Newfoundland Labrador

Water Resources Management Division

Department of Environment & Conservation

Pumping Tests for Municipal Water Supply

Titia Praamsma

March 26, 2013

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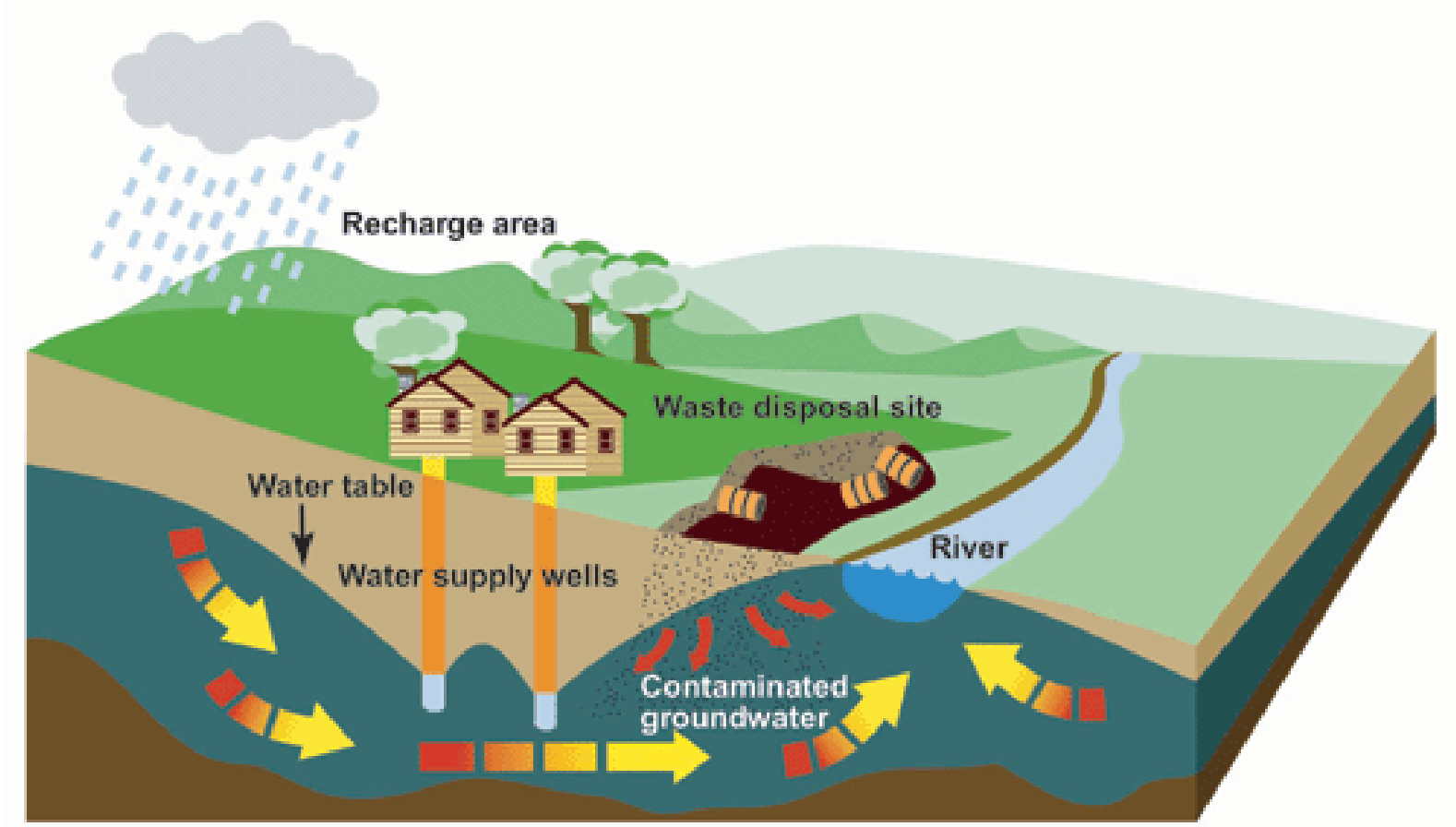
Pumping Tests



Source: Environment Canada

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Pumping Tests – Why?

- To learn about the aquifer
  - How much water it can produce
  - Another way to see underground
- Regulated
- Lift test vs. long term test

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Pumping Tests – Why?

- This is expensive and important data
- Collaboration between MA, ENVC, municipality, driller, and environmental consultant

