SNS COLLEGE OF TECHNOLOGY

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Coimbatore – 35

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DEPARTMENT OF AGRICULTURAL ENGINEERING

19AGB303 – IRRIGATION AND DRAINAGE ENGINEERING

III – YEAR VI SEMESTER

UNIT 2 – WATER RESOURCE AND IRRIGATION REQUIREMENT OF CROPS

TOPIC 1 – WATER RESOURCES & RIVER BASINS

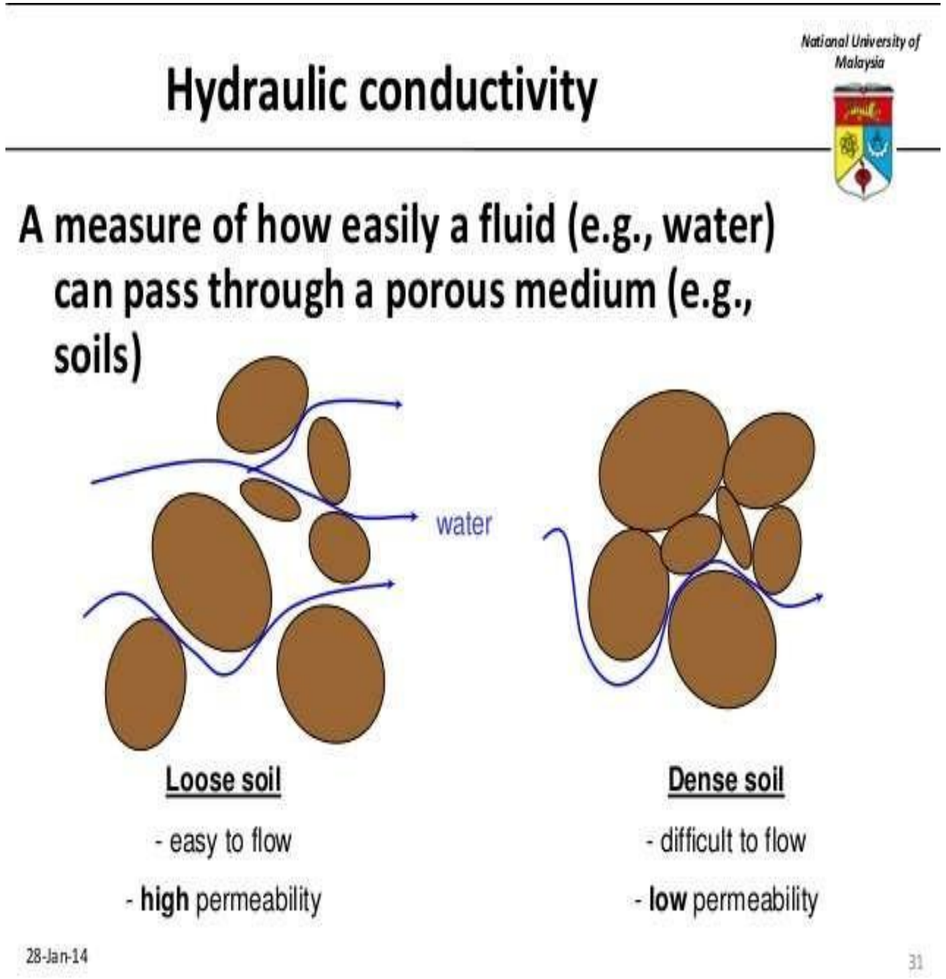
Hydraulic conductivity

✓Hydraulic conductivity is the ratio of velocity to hydraulic gradient indicating permeability of porous media.

✓Symbolically represented as K, that describes the ease with which a fluid (usually water) can move through pore spaces or fractures.

✓It depends on the **permeability** of the material, the degree of **saturation**, and on the **density** and **viscosity** of the fluid.

✓Hydraulic conductivity in non saturated soil is called capillary conductivity



The definition of the hydraulic conductivity follows from the Darcy's Law –Darcy's flow velocity for laminar flow is defined as the quantity of fluid flow along the hydraulic gradient per unit cross sectional area.

