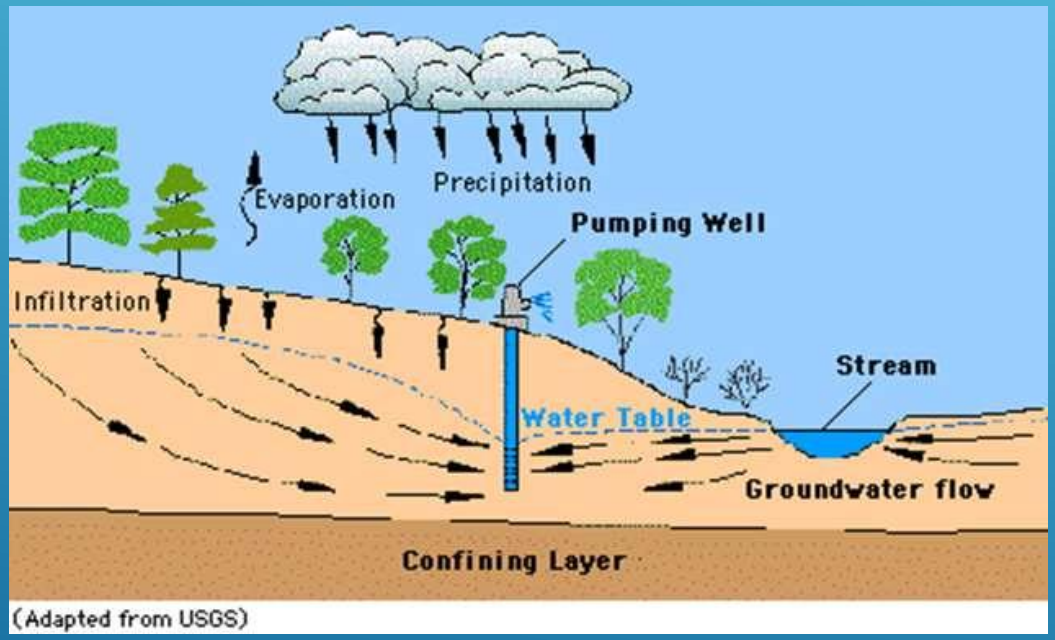
First year of Geomatics Department
Engineering Geology 2018
Lecture 10

GROUNDWATER



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INTRODUCTION

Groundwater is an invisible natural resource. It is available in different proportions, in various rock types and at various depths, on the surface layer of the earth. In the historical past, when there is no visible flow of water along the rivers, people used to dig small pits, in the river alluvium, wait and collect the groundwater coming through seepage and use it for their drinking purposes and for meeting the domestic needs.

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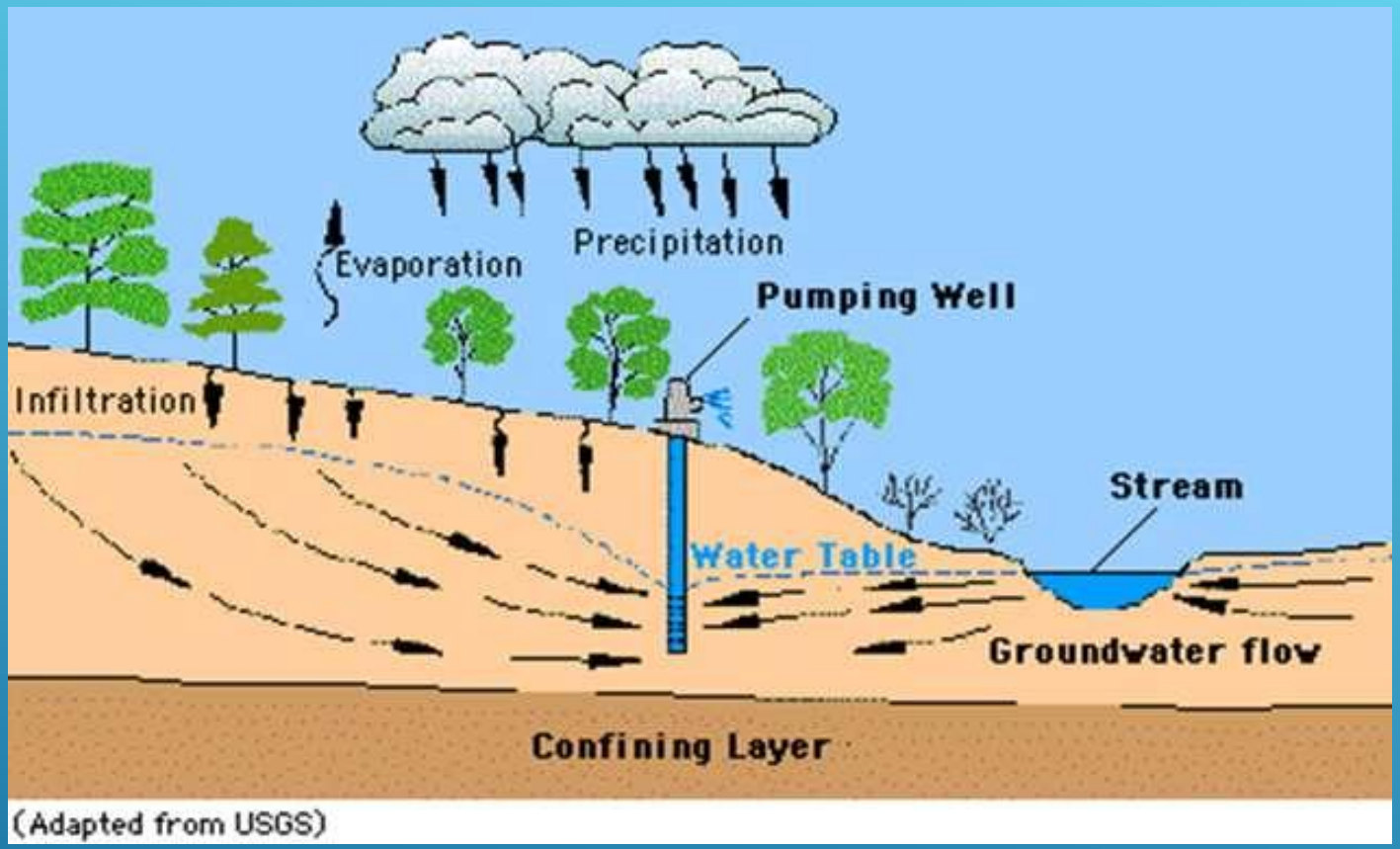
INTRODUCTION



