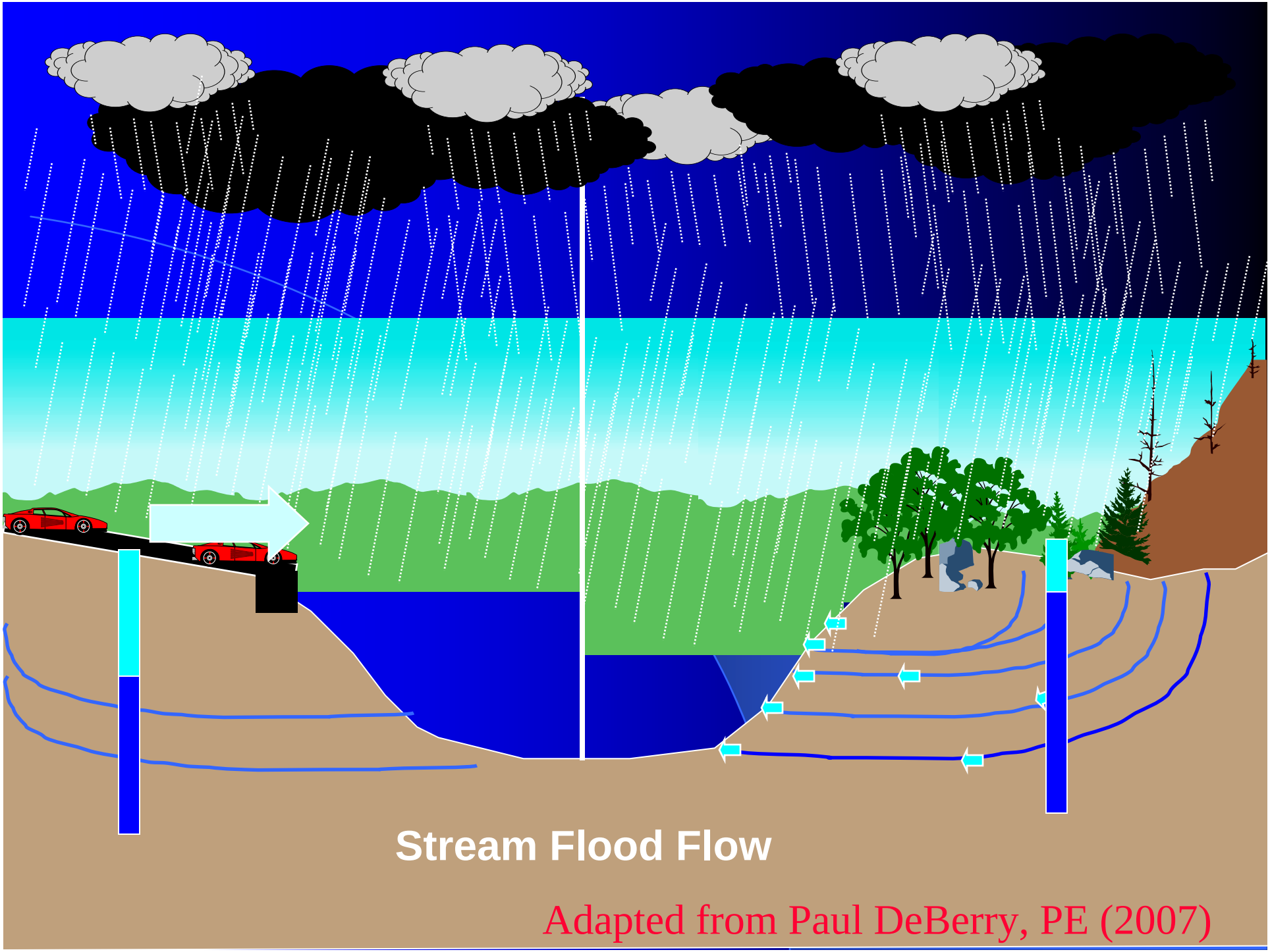