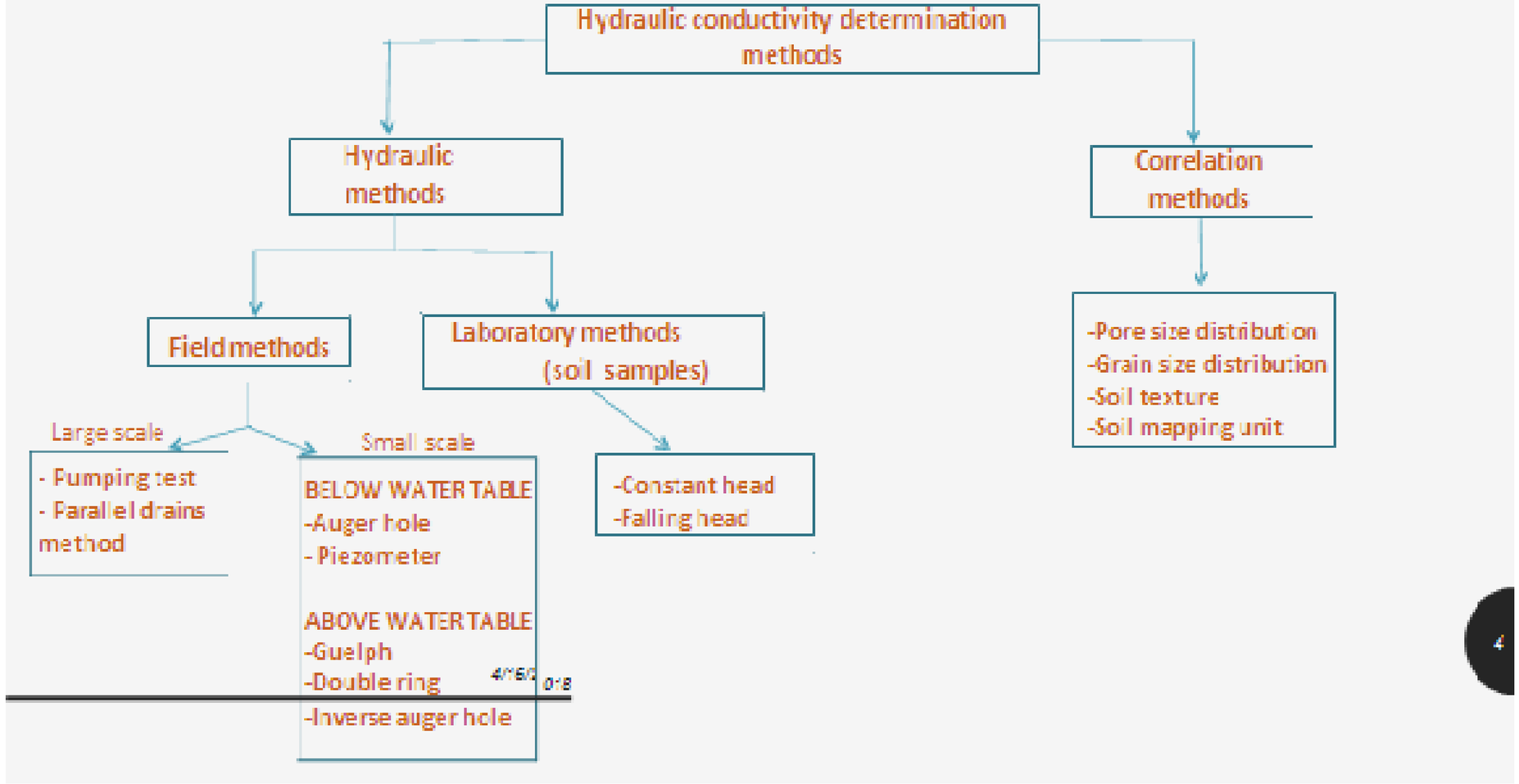
There fore, V = KI

1. In the saturated flow conditions and according to the Darcy's Law, the flow velocity v can be expressed as

$$V = K\,(dh/dx)$$

2. where x is distance in the direction of groundwater flow, h is hydraulic head.

Methods of Hydraulic Conductivity Determination



Hydraulic methods (in the field)

Auger hole method:

✓Measurement of saturated hydraulic conductivity at a locality with available groundwater level in measured layer is best operated by using the auger hole method.

✓This method is quick and easy and does not demand any expensive equipment. Moreover, natural water from the place being measured is used for the experiment.