Ground water is that part of precipitation that infiltrates through the soil to the water table. An important component of water resource systems

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RENEWABLE RESOURCE

- Groundwater is a renewable source. Groundwater gets replenished after every rainfall. This is called as rainfall recharge. The level of water seen in an open well denotes the uppermost surface of the zone of saturation of the porous media. This is called as the water table.
- After every recharge, the water table raises, denoting that the porous media has saturated with more water. When we pump out water, the water level goes down.
- Continuous pumping of water, beyond the recharge, will make the wells go dry and force to deepen the well.

SOURCES OF GROUNDWATER

- **Precipitation**
- **Interception**
- **Subsurface flow**
- **Soil moisture**

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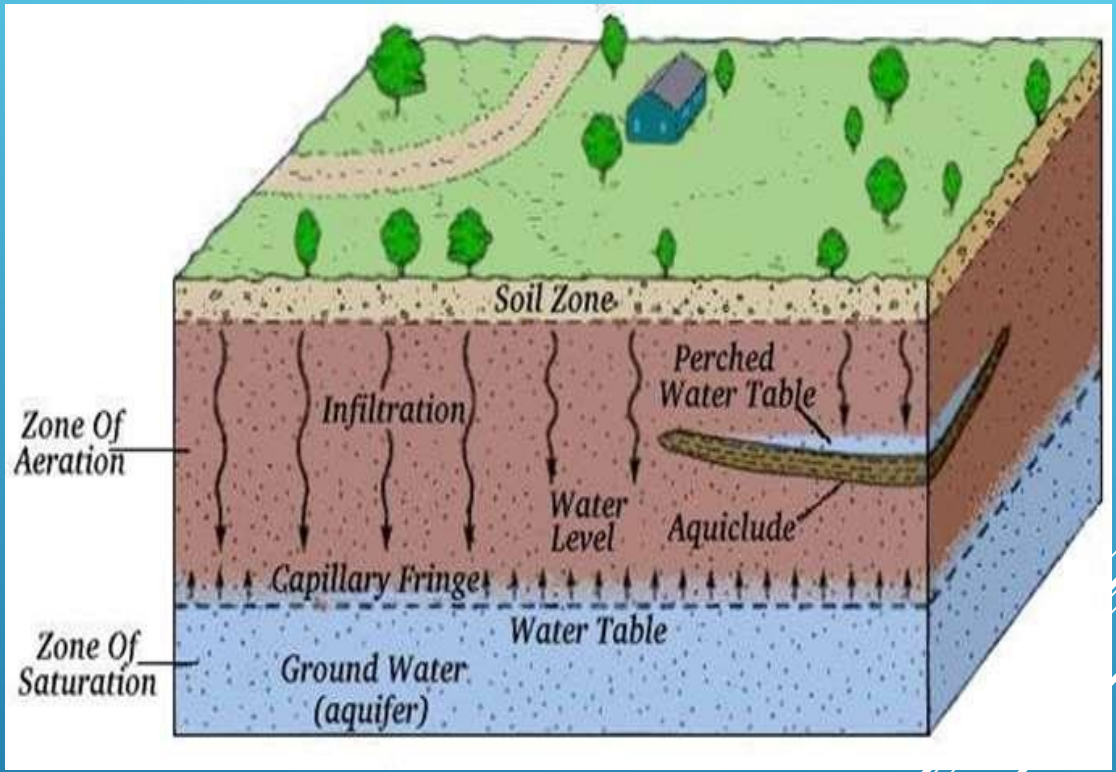
ZONES OF UNDERGROUND WATER

1. Zone of aeration/ vadose zone

a zone that contains both water and air

2. Saturated zone

where all the interconnected openings between rock particles are filled with water