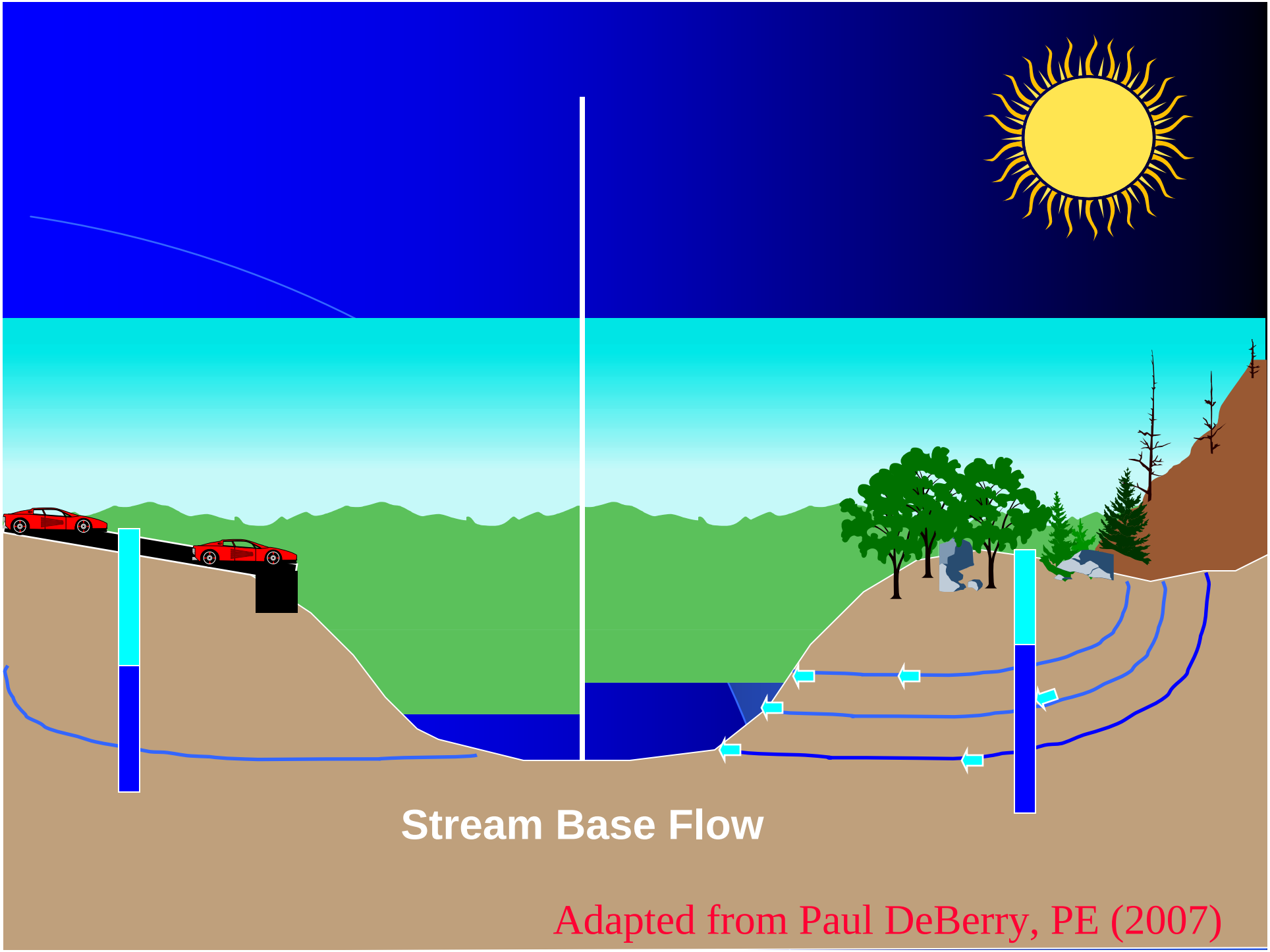
Courtesy May, U of W


