



When Clay Attacks!

# Legal Disclaimer

- This presentation and all the information contained within is provided FOR INFORMATION ONLY. This presentation is not intended to provide any instructions or guidance on construction or design practice and no warranty is provided that use of this material will in any way reduce or limit foundation damage associated with swelling soil behaviour. Any use or interpretations made from this information are left to the sole discretion of the end user who is responsible for the results of any use in design or construction activities.
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# Residential Inspections

- The geotechnical engineer and residential pre-purchase or performance inspections is a high risk business.
- Problem for the engineering industry as this is the most likely contact with the public.
- Can we do better to represent out field without accepting undue risk?



- Memorandum of Understanding established in 2006.
- National certification standards for education, experience and insurance coverage.
- CAHPI Inspectors do not report on structural or foundation elements of the home, they recommend hiring professional engineers.

# Let the Public Decide?

- Avoid liability by working together with insured CAHPI.
- Helps define the scope of engineering inspection and there is an identified need when engineer is called.
- Charge a reasonable fee and let the public decide (spend the time).
- Positive impacts in MB. Now just working on the Realtors.

# When Clays Attack!

- Foundations in Winnipeg are notorious for movements associated with swelling of our high plastic clay.
- Houses often suffer from:
  - Uneven floors
  - Doors that won't close (or close on their own)
  - Unsightly cracks in walls / basement floor
  - Moisture that can lead to mold









# Two Fundamental Realities

- 1) Volume change in swelling soils (shrinkage or swelling) occur due to changes in water content.
- 2) Swelling pressure is created by boundary conditions.

# Natural Factors

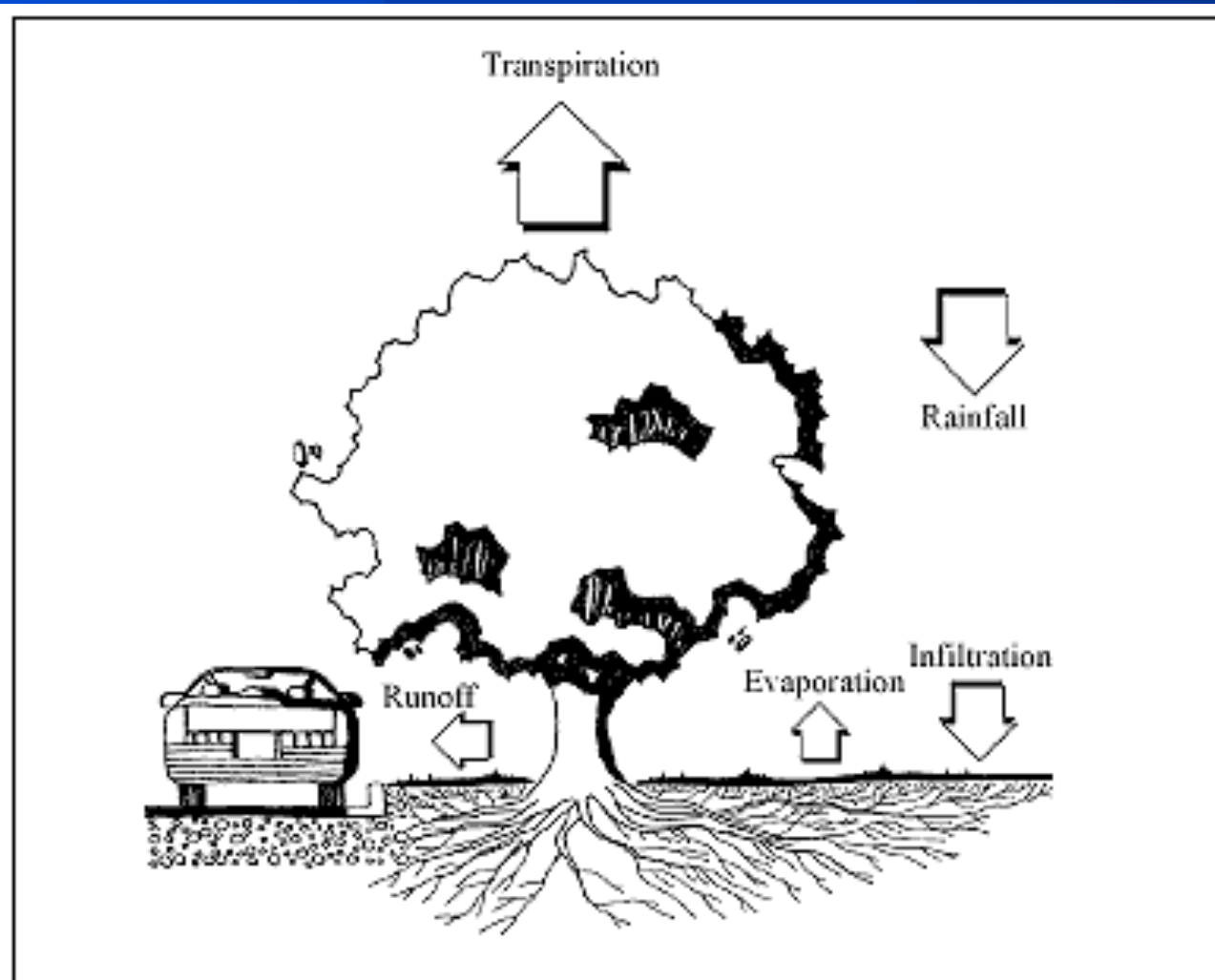
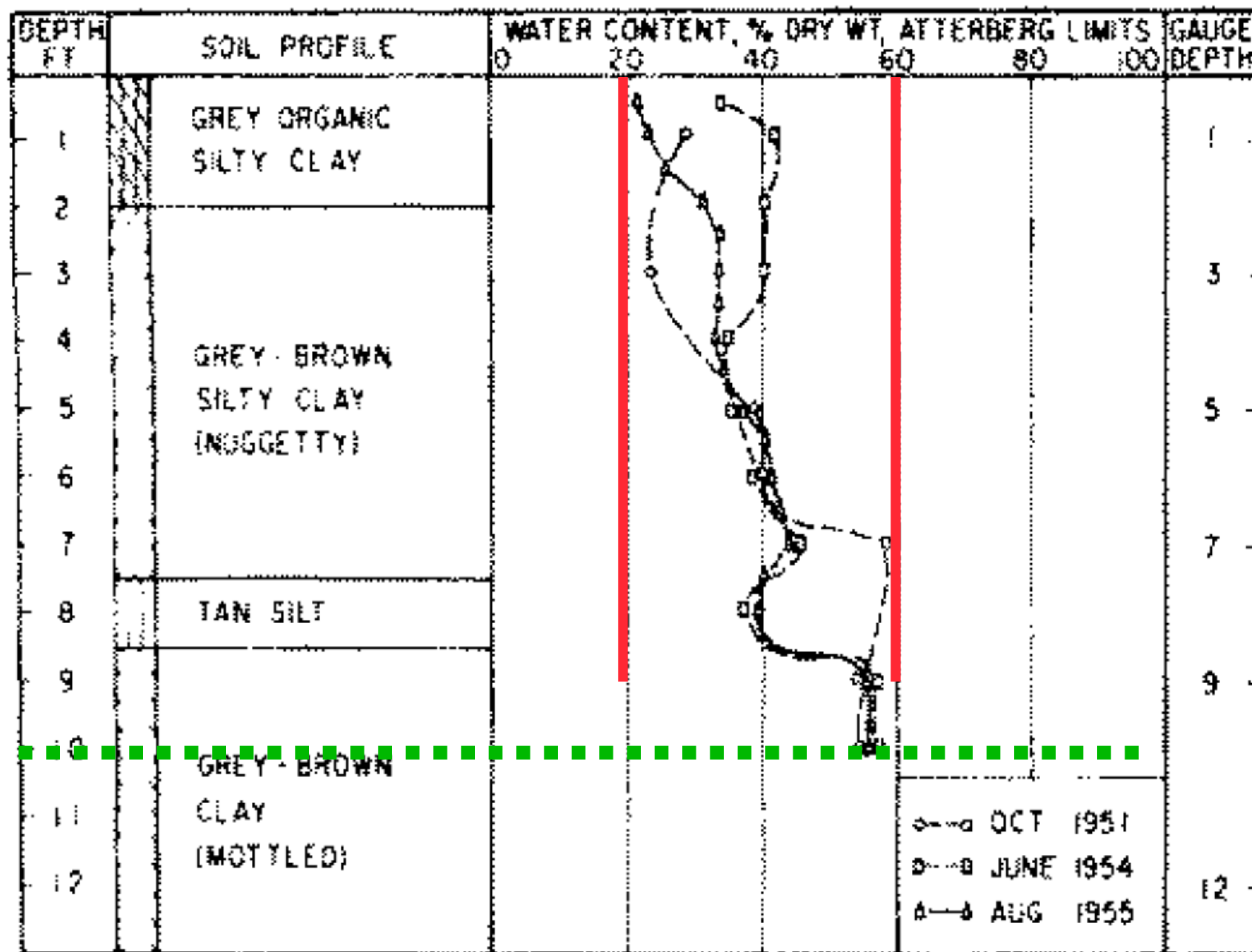