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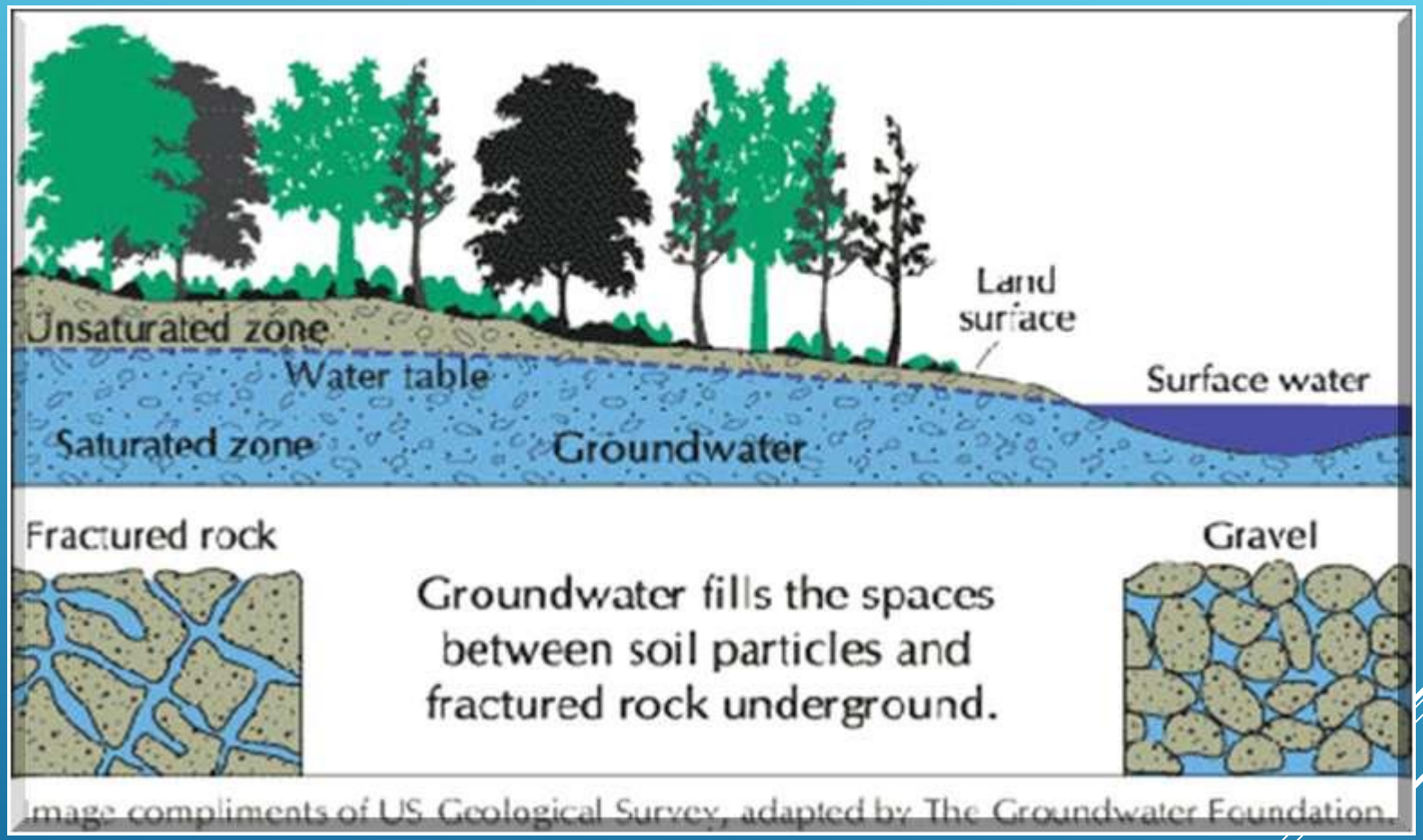
HOW GROUND WATER OCCUR IN ROCKS?



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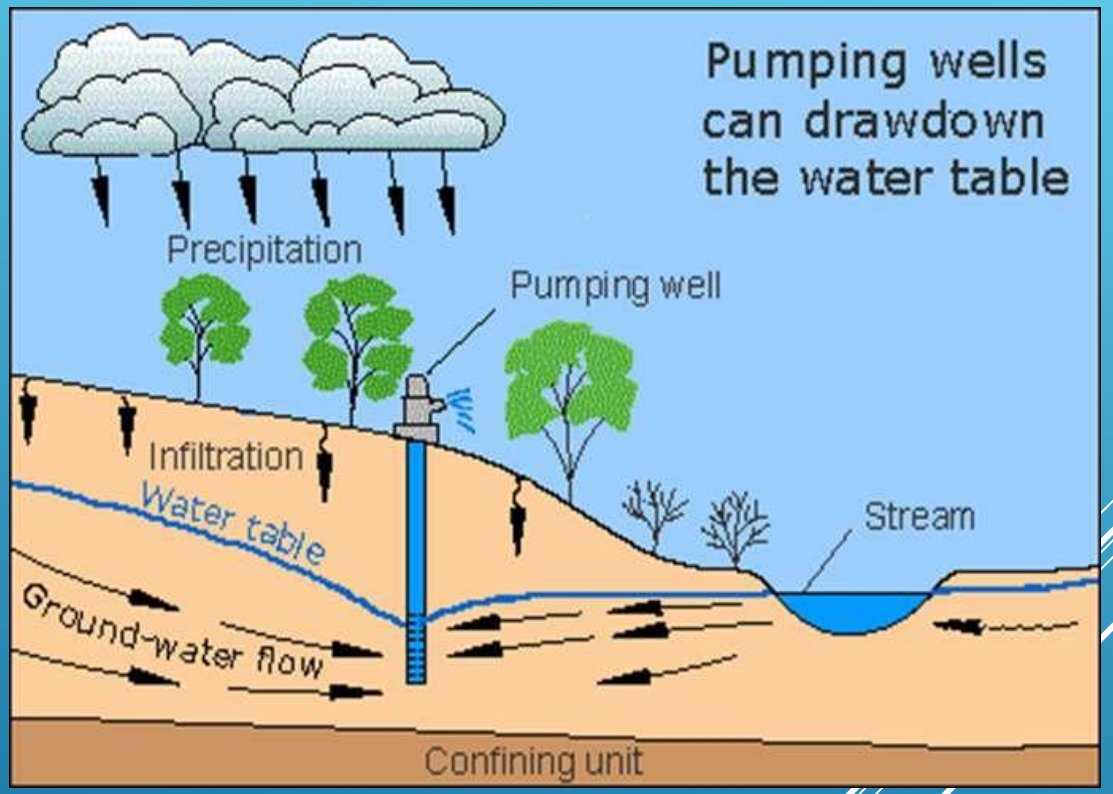
WATER TABLE

- It is a surface of a water body that is constantly adjusting itself toward an equilibrium condition.
- If there were no recharge to or outflow from the ground-water basin, the water table would eventually become horizontal.