Stream Flood Flow
Adapted from Paul DeBerry, PE (2007)



Adapted from Paul DeBerry, PE (2007)

Types of Water in PA

- Freshwater – Typically 600 to 1200 feet
  - < 1000 mg/L
- Saline Water – Where?
  - 1000 to < 35,000 mg/L
- Brine Water- Where? > 35,000 mg/L
  - Connate Water - This would include water that has been trapped in the formation- when it was deposited.

PADEP – Protects – Freshwater; EPA – Protects Water with a Total Dissolved Solids ≤ 10,000 mg/L – UIC Program

What is the Purity of the "Protected" Water ?

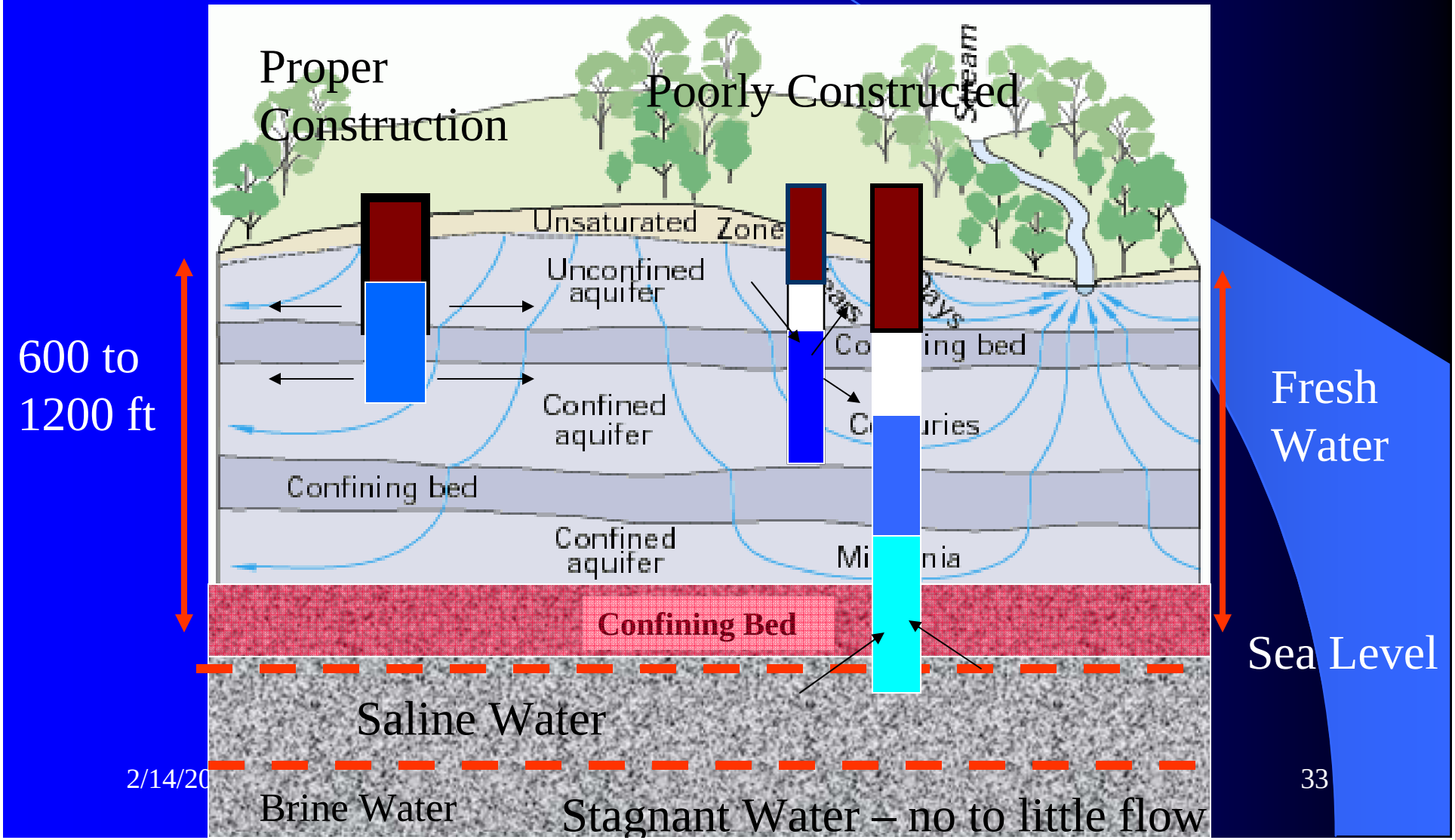
- Regulated Drinking Water – Typically has a Total Dissolved Solids of 500 mg/L or 99.95 % pure water.
- Freshwater actually includes – water with a TDS of 1000 mg/L or 99.9 % pure
- EPA Protects Water is up to 10,000 mg/L or 99% pure water.

