

# Groundwater Level and Movement

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# Infiltration and Recharge

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## Infiltration

- Entry of rain water into the ground.

## Recharge

- Addition of infiltrated water to the aquifer.
- Two types of Recharge-
  1. Natural
  2. Artificial



# Natural Recharge

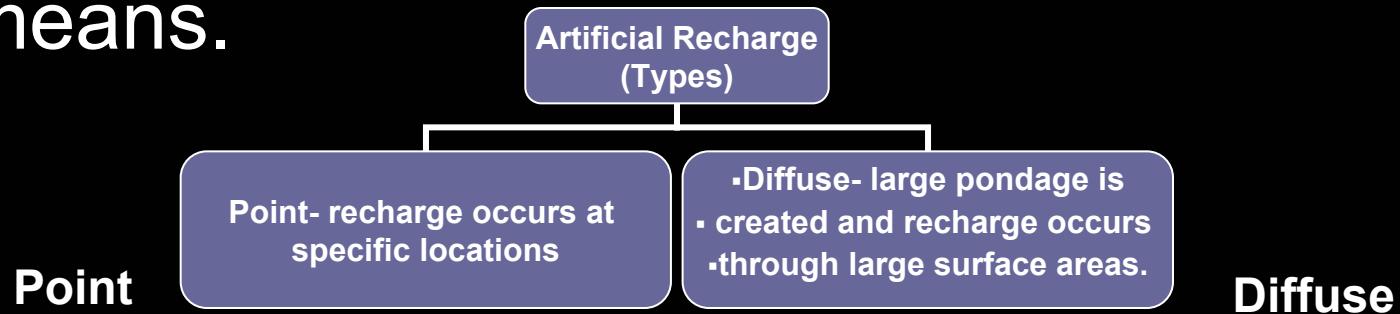
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- Rainfall *infiltrates the ground surface under natural conditions*
- Leads to an addition to the ground water storage
- This is called *Natural Recharge*



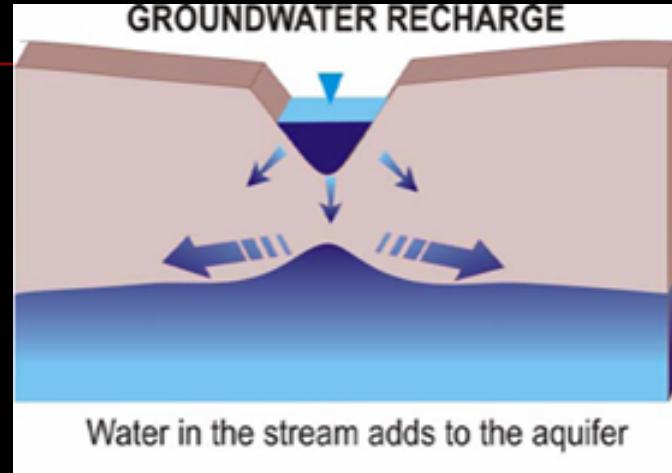
# Artificial Recharge

- ***Collection of precipitation artificially*** and channeling it into the aquifer by artificial means.



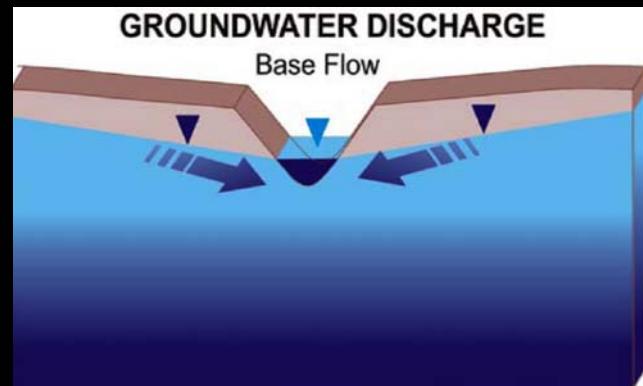
# Recharge Sources

- Direct infiltration through the soil over the whole or part of a watershed
- From the bed of a stream, river or lake
- From a ponded stock of water



# Discharge of Groundwater

- Natural- Springs and Seeps (baseflow to streams)
- Pumping from wells
- Deep infiltration



Groundwater in the aquifer flows and discharges to the stream as BASE FLOW

# Movement of Groundwater

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Aquifer is very much like an **under ground watershed**.