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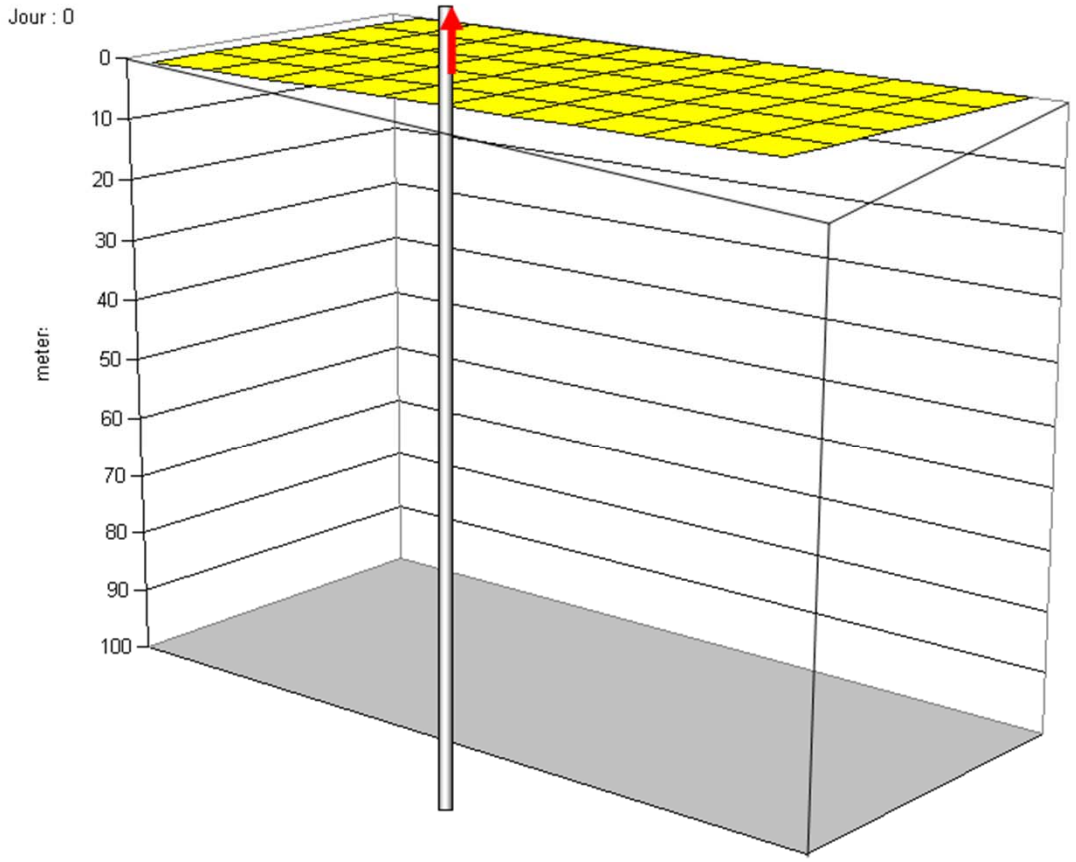
Pumping a Well



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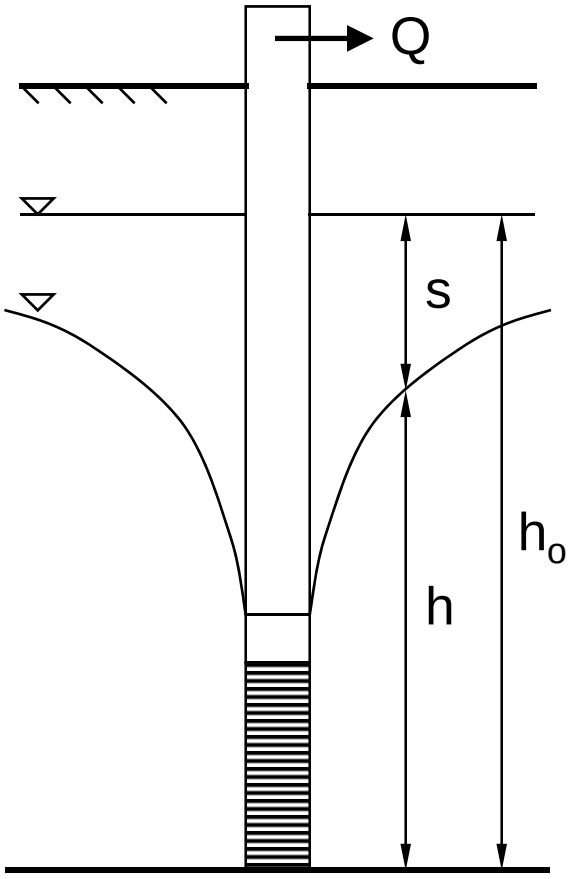
Terminology



- **Static Water Level** (h_o) is the equilibrium water level before pumping commences
- **Pumping Water Level** (h) is the water level during pumping
- **Drawdown** ($s = h_o - h$)
- **Well Yield** (Q) is the volume of water pumped per unit time
- **Specific Capacity** (Q/s) is the yield per unit drawdown