Most Contamination appears to be associated with Total Coliform Bacteria

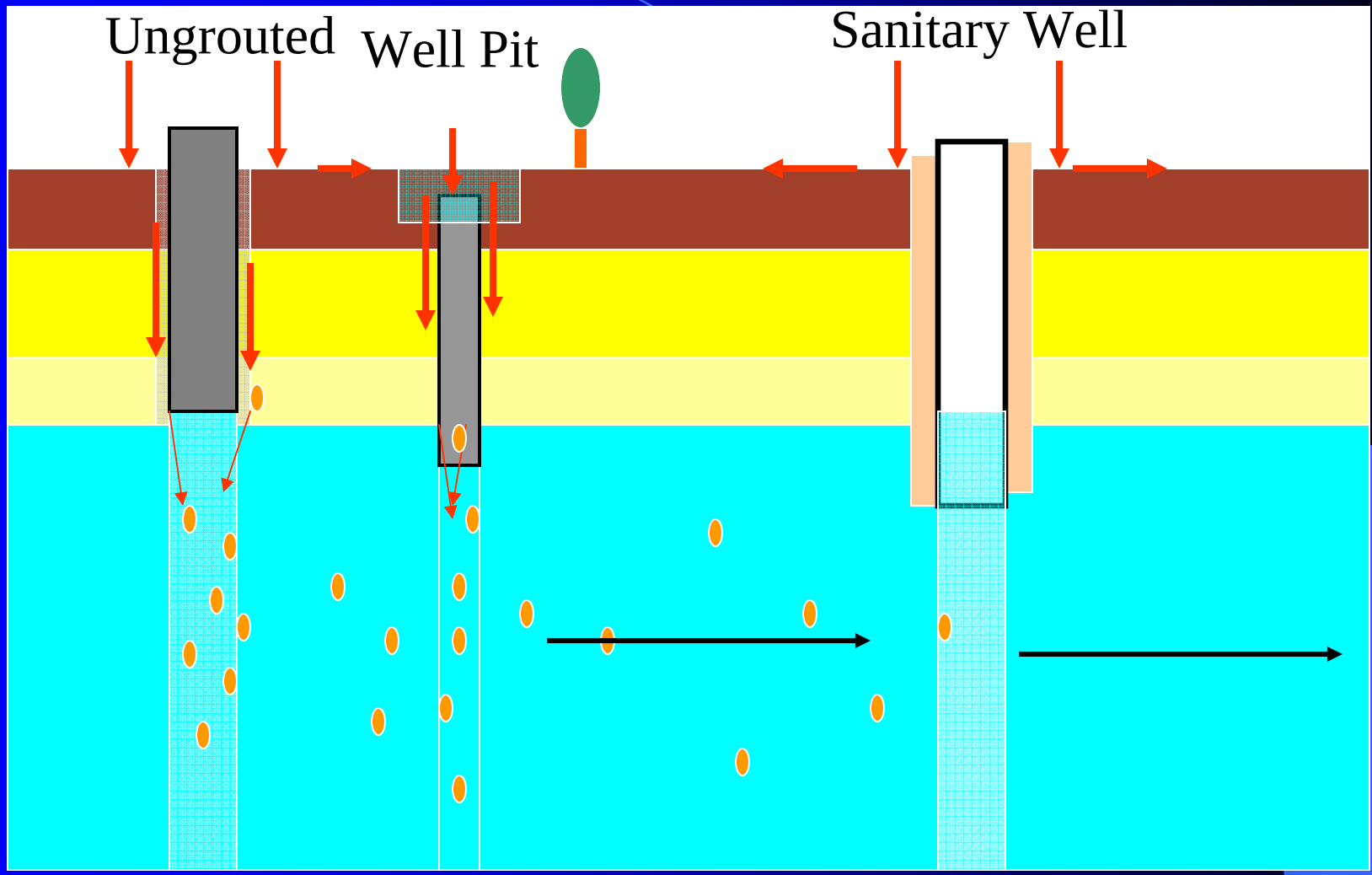
- Insects, Larvae and Nests / Egg Masses
- Mouse Colonies
- Snakes
- Beehives
- Mud - when casing to close to ground