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EXPLORING GROUNDWATER

- The surface methods are easy to operate and implement include the following:

1. Esoteric Methods
2. Geomorphologic methods
3. Geological & structural Methods
4. Soil and Micro-Biological Methods
5. Remote Sensing Techniques
6. Surface Geophysical Methods

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DISCHARGE OF GROUNDWATER

1. **TRANSPIRATION AND EVAPORATION**
2. **SPRINGS**
3. **SUBSURFACE FLOW**
4. **WELLS**

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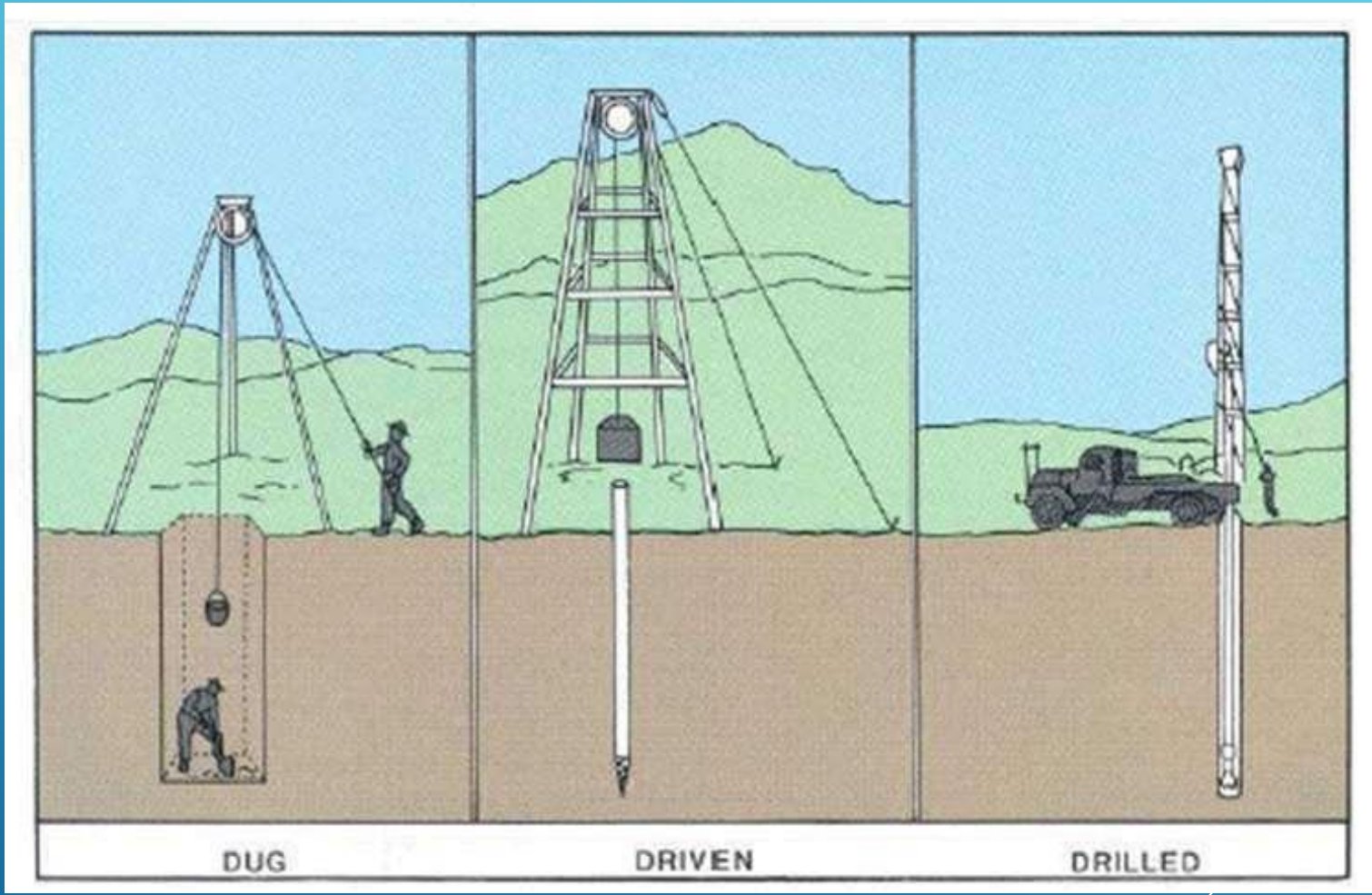
TYPES OF WELLS