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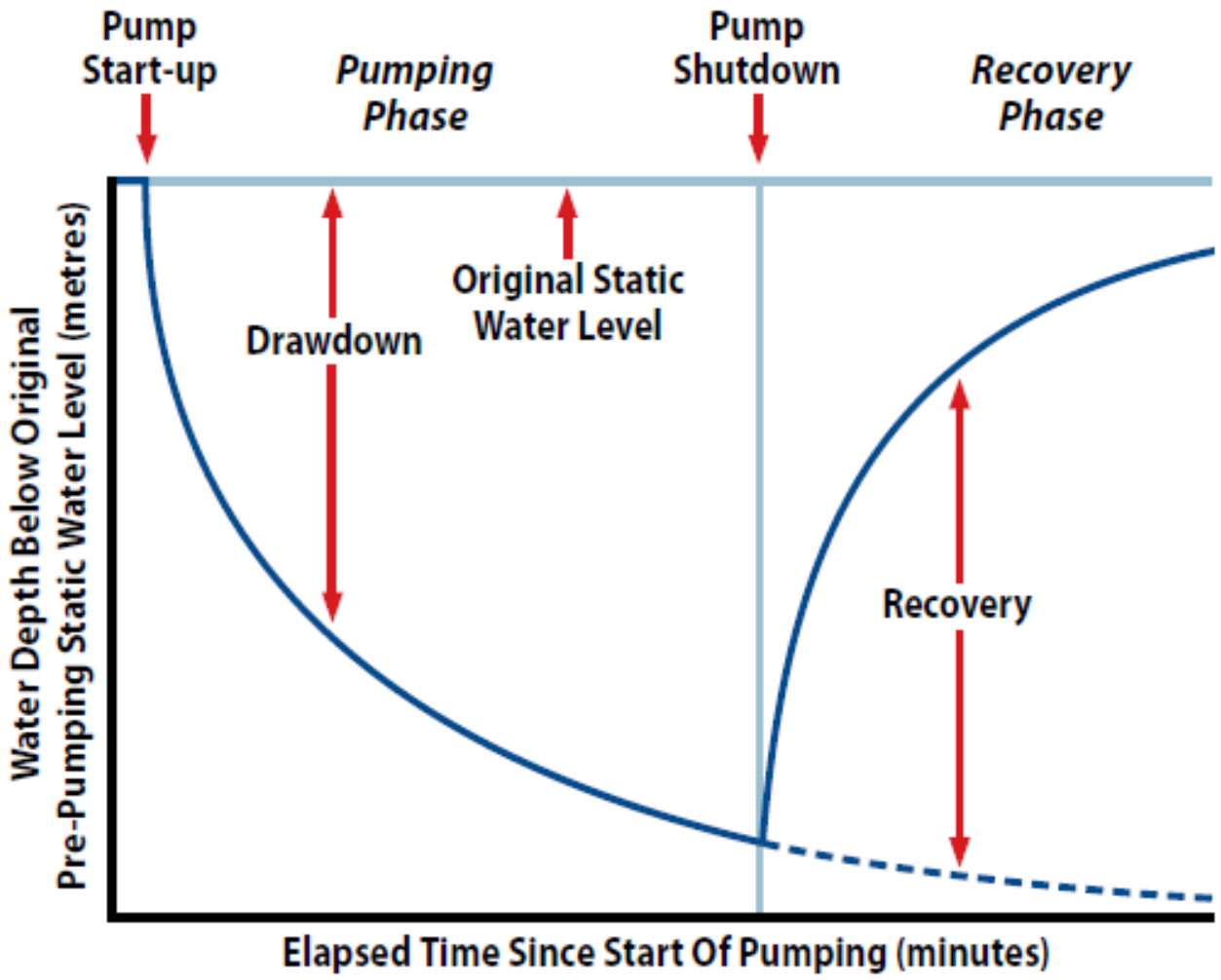
Pumping Test



Source: BC MOE

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Before you start the pump AKA: Planning

- Survey elevations of all well measurement reference points

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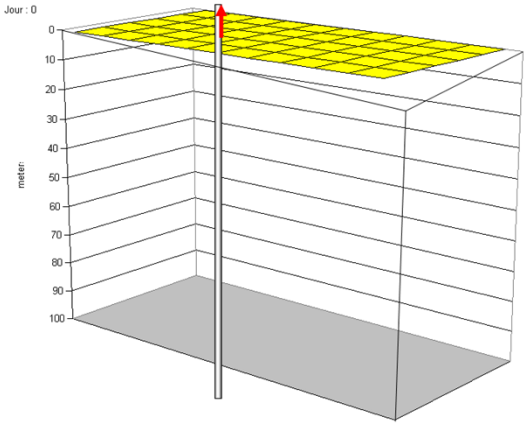
Before you start the pump

- Estimate the maximum drawdown at the pumped well



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Before you start the pump

- Determine how long the test will be
  - Recharge/boundary conditions
- Consider the geology and hydrogeology of the area

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Before you start the pump

- Estimate the maximum pumping rate
- Step Drawdown Test

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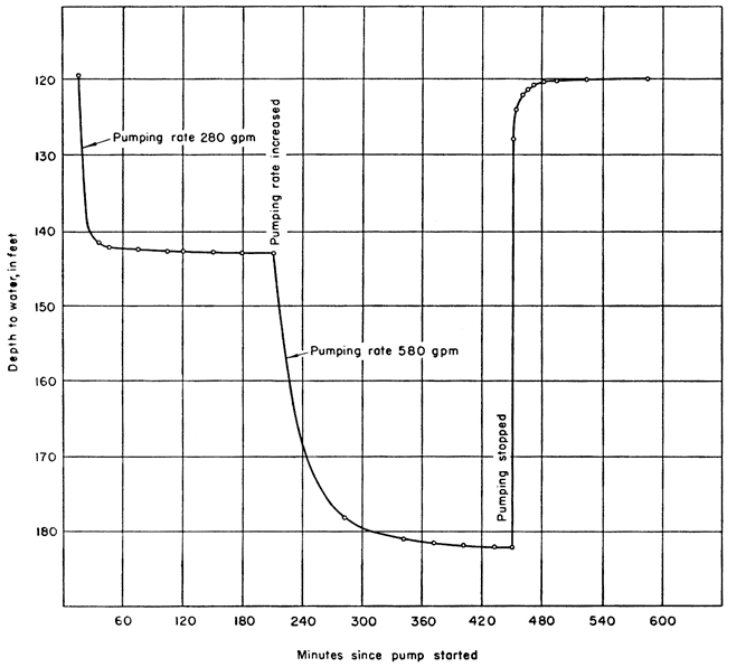
Step Drawdown Tests