Figure 2: Main water movements in urban areas

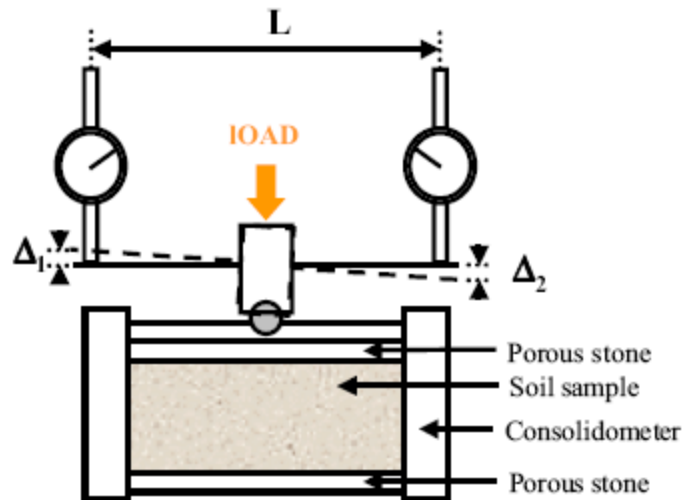








## Swell Test

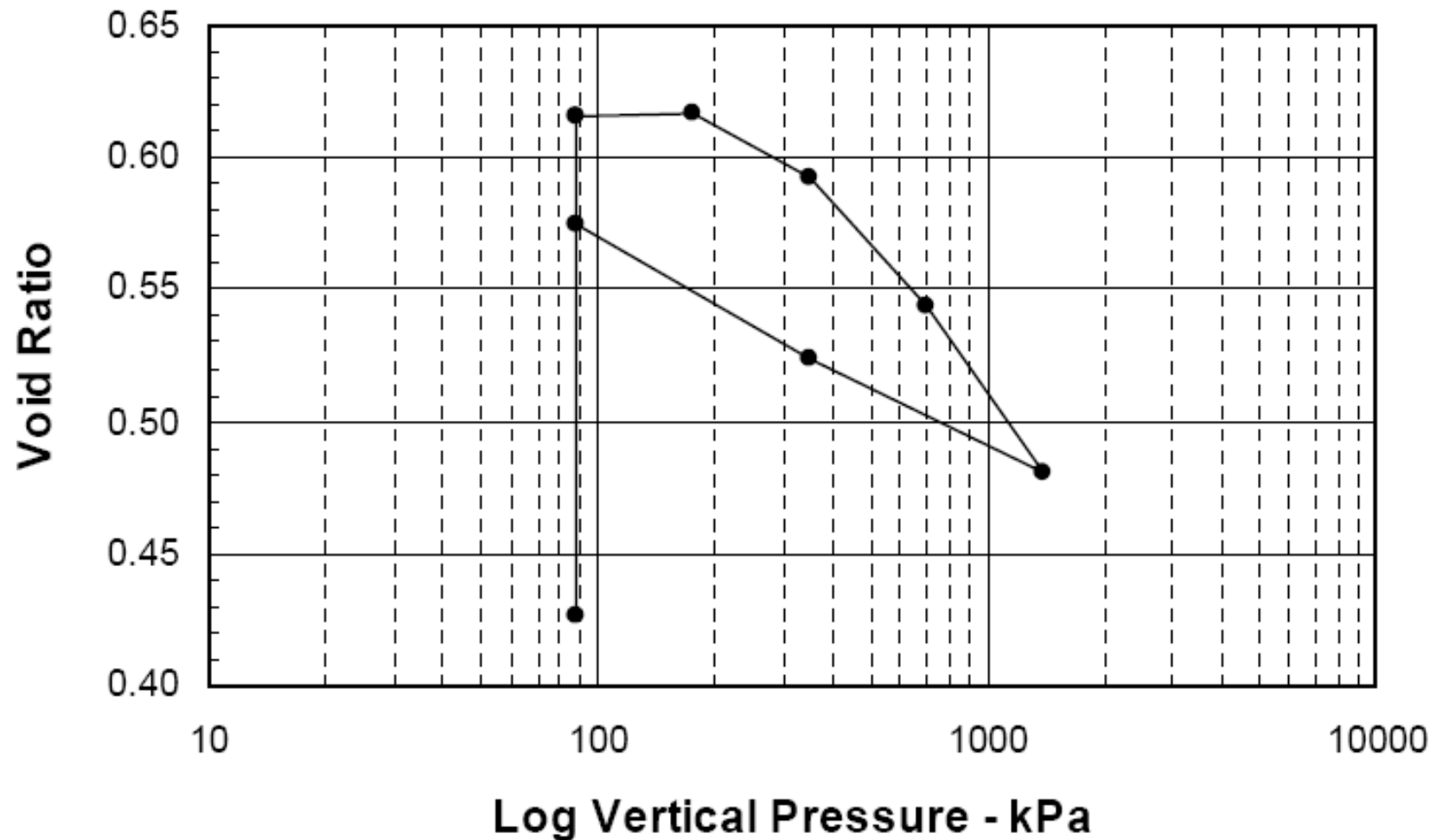


# Oedometer Study

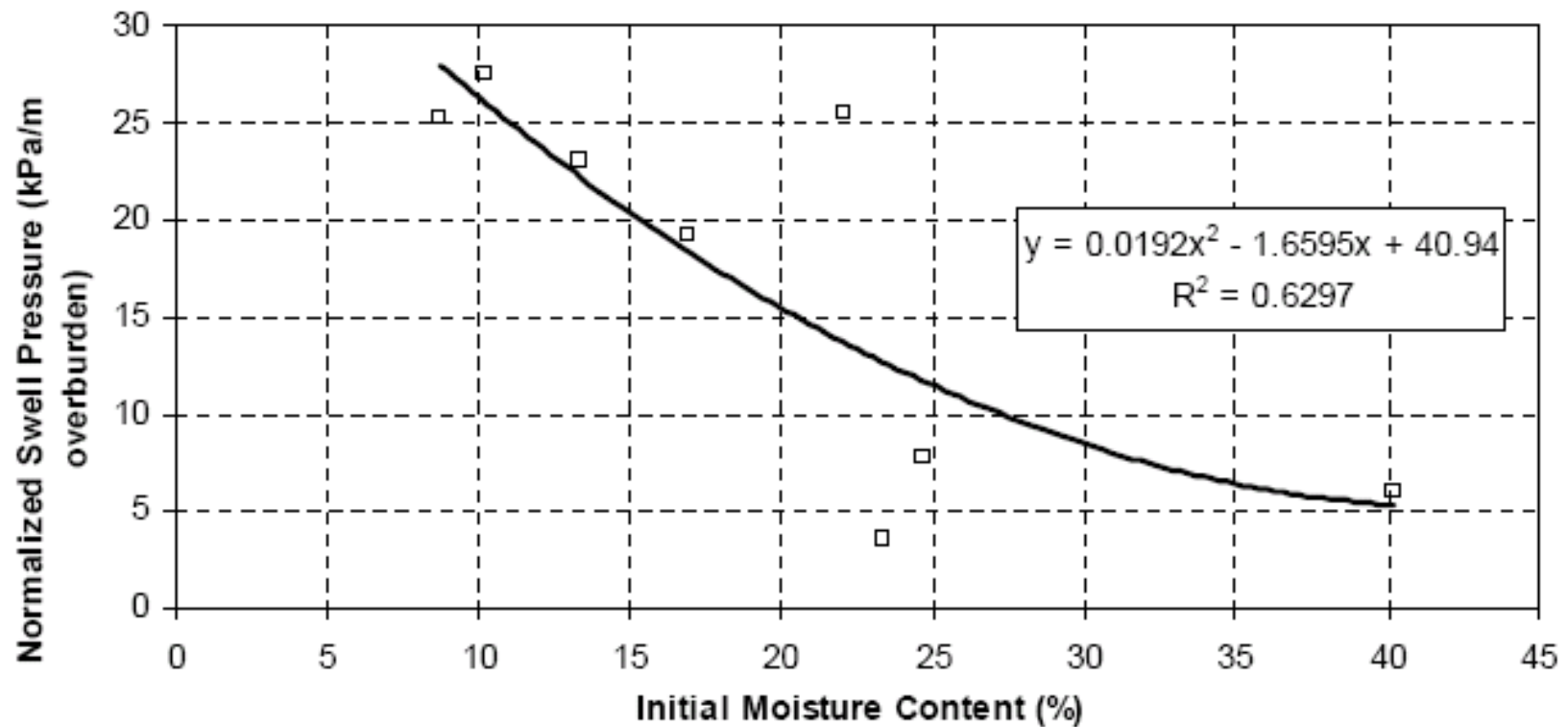
- Replicates swell conditions under confinement or constant pressure
- Allows examination of the influence of initial water contents.