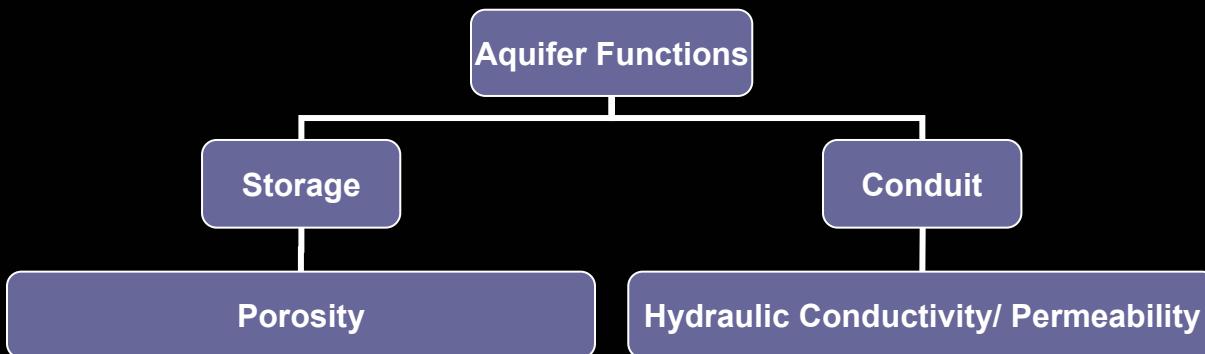
- **Aquifer catchments-** groundwater recharge areas i.e. aquifers receive recharge
- **Aquifer Commands-** groundwater discharge areas i.e. aquifers release groundwater

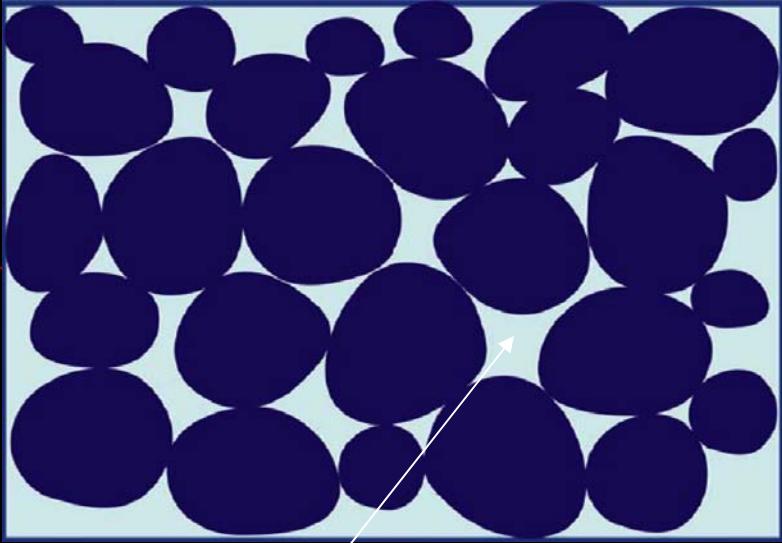
# Aquifer

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- Rocks that contain and allow water to flow through them.

## Important Functions-





## Porosity

Material that contains voids or openings is said to be *porous*. The property is called POROSITY.

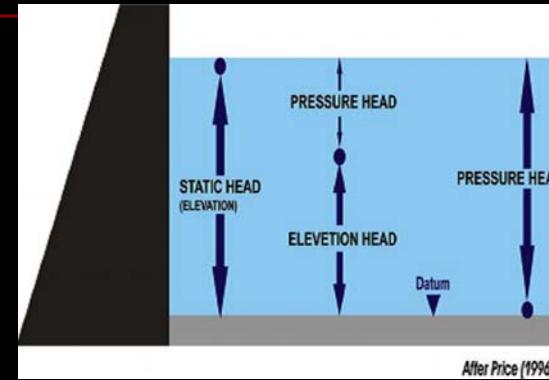


## Hydraulic Conductivity

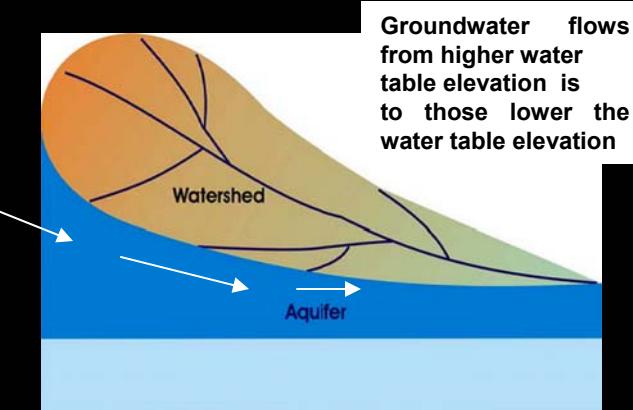
Ability of the rock or rock material to allow the flow of groundwater through it.  
Also called as **permeability**

# Energy that drives Groundwater Movement is derived from

- **Elevation (HEAD)** of water at any given location
- **Pressure** of (overlying) water at another location
- **Combination** of elevation and pressure



After Price (1996)



**Differences in HEAD or PRESSURE make groundwater flow from one point to another**

# Equating Recharge and Discharge

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- In areas where the aquifer empties and fills up each year (a good balance between discharge and recharge), the value of net ground water discharge is equal.
- The maximum capacity of an aquifer to hold water is called **Potential Recharge**

# Lessons

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- Infiltration- Entry of rain water into the ground.
- Recharge and discharge- Processes by which water enters and leaves the aquifer
- Aquifer properties like Storage and Hydraulic conductivity allow water to flow through the rocks.