- Single well test where well is pumped at a low constant discharge rate until drawdown stabilizes.
  - Then increase the pumping rate
  - At least three steps of one hour duration



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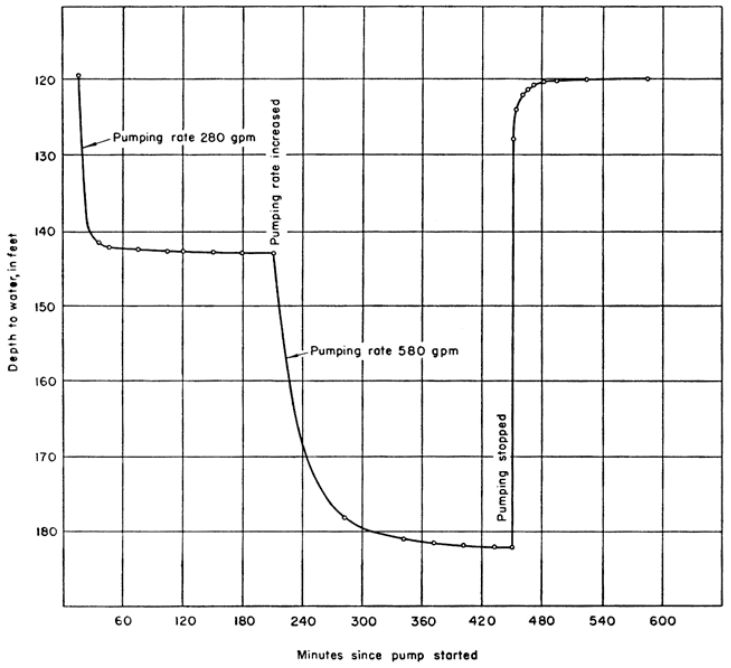
Step Drawdown Tests

- Used to decide pumping rate for constant rate test;
- Can evaluate well loss and efficiency;
  - As well as transmissivity, hydraulic conductivity, and storativity



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Before you start the pump

- Evaluate the best method to measure the pumping rate

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Before you start the pump

- Plan discharge very far from the well

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Before you start the pump

- Measure static water levels several times to ensure that steady-conditions prevail

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24 Hour Pumping Test Form

Well Name: _____ Well Depth: _____

Well Location: _____

Start Time: _____ End Time: _____

Initial Water Level: _____ Final Water Level: _____

Pumping Rate: _____

Notes: _____

_____

Time (min)	Water level	Drawdown	Time (min)	Water level	Drawdown	Time (min)	Water level	Drawdown
0			40			660		
1			50			720		
2			60			780		
3			75			840		
4			90			900		

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Taking measurements

- Take water levels at appropriate intervals
  - Every min to 15 mins
  - Every 5 mins to 30 mins
  - Every 10 mins to an hour
  - Every 15 mins to 2 hours
  - Every 30 mins to 4 hours
  - Every hour to 24 hours
  - Every 2 hours to 48 hours
  - Every 4 hours to 72 hours

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Taking measurements

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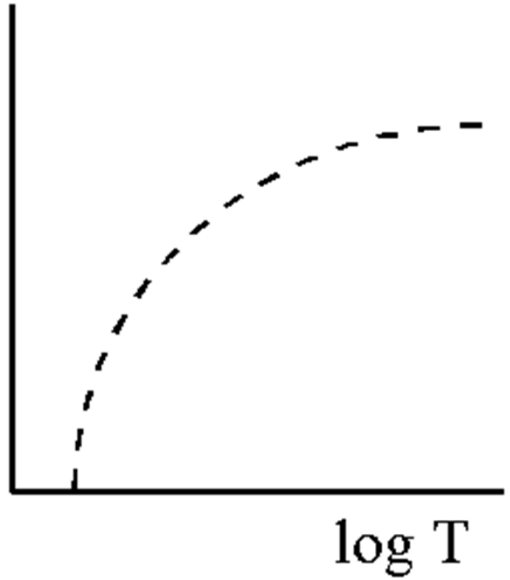

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Taking measurements

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Taking measurements

- Constant rate
  - Stay at the same rate
- Check often during test

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Observation Wells

- Number depends on test objectives and available resources for test program.
  - Single well can give aquifer characteristics (T and S).
  - Reliability of estimates increases with additional observation points.
  - Three wells at different distances are needed for time-distance analysis