# Constant Stress – Basement Slab

Sample 46-3  
Void Ratio vs. Log Vertical Pressure

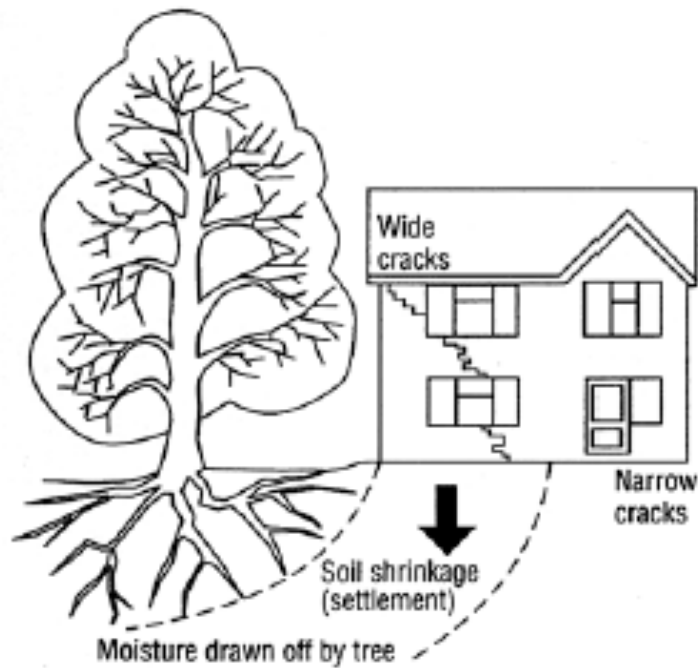


# Generalized Relationship



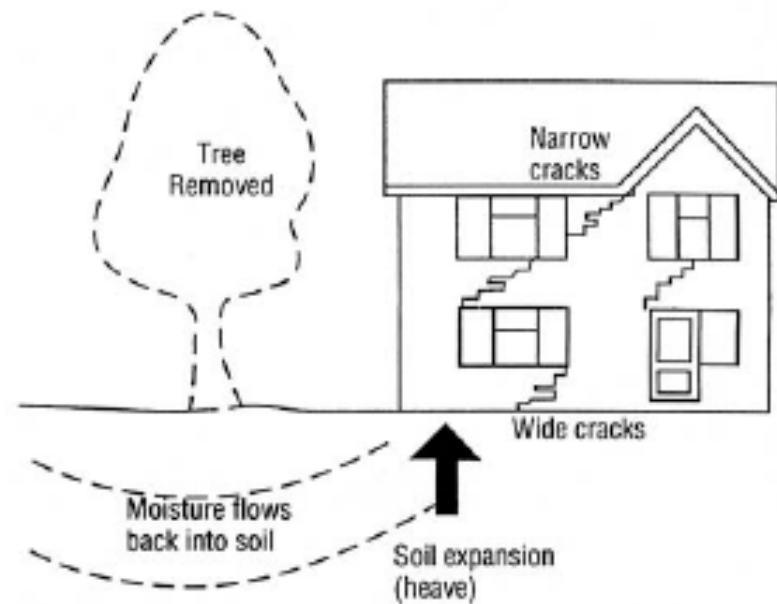
# Intentional Factors that Cause Changes in the Soil Moisture Changes

- 1. Change in Vegetation***
2. Construction Activities
3. Drainage Problems
4. Irrigation
5. Owners