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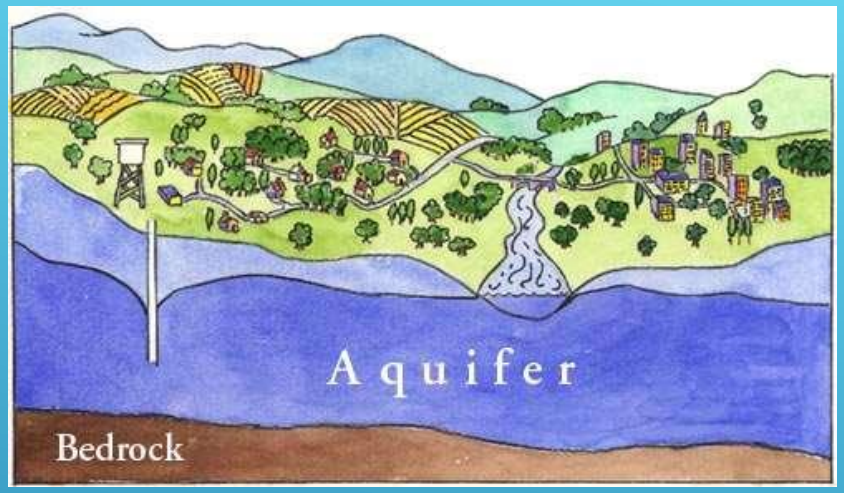
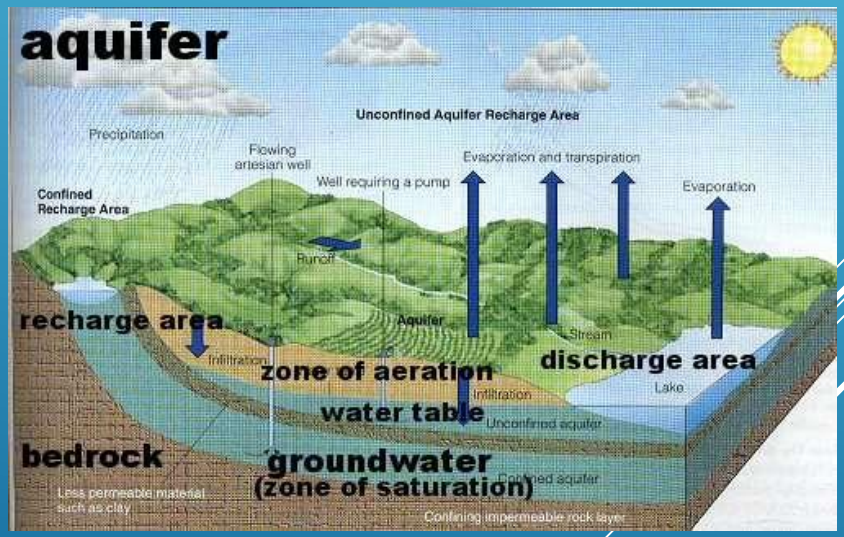
AQUIFER

- A body of saturated rock which water can easily move.
- Aquifers must be both permeable and porous and include such rock types as sandstone .





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TYPES OF AQUIFER

- **Unconfined Aquifers**

Where groundwater is in direct contact with the atmosphere through the open pore spaces of the overlying soil or rock, then the aquifer is said to be unconfined. The upper groundwater surface in an unconfined aquifer is called the water table.

- **Confined Aquifers**

Confined aquifers are permeable rock units that are usually deeper under the ground than unconfined aquifers. They are overlain by relatively impermeable rock or clay that limits groundwater movement into, or out of, the confined aquifer.

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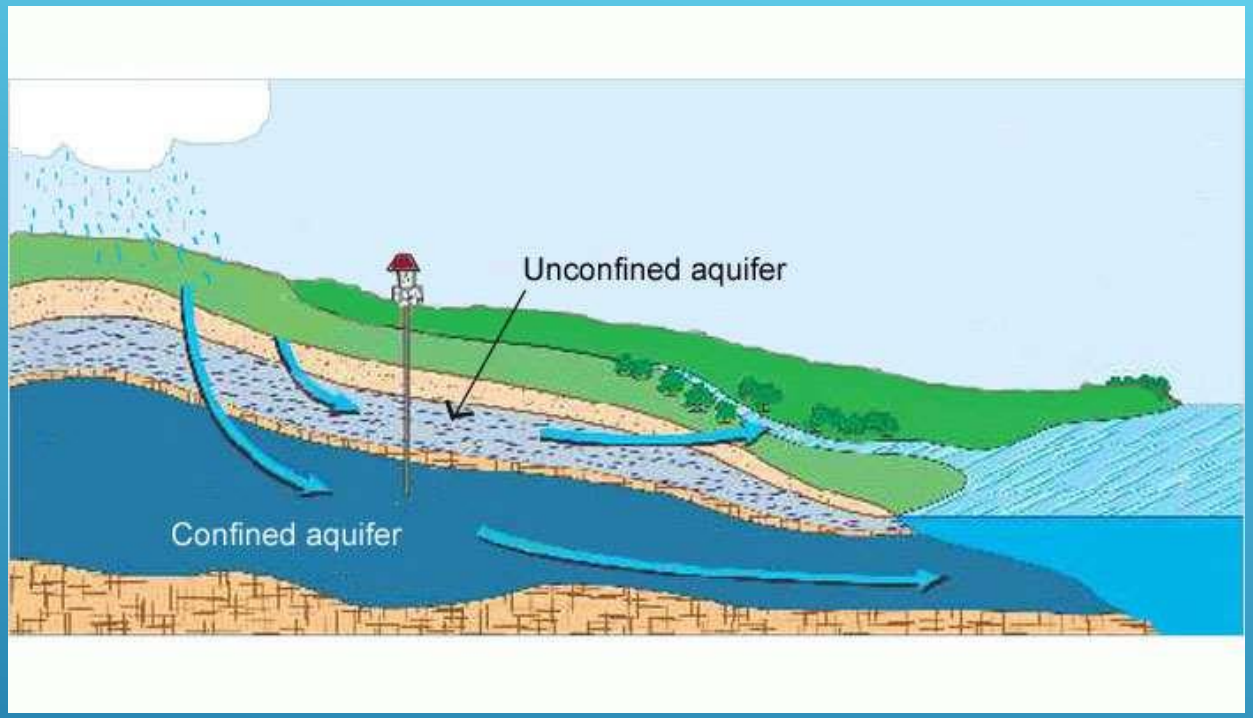
TYPES OF AQUIFER



- Unconfined aquifers receive recharge directly from rainfall and surface water infiltrating downward.
- Confined aquifers are connected to unconfined areas where water can flow in.