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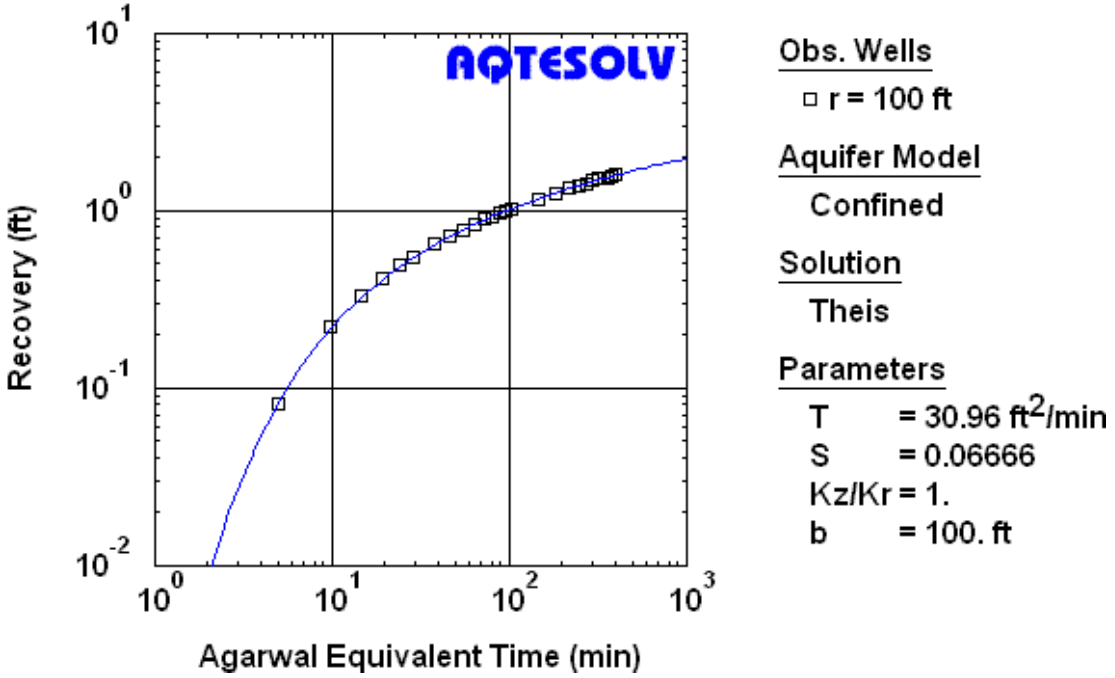
Recovery

- Take measurements at the same intervals until 80% recovered
- Can analyze the data the same way



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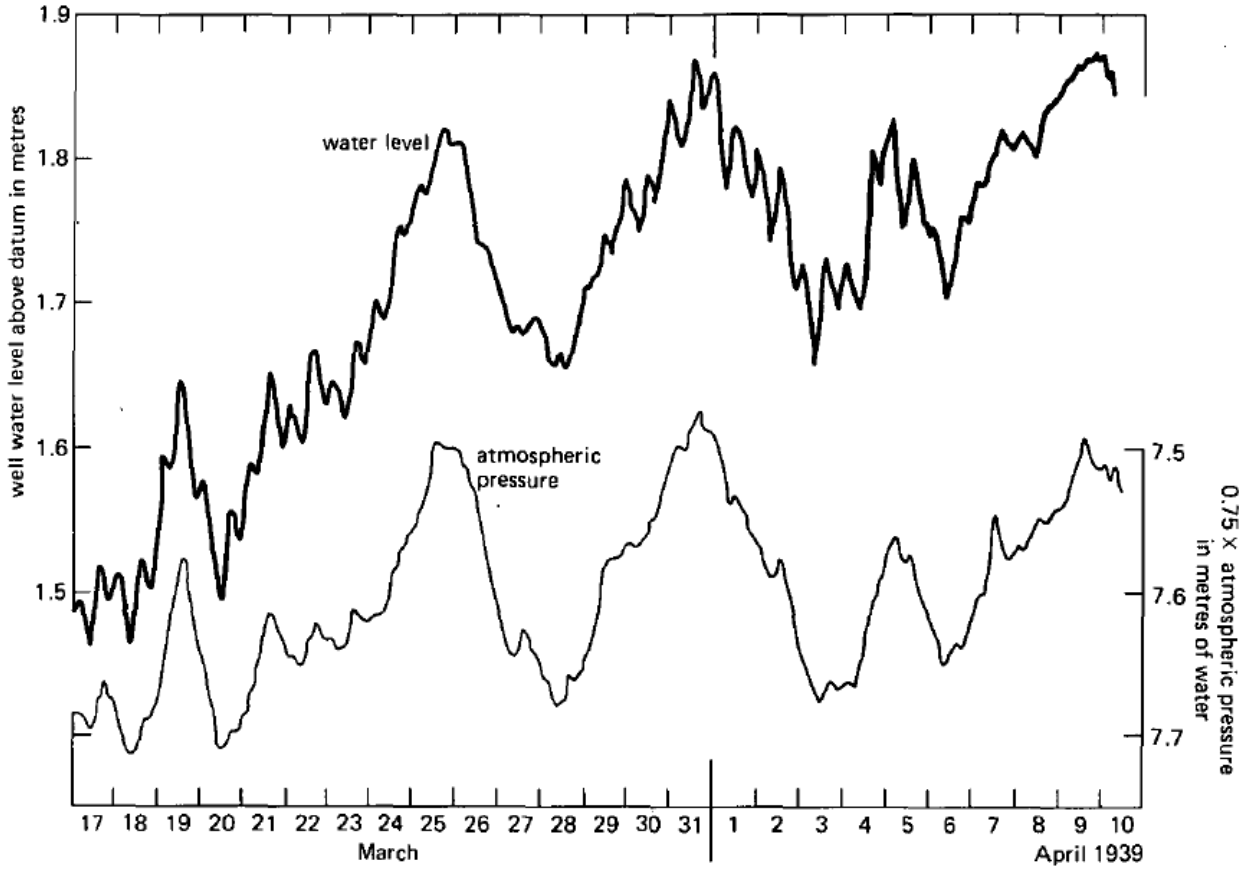
More measurements