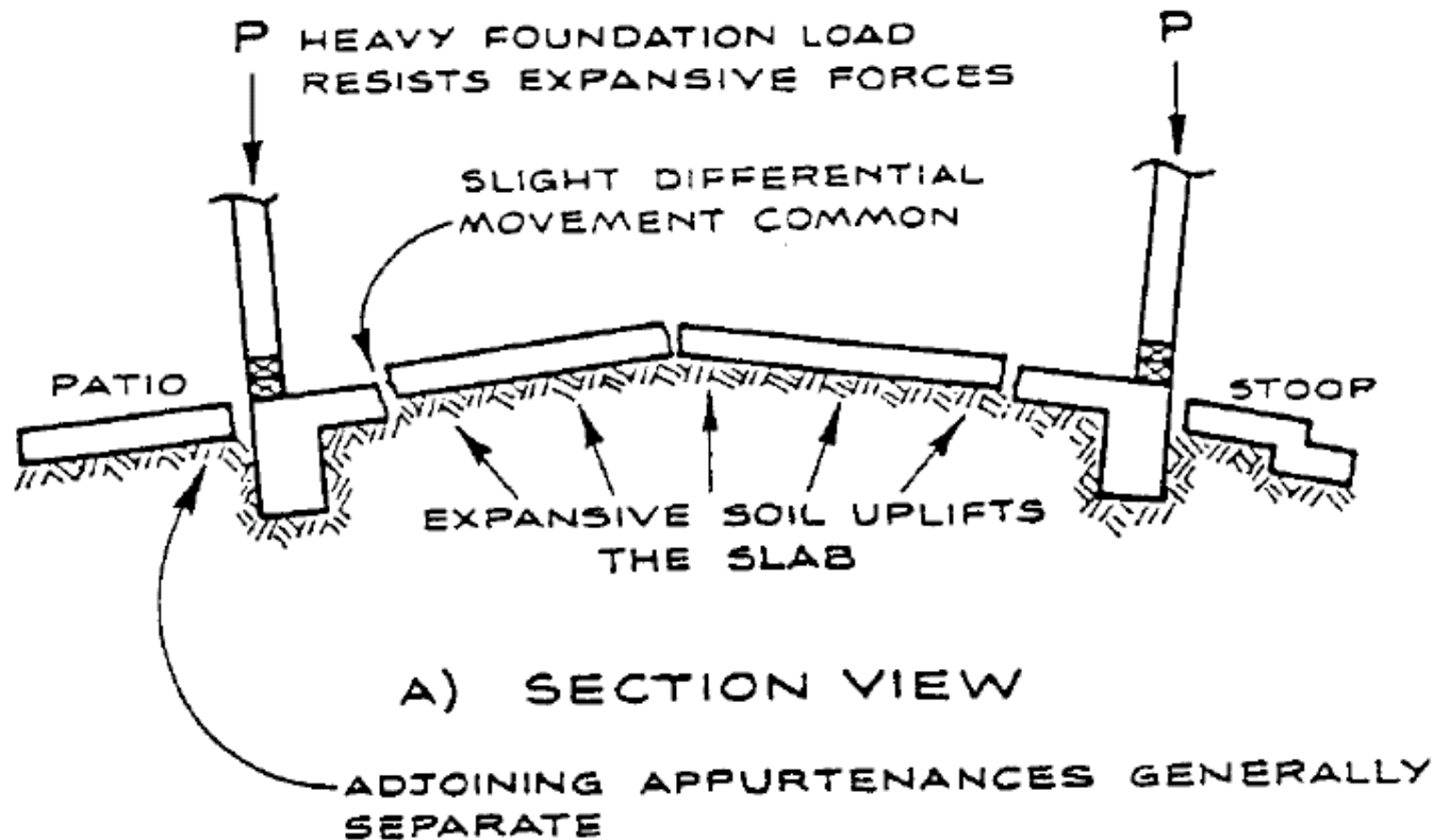
## Remove Vegetation Swelling

## Add Vegetation