Therefore – In some cases - the Private Wells are Facilitating Groundwater Contamination.

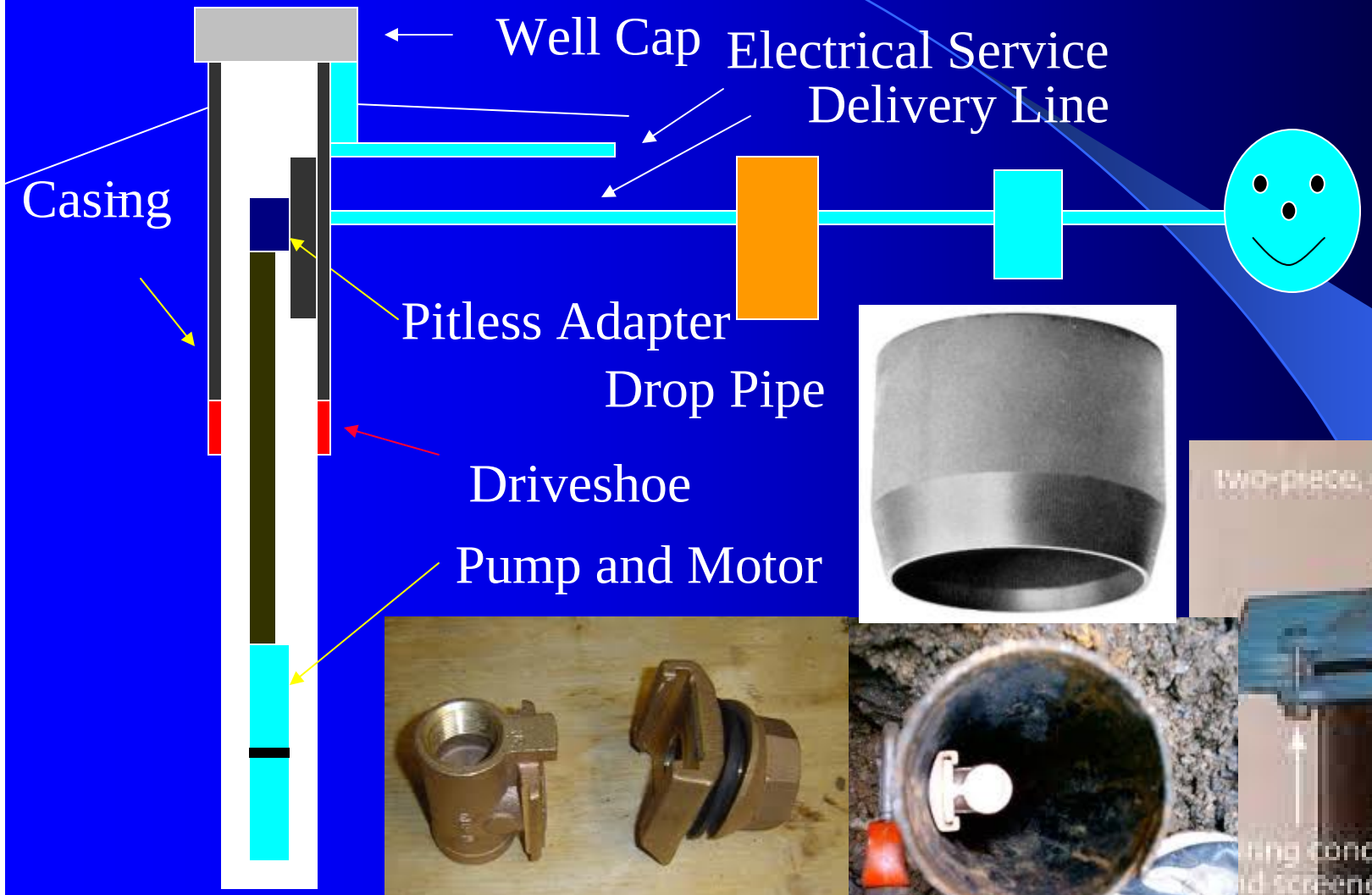
Properly Constructed Wells and Poorly Constructed Wells