Barometric pressure



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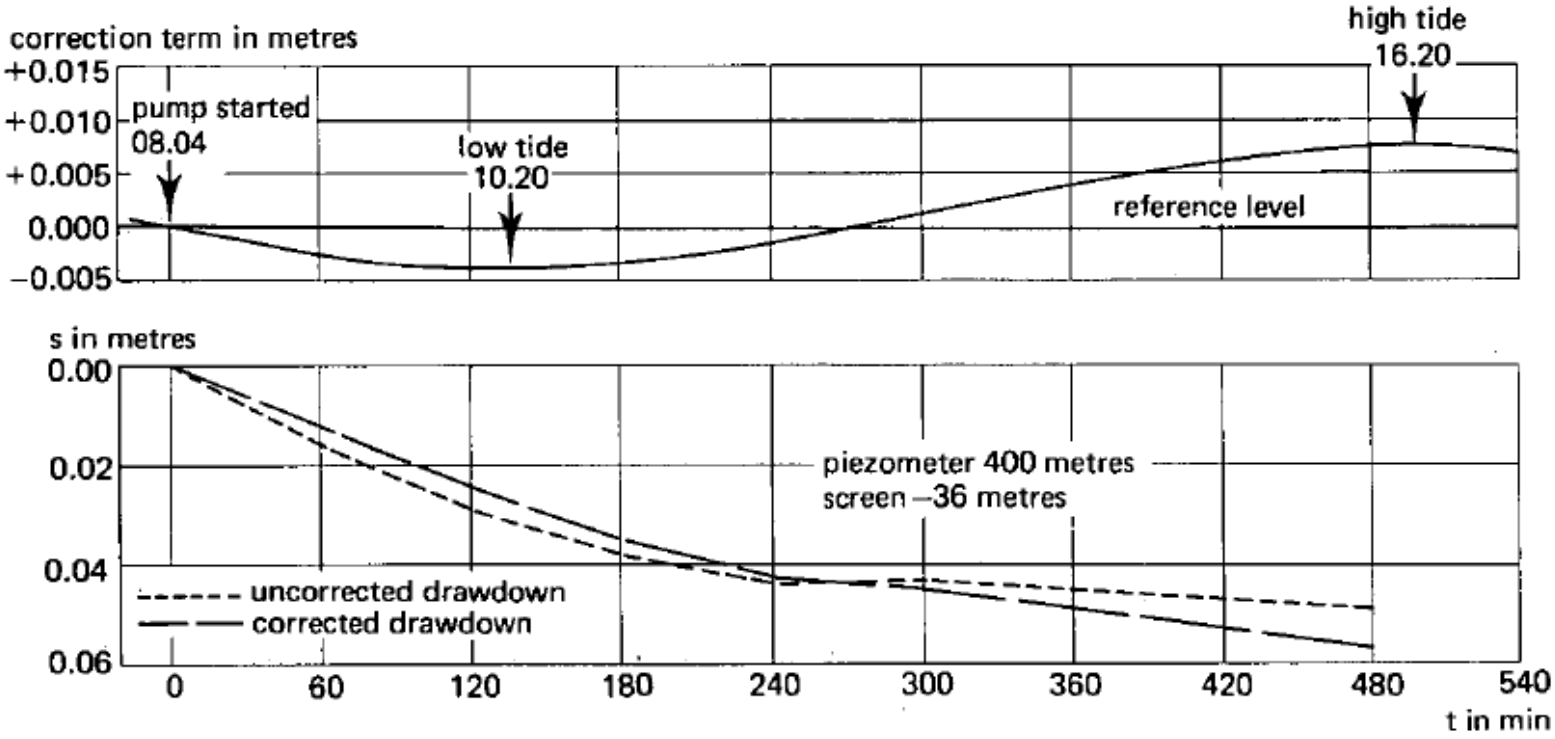
More measurements