Shrinkage





# Typical Swelling Scenario



# Modeling Moisture Movements

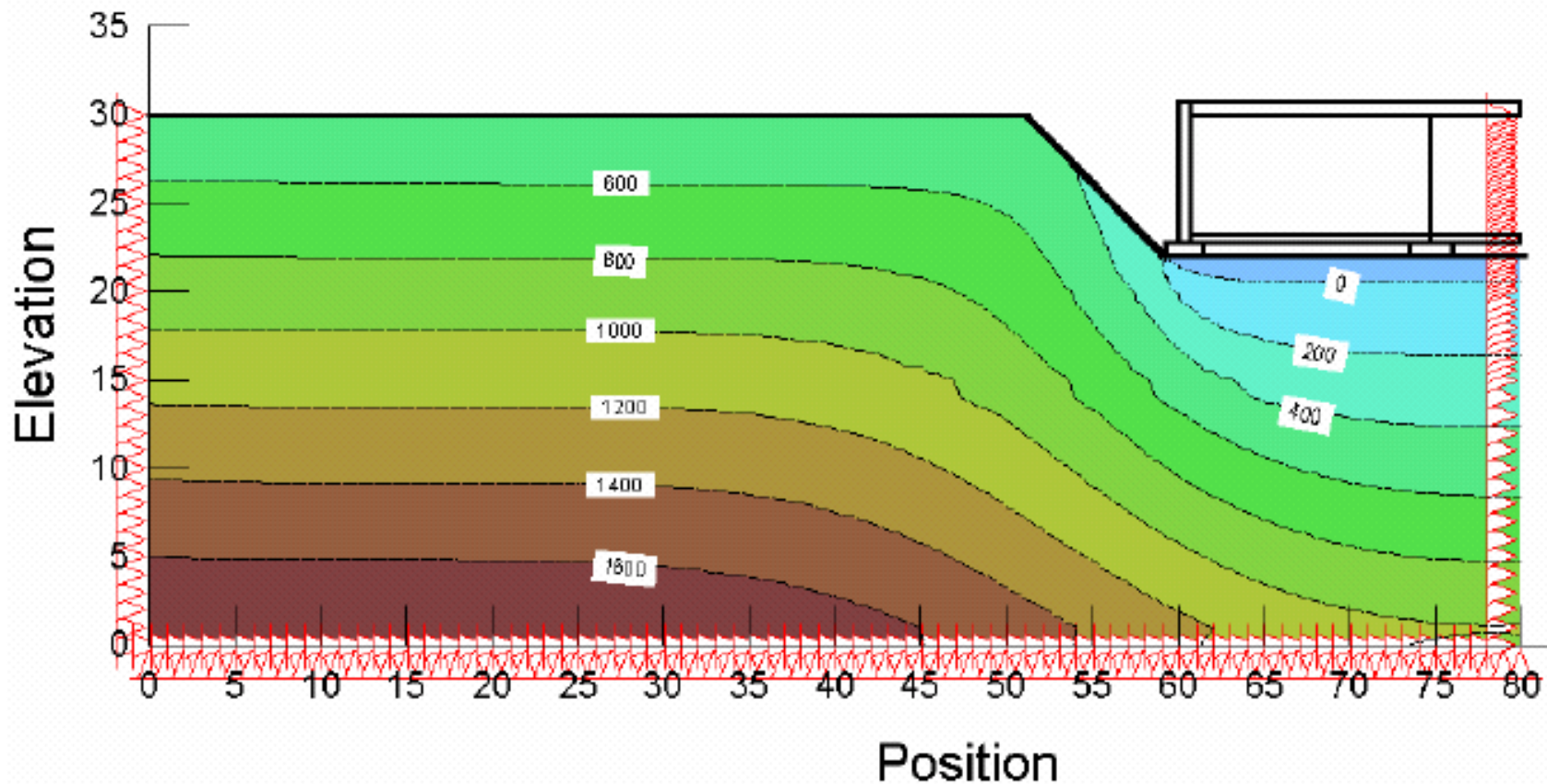