How Contaminants Can Get In to the Aquifer (Surface)



Components of a Well



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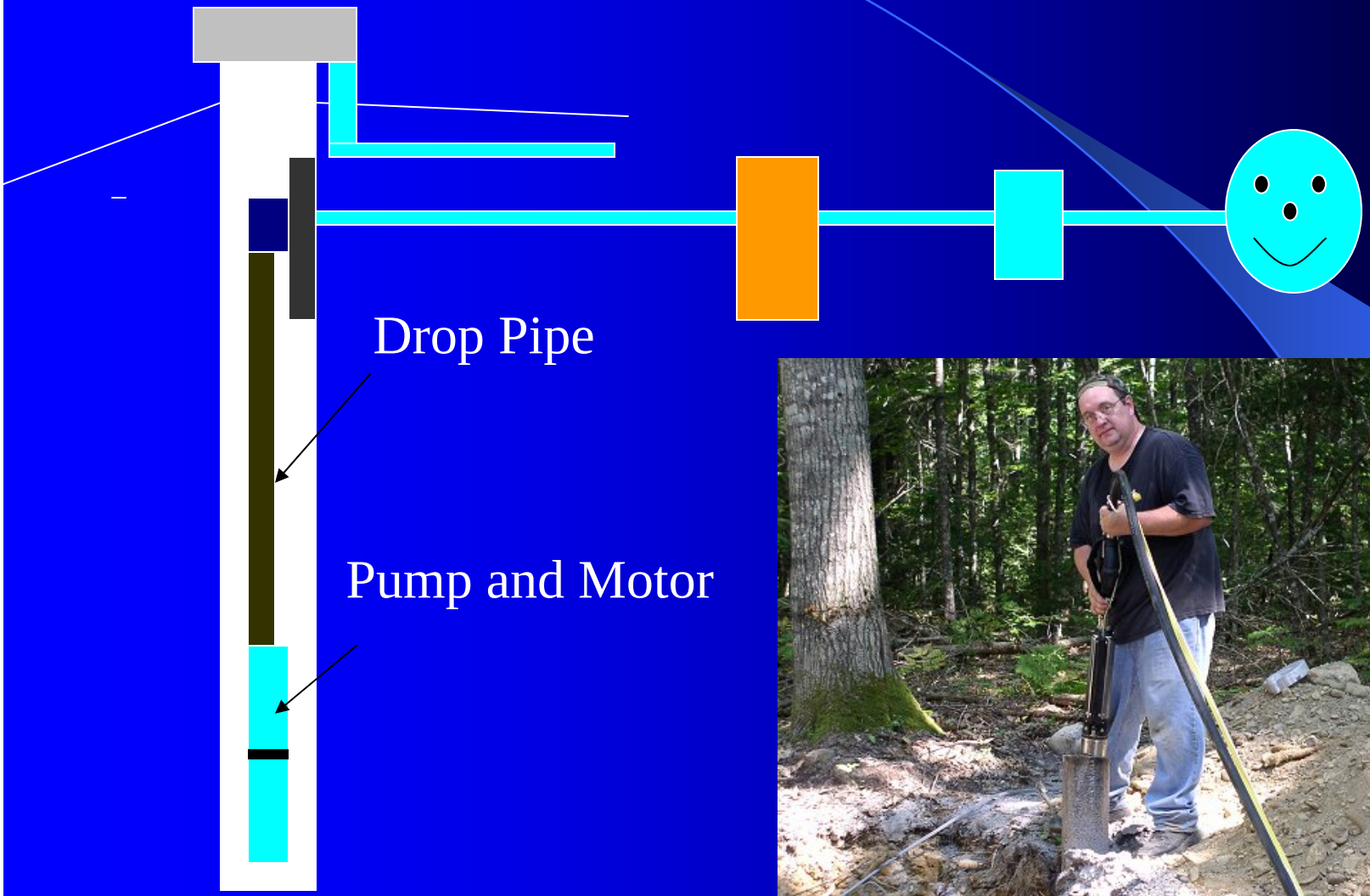
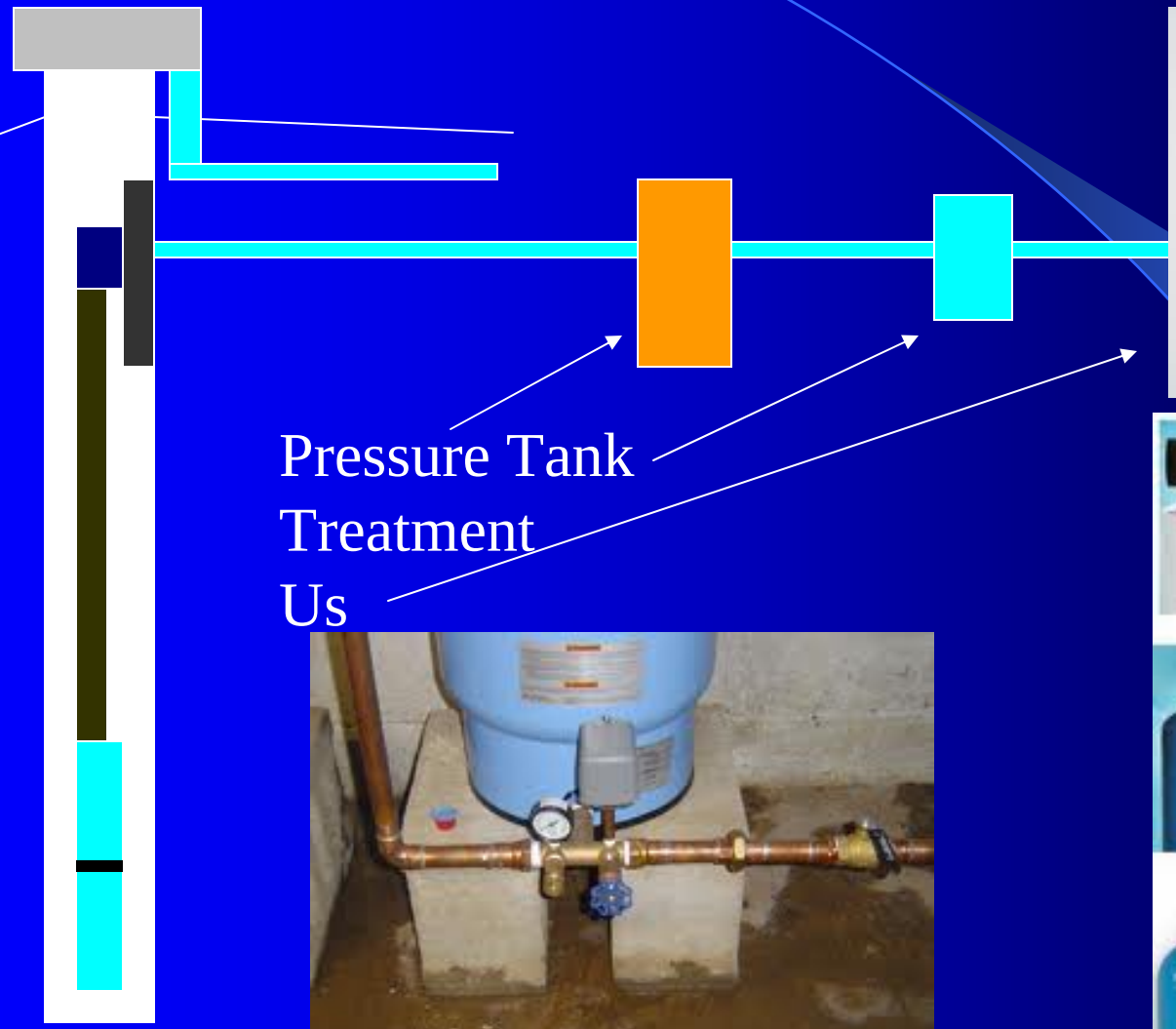


Components of a Well



Pressure Tank
Treatment
Us

This is Drinking Water in PA?