✓A hole is made to a certain depth below the groundwater table. The water table in the hole is lowered with a bailer and then the rate of rise of the water table is measured.

✓From the geometry of the auger hole, the value of hydraulic conductivity can be calculated .

✓In the finer textured soils, the pressure required for the initial augering causes a thin, dense seal to form on the sides of the hole.

✓This seal is hard to remove with a hole scratcher. But the removal of seal is essential to obtain reliable data from the

Measurement procedure

1)Drilling of the hole
2)Removal of the water from the hole
3)Measurement of the rate of the rise
4)Computation of the hydraulic conductivity from the measurement data

Drilling of the hole

- The hole is bored into the soil to a certain depth below the groundwater (GW) level
- The depth where the GW level is reached for the first time is registered
- Observe the changes in soil characteristics (color, water saturation, etc.)
- Wait until the equilibrium with the surrounding GW is reached (until the GW level keeps constant), the stable GW level is measured
- Ground water is removed manually by using abailer or pumped out from the hole
- Final GW level after removal is registered

- Use of float gauge with a measuring tape or electrical device.

- The observations are most often made at regular time intervals.

- About 10 readings are recommended

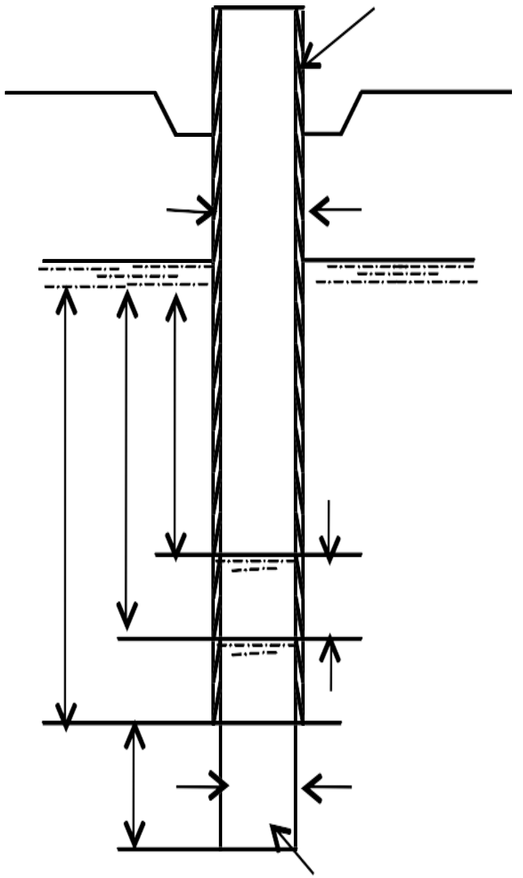
Piezometer Methods

✓The piezometer test measures the horizontal hydraulic conductivity of individual soil layers below a water table.

✓This test is preferred over the auger hole test when the soil layers to be tested are less than 18 inches thick and individual layers below the water table are to be tested.

✓This test also provides reliable hydraulic conductivity data for any soil layer below the water table.

$$k = \frac{\pi a^2 \ln\left(\frac{y_1}{y_2}\right)}{S(t_2 - t_1)}$$



✓This field method can be used for measuring the hydraulic conductivity of layers at relatively great depth or of separate soil layers.

✓Piezometer method is not used in practice very often. This method serves for estimation of impact of soils heterogeneity and also for differentiation of horizontal and vertical components.

Disadvantages:

The value of hydraulic conductivity represents only the direct surrounding of the small cavity.

Guelph permeameter method

✓The Guelph Permeameter is an easy to use instrument to quickly and accurately measure in-situ hydraulic conductivity.

✓Accurate evaluation of soil hydraulic conductivity, soil sorptivity, and matrix flux potential can be made in all types of soils.

✓The equipment can be transported, assembled, and operated easily by one person.

✓Measurements can be made in 1/2 to 2 hours, depending on soil type, and require only about 2.5 liters of water.

✓Measurements can be made in the range of 15 to 75 cm below the soil surface.

✓The method involves measuring the steady-state rate of water recharge into unsaturated soil from a cylindrical well hole, in which a constant depth (head) of water is maintained.

Reference Videos

https://www.youtube.com/watch?v=sL3AfZ37Kf4

See You at Next Class!!!!