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SOURCES OF CONTAMINATION IN GROUNDWATER

- **Salt contamination**
- **Leakage and spills**
- **Pesticides and fertilizers**
- **Waste disposals**

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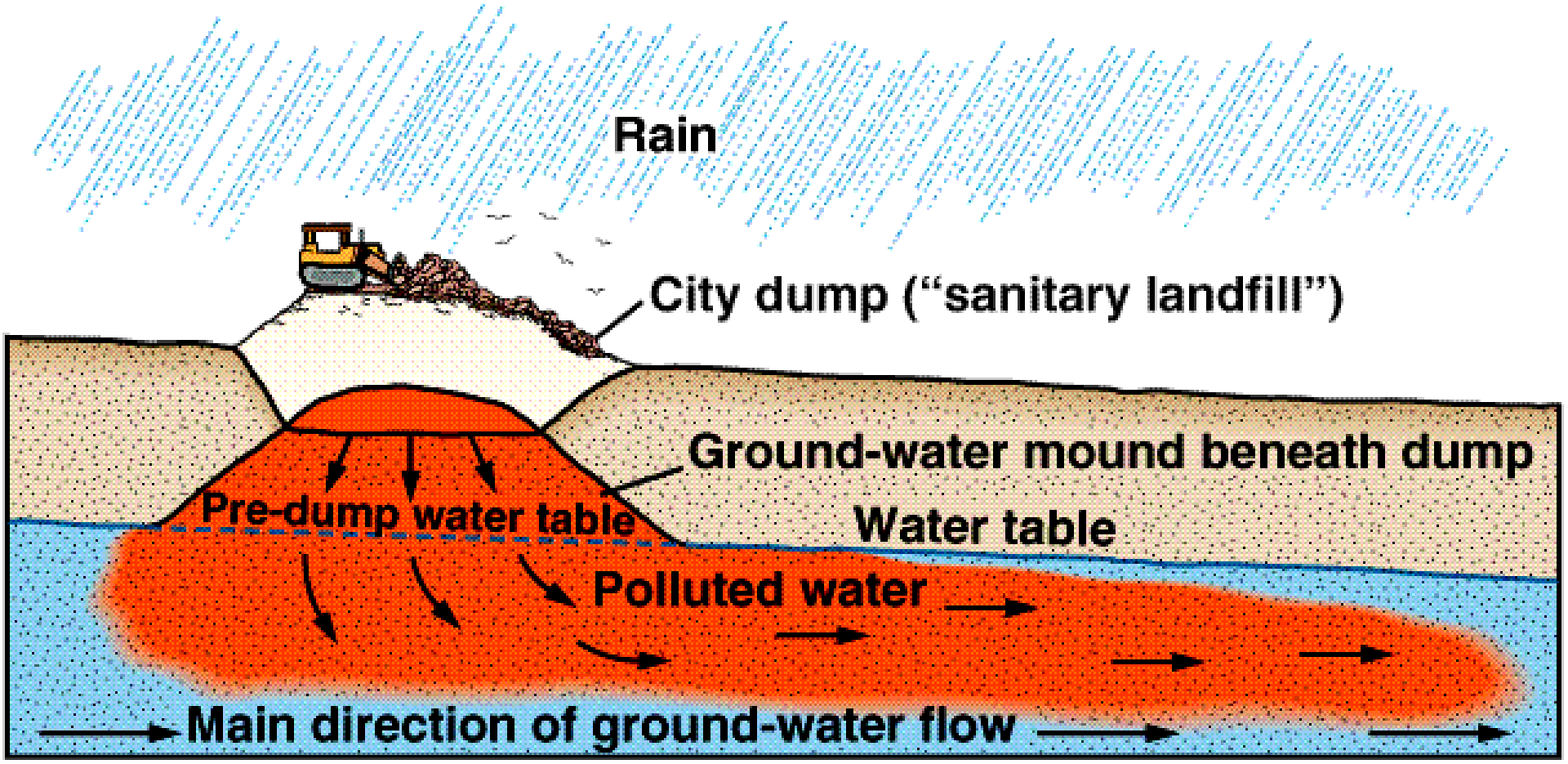
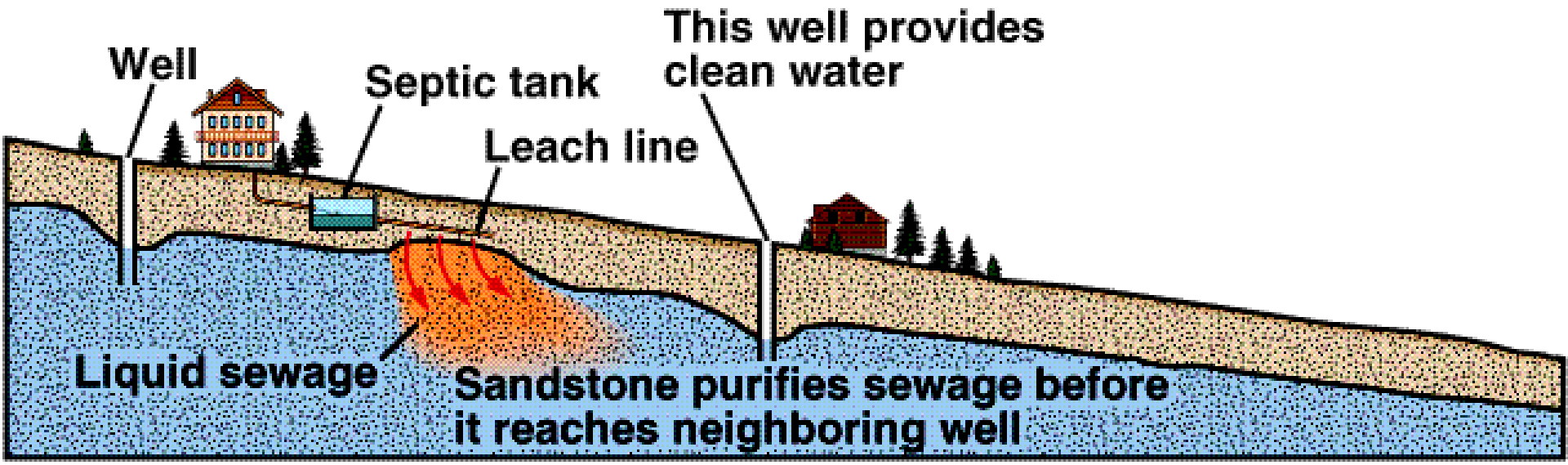
Ground-Water Mound