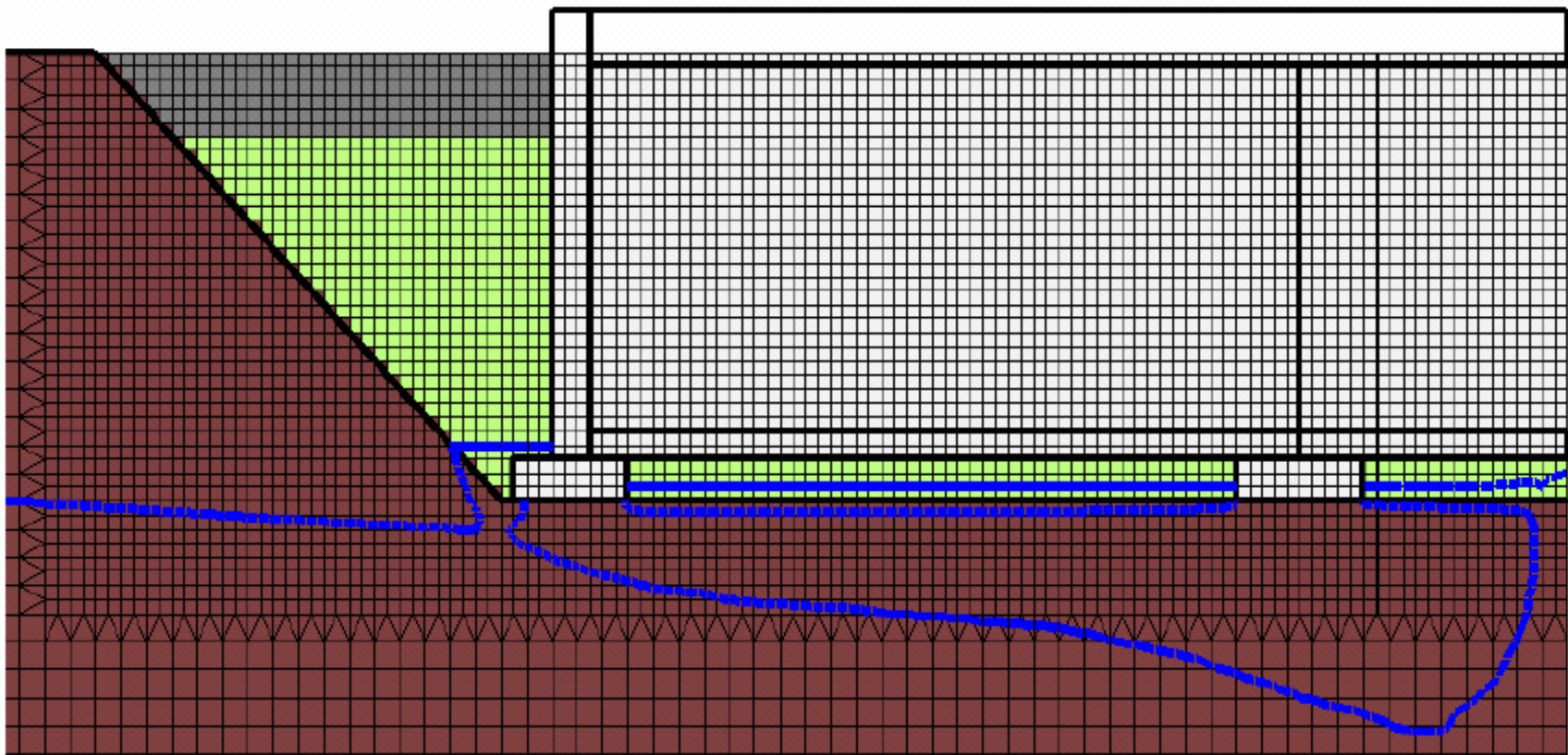
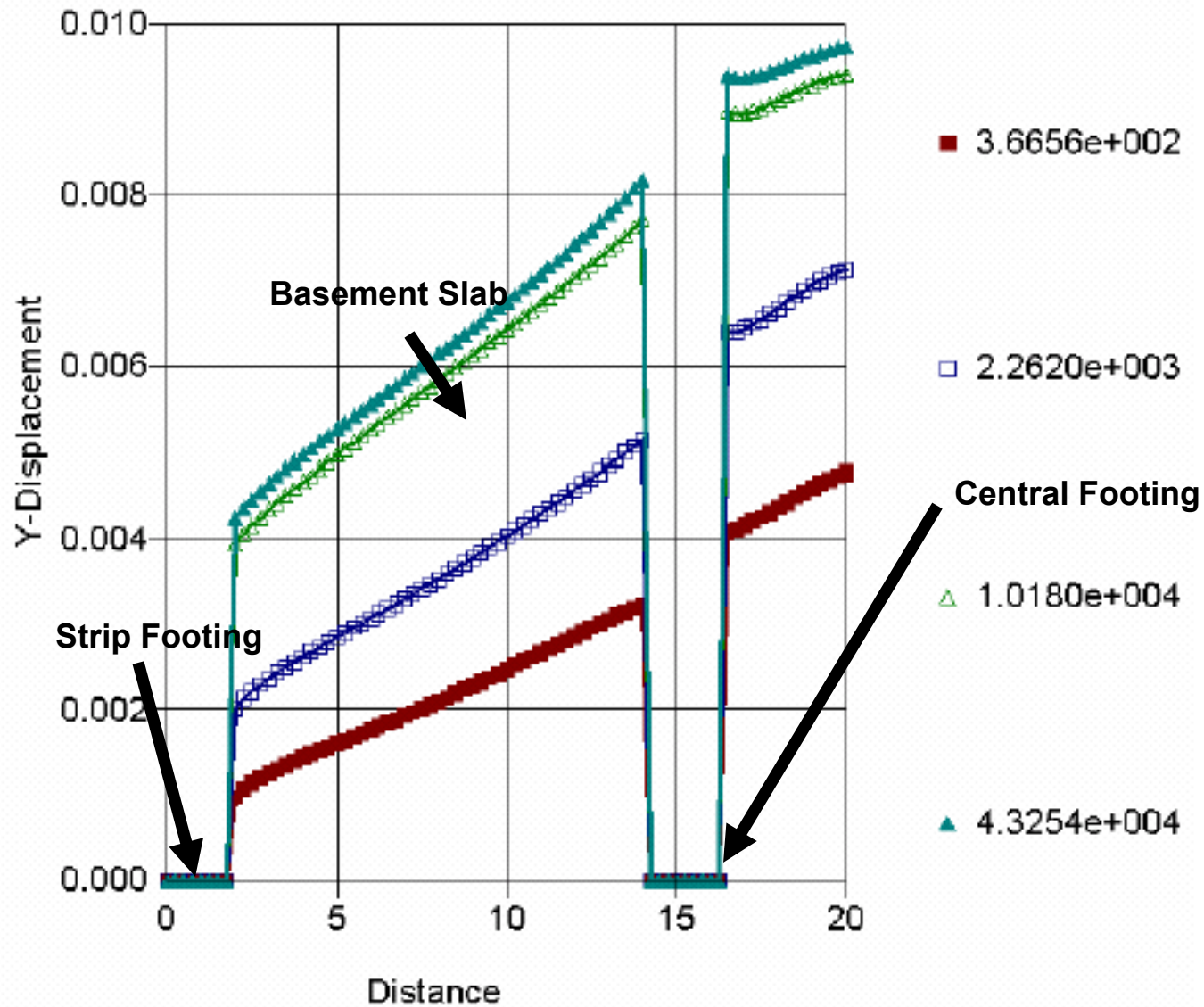