Tidal influences



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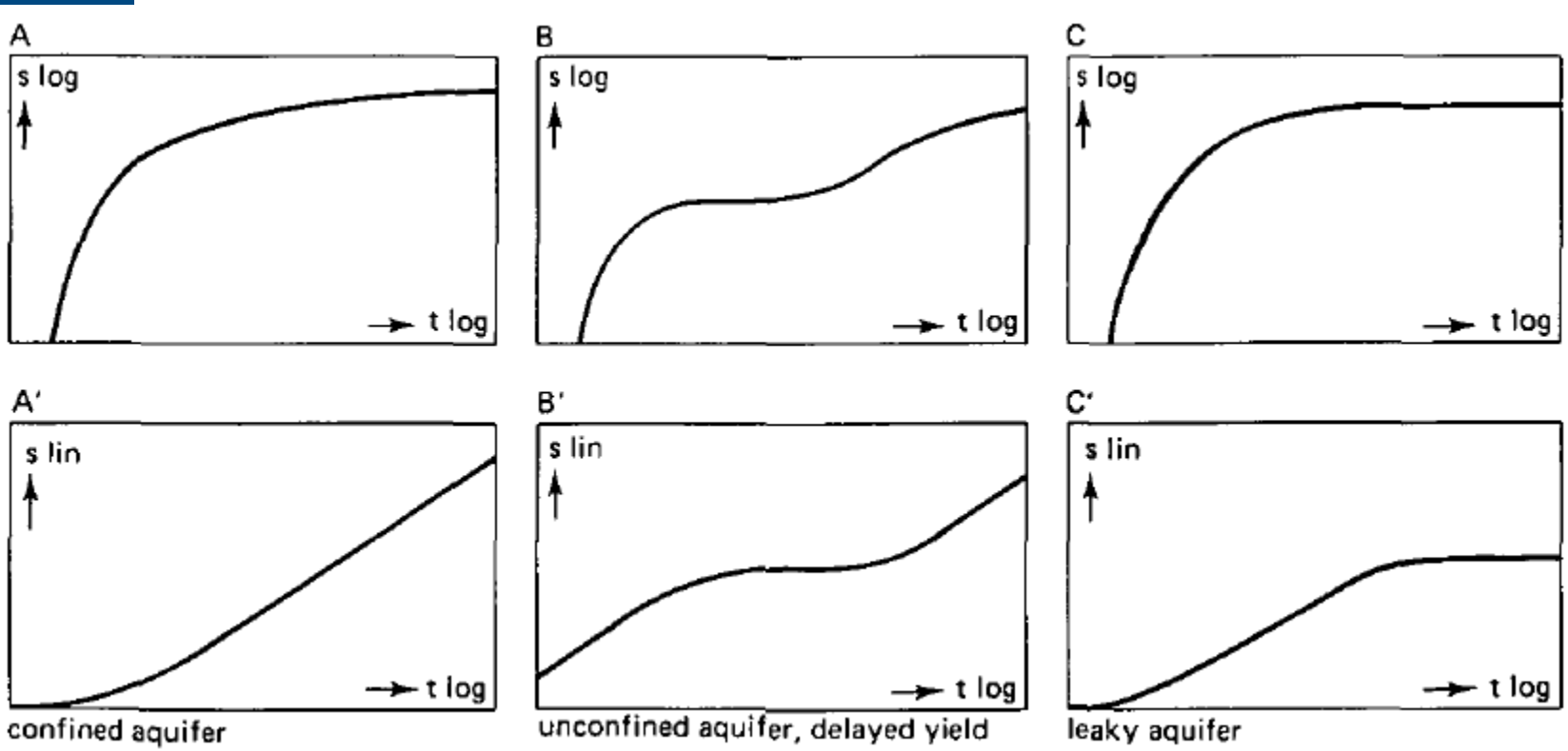
Analyzing the data

Interpret the curves



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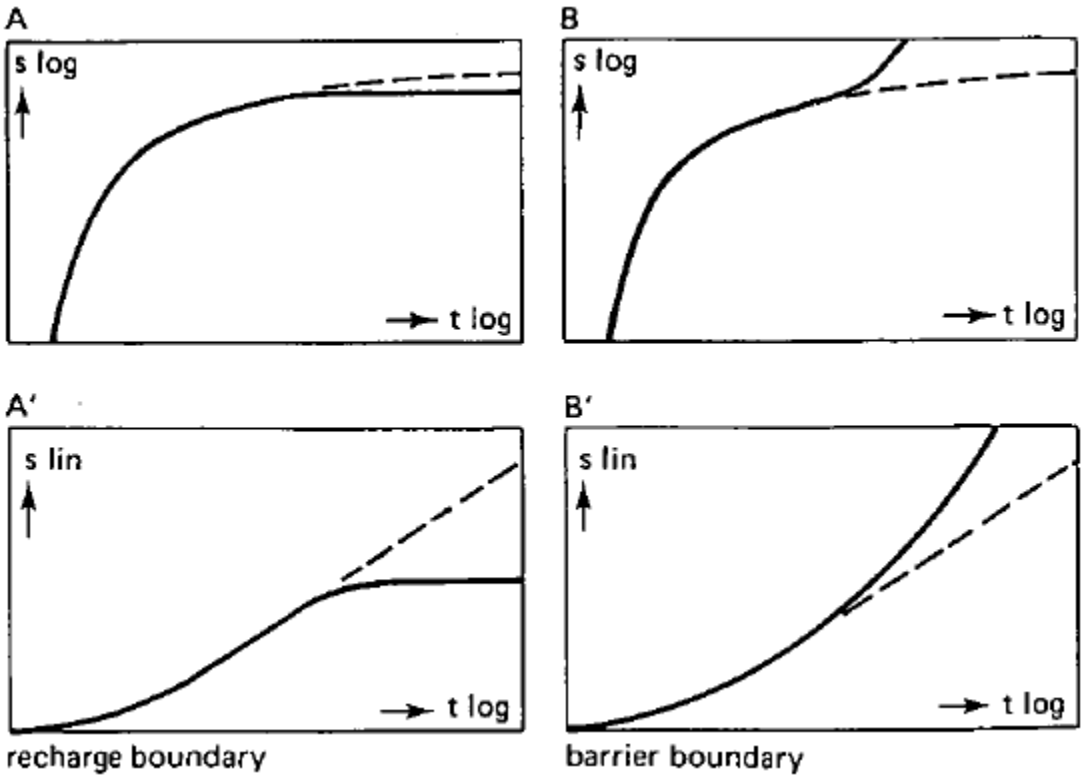