**Storage of Groundwater depends on:**

- **Shape and size of grains and hence the spaces between grains.**
  - **For granular material and unconsolidated material like sand, gravel, clay etc.**
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**Observe the size of opening due to them.**

**For joints observe**

- **Openings in hard rocks**
- **Geometry- Vertical/Horizontal/Inclined**
- **Direction and trend**
- **Distance or spacing**
- **Relation of different sets of joints**

## **Demarcation of groundwater recharge and discharge areas - Based on water level fluctuation**

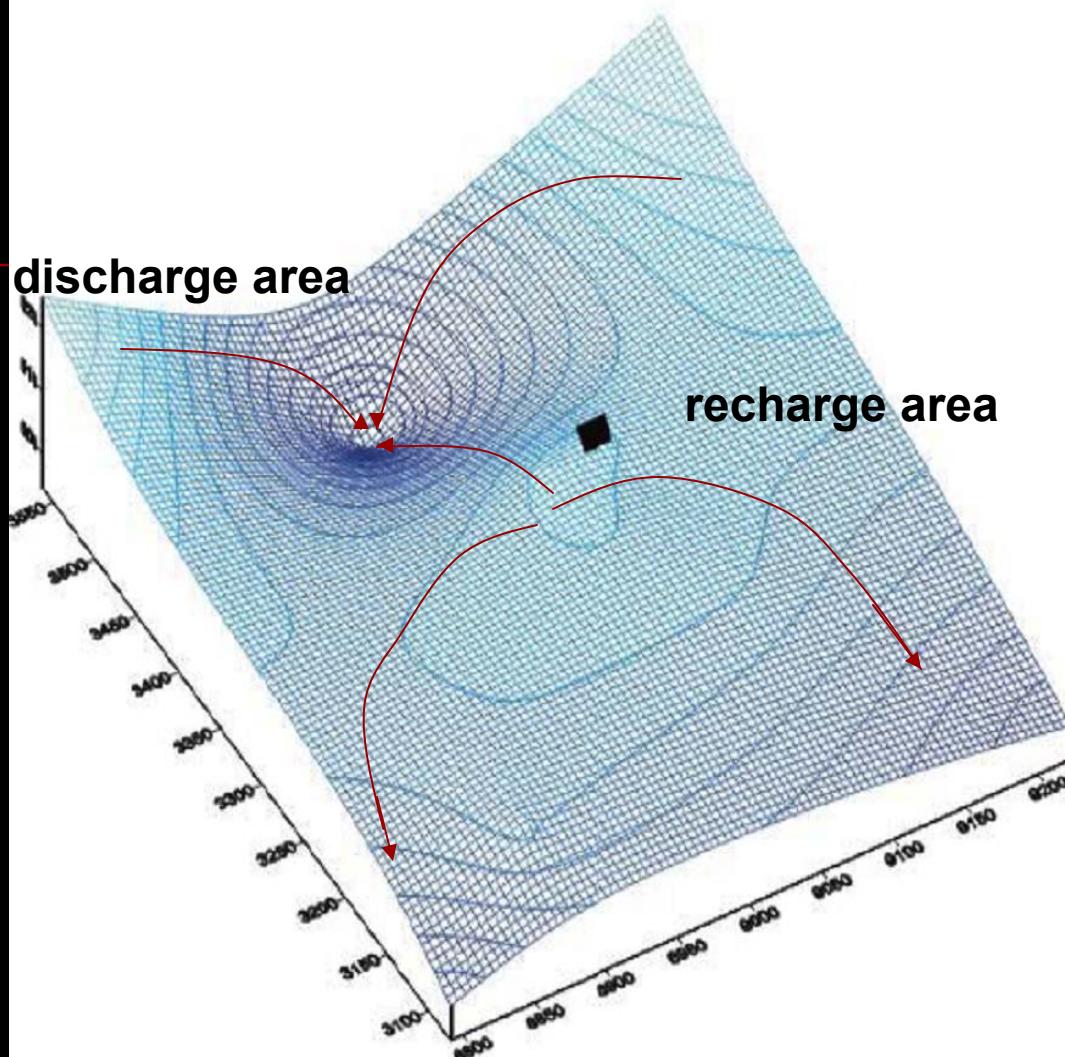
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- **Wells showing more fluctuation in water levels indicate a recharge area.**
- **Wells showing less fluctuation in water levels indicate a discharge area.**
- **Wells in recharge area run dry soon after a few months from the rains.**
- **Discharge area wells retain water up to the end of summer, the wells are often perennial.**

# **Demarcation of groundwater recharge and discharge areas - Based on water level contours**

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- Groundwater flow lines diverge away from a groundwater recharge area.**
- Groundwater flow lines converge towards a groundwater discharge area.**
- Recharge area shows a groundwater mound in 3-D.**
- Discharge area shows a groundwater trough in 3-D.**



Draw hydrographs to represent recharge and discharge

### Hydrographs-Rainfall