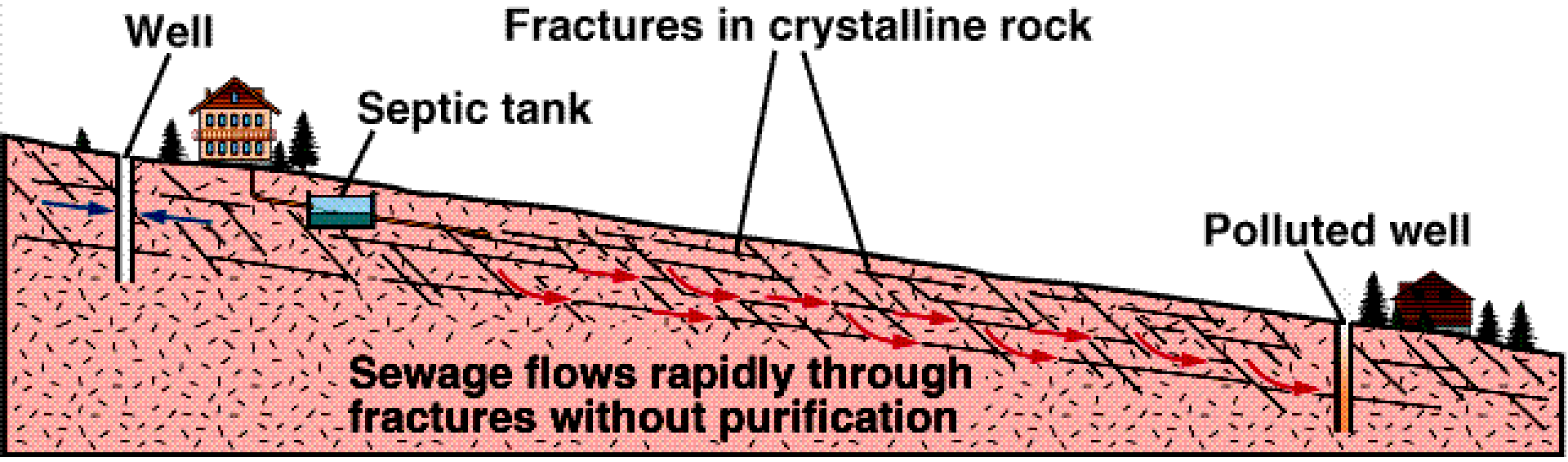
A Cross section

Sewage Contamination

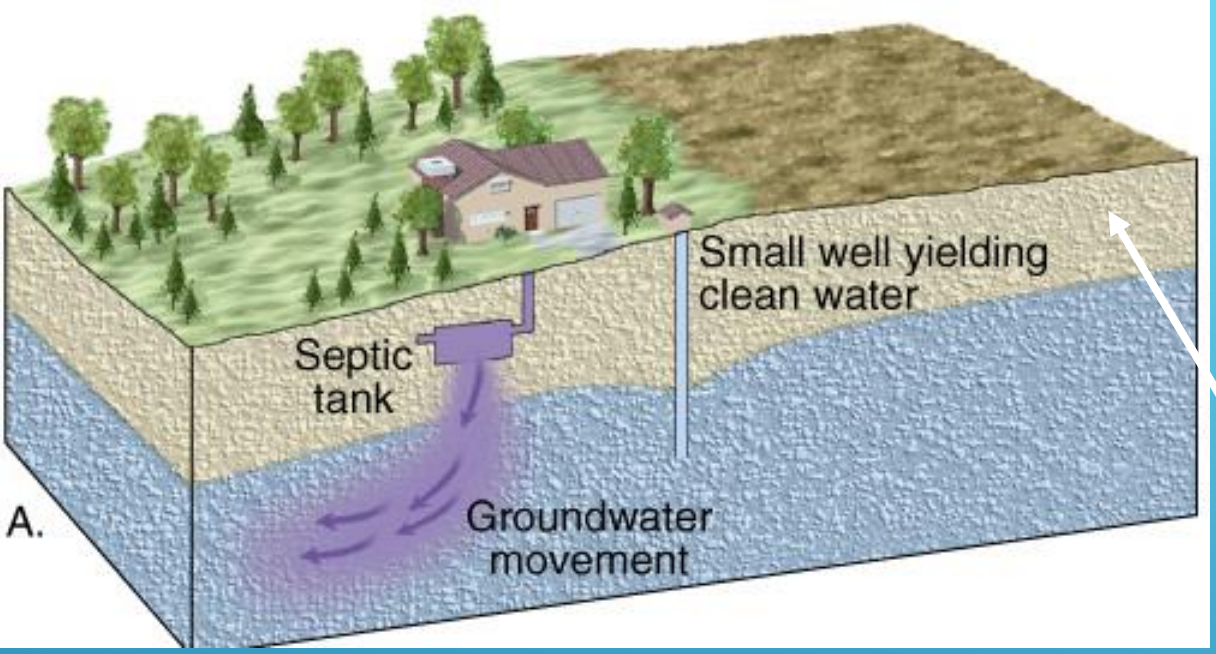


A

Contamination from Open Fractures

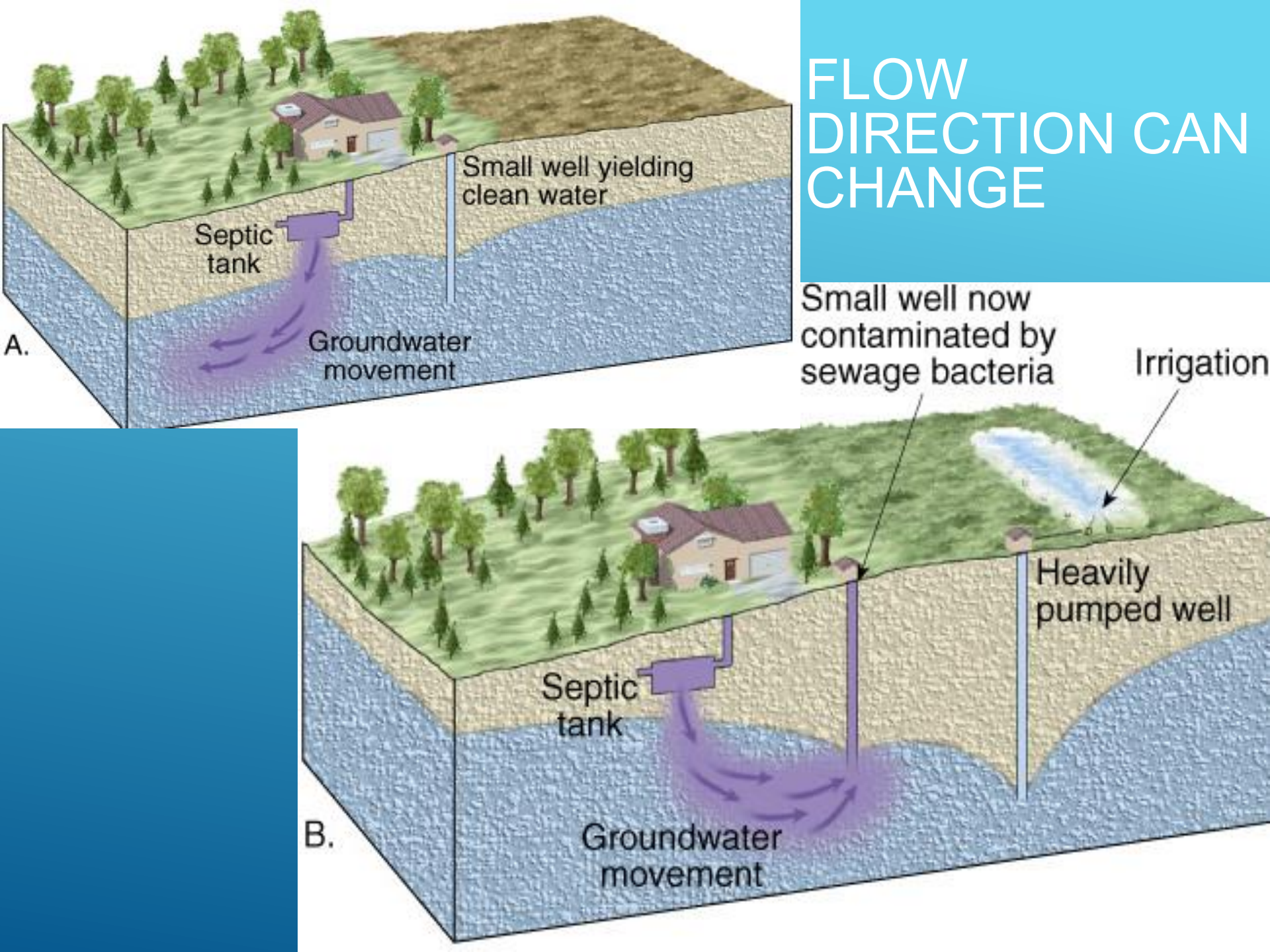


B



What happens when a new well here is heavily pumped?

FLOW DIRECTION CAN CHANGE



THANKS

Please visit the following links:

https://en.wikipedia.org/wiki/Groundwater

http://www.groundwater.org/get-informed/basics/groundwater.html

https://www.youtube.com/watch?v=oNWAerr_xEE

https://www.youtube.com/watch?v=MeeYy-dVzJU

https://www.youtube.com/watch?v=Z2HQY5A3o-s

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