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Analyzing the data

- Apply the appropriate model for the curves
  - Theis
  - Cooper-Jacob
  - There are many more

- Use a computer program or excel spreadsheet
  - AQTESOLV, Aquifer Test

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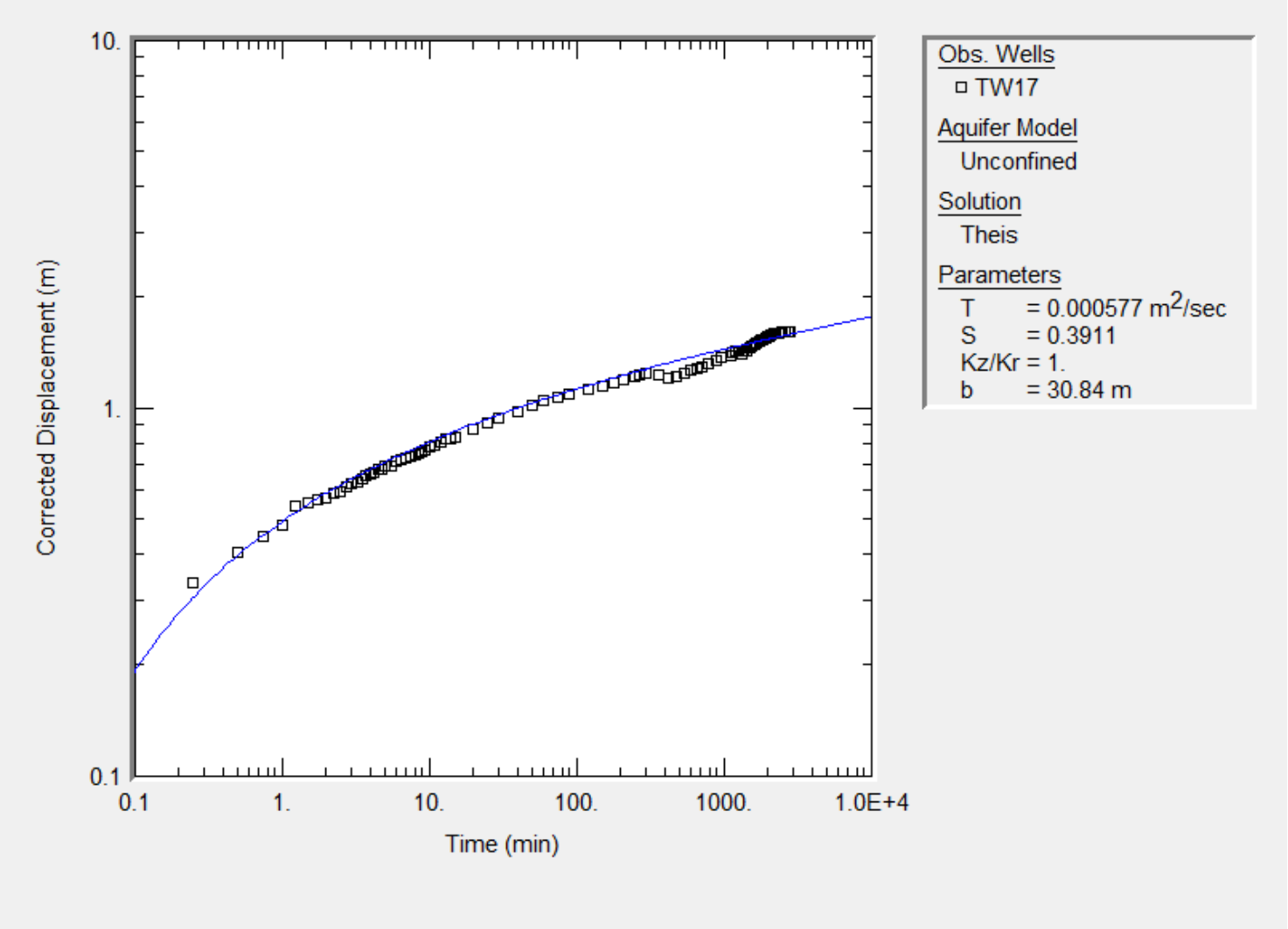
Analyzing the data



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Thanks

- New pumping test guidelines are coming soon.

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