

UNIT – II

Analysis of Pumping Test Data – I

1. Introduction to Pumping Tests

Pumping tests are conducted to determine aquifer properties such as:

- Permeability
 - Transmissivity
 - Storage coefficient
 - Well yield
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2. Steady Flow Towards a Well

In steady flow, water level remains constant with time.

Assumptions

- Aquifer homogeneous and isotropic
 - Infinite aerial extent
 - Fully penetrating well
 - Laminar flow
 - Constant pumping rate
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3. Dupuit's Equation

Dupuit developed equations for radial groundwater flow.

3.1 Confined Aquifer

$$Q = \frac{2\pi K b (h_1 - h_2)}{\ln(r_2/r_1)}$$

Where:

- Q = Pumping rate
 - K = Permeability
 - b = Aquifer thickness
 - h_1, h_2 = Heads
 - r_1, r_2 = Radial distances
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3.2 Unconfined Aquifer

$$Q = \frac{\pi K (h_2^2 - h_1^2)}{\ln(r_2/r_1)}$$

4. Thiem's Equation

Used for steady radial flow.

$$T = \frac{2.3Q}{2\pi(s_1 - s_2)} \log \frac{r_2}{r_1}$$

Where:

- T = Transmissivity
 - s_1, s_2 = Drawdowns
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5. Drawdown

Drawdown is the lowering of water level due to pumping.

$$s = h_0 - h$$

Where:

- s = Drawdown
- h_0 = Original head
- h = Pumping head

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6. Assumptions in Well Hydraulics

- Horizontal flow
- Constant pumping rate
- No recharge during pumping
- Fully penetrating well
- Darcy's law valid

7. Formation Constants

a) Hydraulic Conductivity ((K))

Ability of aquifer to transmit water.

b) Transmissivity ((T))

Rate of groundwater flow through aquifer thickness.

c) Storage Coefficient ((S))

Water released from storage.

8. Yield of Open Wells

Yield is the amount of water supplied by a well.

Factors Affecting Yield

- Aquifer permeability
 - Radius of well
 - Pumping rate
 - Saturated thickness
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9. Well Losses

Well losses occur due to:

- Friction losses
- Turbulence
- Entrance losses

Total Drawdown

$$s = BQ + CQ^2$$

Where:

- BQ = Formation loss
 - CQ^2 = Well loss
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10. Well Tests

Types of Well Tests

1. Pumping test
2. Recuperation test
3. Step drawdown test

Objectives

- Determine aquifer properties
 - Estimate safe yield
 - Evaluate well performance
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