Figure 13 - Post Excavation Vertical Effective Stress

# Predicting Moisture Movements



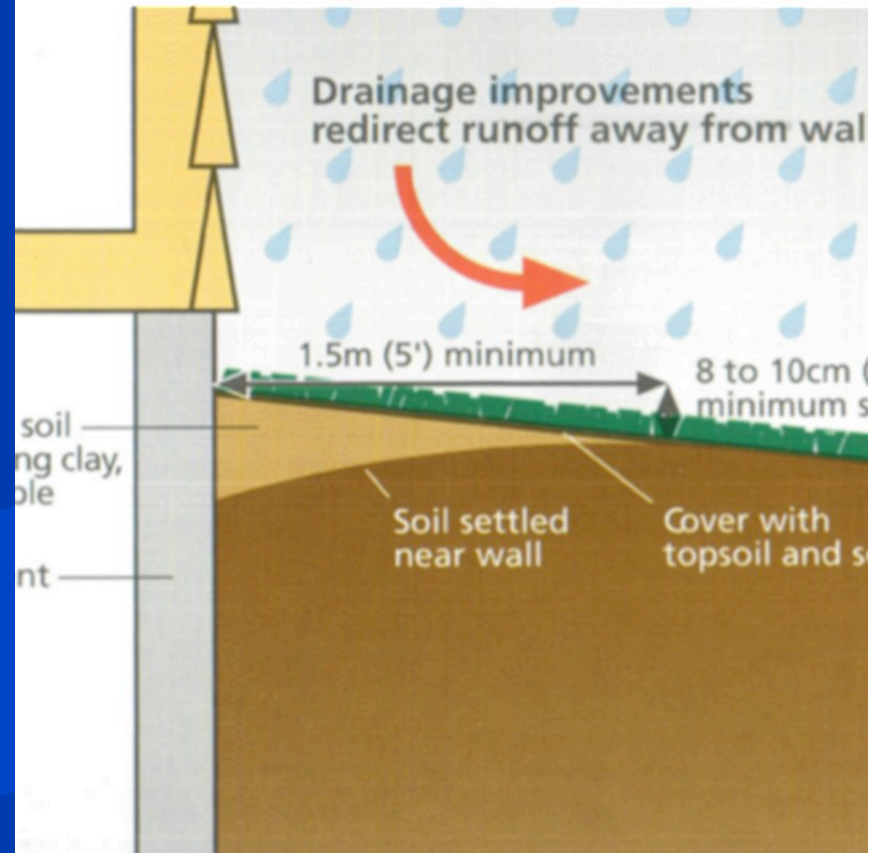
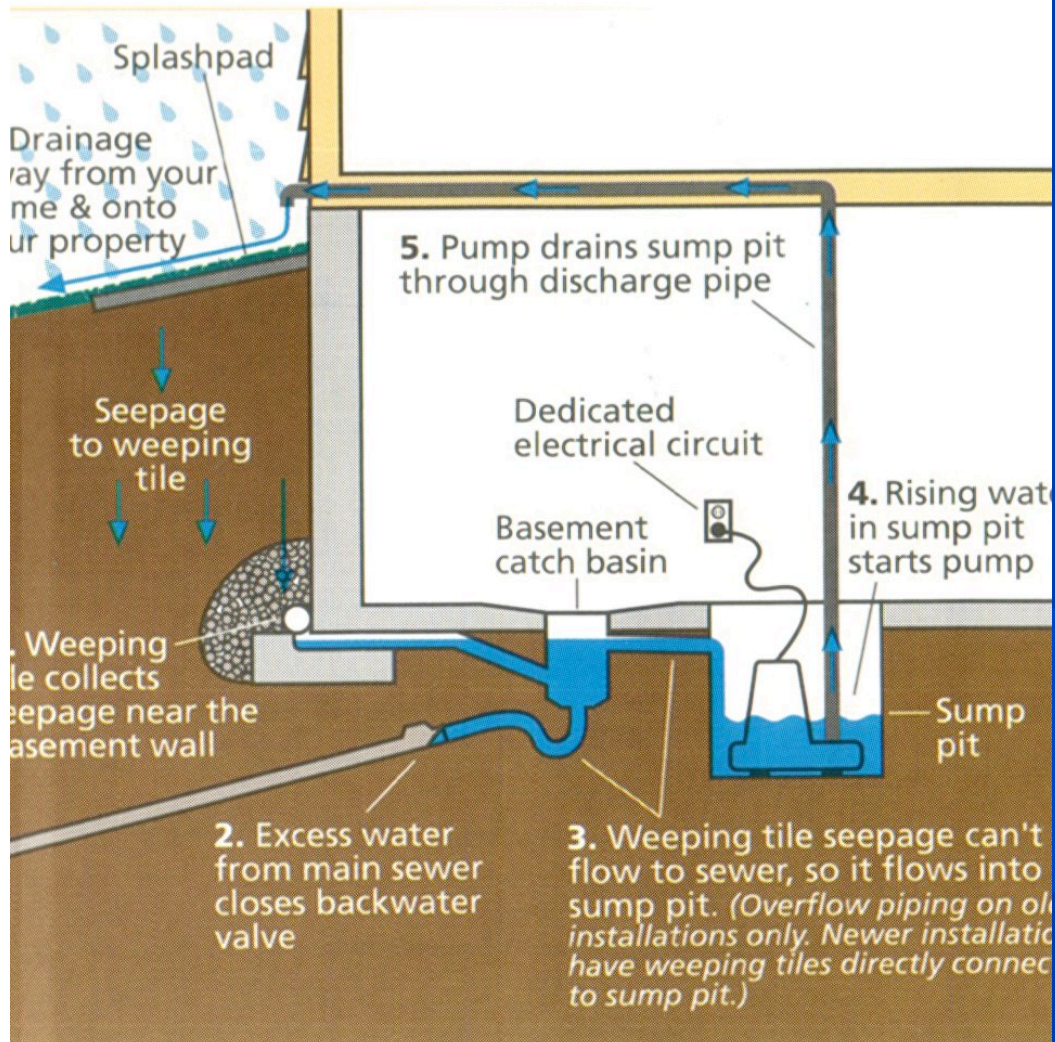
# Vertical Heave



# Landscaping and Irrigation

- Any activities that change the ground cover or slope of the ground.
- Most common is depression of the soil around the walls of the house.
- ***Backyard sloped towards the house.***
- Result is increased soil moisture beside the house which goes to the foundation level.





# What are Some Typical Impacts?

- Change in vegetation – adding / removing large trees / shrubs.
- Changing drainage – moving eaves trough to new location, landscaping.
- Pools – leaks, drainage, emptying.
- Removing compliance – filling in shrinkage cracks around the foundation.

# Forensic Assessment

- Very difficult due to limitations of visual inspection. Some obvious indicators:
  - Golf ball
  - Door frames / window frames
  - Cracks in stucco / drywall
  - Moisture
  - Shrinking room effect
  - Fresh paint / missing telepost
  - Utility connections
- Problem is indicators are not evidence!



# Don't Try to Out Muscle the Clay!



# Thanks!