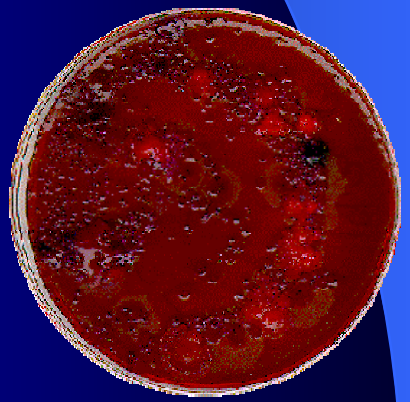
50%

Iron / Manganese

Sediment / Gases

Other
50%

Corrosion



Bacteria

Groundwater Moves

1. Which ways can groundwater move?
a. Up
b. Down
c. Sideways
d. All of the above

1. d. All of the above
Although most movement is lateral (sideways), it can move straight up or down. Groundwater simply follows the path of least resistance by moving from higher pressure zones to lower pressure zones.

Groundwater Moves

2. How is the speed of groundwater movement measured?

a. Feet per day
b. Feet per week
c. Feet per month
d. Feet per year

2. d. Feet per year
Groundwater movement is usually measured in feet per year. This is why a pollutant that enters groundwater requires many years before it purifies itself or is carried to a monitored well.

Surfacewater Moves

3. How is stream flow usually measured?
a. Feet per second
b. Feet per minute
c. Feet per hour
d. Yards per hour

3. a. Feet per second
Water flow in streams/rivers is measured in feet per second.

Groundwater Moves

4. What determines how fast groundwater moves?
a. Temperature
b. Air pressure
c. Depth of water table
d. Size of materials

4. d. Size of materials
Coarse materials like sand and gravel allow water to move rapidly. (They also form excellent aquifers because of their holding capacity.) In contrast, fine-grained materials, like clay or shale, are very difficult for water to move through. Thus, water moves very, very slowly in these materials.

Groundwater Moves

5. Can the water table elevation change often?

a. Yes

b. No

5. a. Yes

Water table elevations often fluctuate because of recharge and discharge variations. They generally peak in the winter and spring due to recharge from rains and snow melt. Throughout the summer the water table commonly declines due to evaporation, uptake by plants (transpiration), increased public use, industrial use, and crop, golf course and lawn irrigation. Elevations commonly reach their lowest point in early fall.

Groundwater Moves

6. Does aquifer storage capacity vary over time naturallly?

a. Yes

b. No

6. a. Yes

Just like the water level in rivers and streams, the amount of water in the groundwater supply can vary due to seasonal, weather, use and other factors.

Regular Maintenance

- Divert Surfacewater Runoff Away from Wellhead
- Annual Water Test
- Annual Maintenance on Water Treatment Systems
- Conserve Water/ Fix Leaks
- Proper Use and Storage of Chemicals and other Hazards

Remember We ALL Live Downstream

Educating the Community

Download a Free Copy (pdf) or Link to a copy at http://www.bfenvironmental.com

Also:

1. New Booklet available March/ April 2012.

2. New Web-portal on Methane Gas Migration And Mitigation (available now)

Help Promote the Citizens Groundwater Surfacewater Database to Your Community Partners.

Workshop 2
Groundwater – Citizen Homeowner Monitoring

Hosted by:
Lackawanna County Conservation District

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Growing Greener Program

Attend Workshop 2
Get Free Water Sample Kit
For Workshop 3

Attend Workshop 3
Free Screening of Your Well Water

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