NJDEP Stakeholder Meeting
Stormwater Infiltration

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Distributed Outline

1. **Groundwater Mounding** – a reduction in permeability rate may occur when groundwater mounding is present
2. **Soil Temperature** – soil permeability may decrease when the ground is partially or fully frozen and impact the infiltration rate.
3. **Soil Testing** – reliance on a limited number of soil test pits and/or improper implementation of testing protocols may not provide accurate soil permeability information
4. **Construction Methods** - soil compaction during construction may decrease soil permeability and infiltration rates
5. **Maintenance** – improper maintenance that decreases soil permeability, such as insufficient removal of accumulated sediment and overgrown vegetation may decrease actual infiltration rates

Groundwater Mounding

Groundwater Mounding – a reduction in permeability rate may occur when groundwater mounding is present

Considerations:

1. The influence of groundwater can make the measured hydraulic conductivity **essentially irrelevant** to the expected performance of an infiltration basin.
2. Mounding shifts system operation from one driven by "near" saturation vertical flow, with a hydraulic gradient of one to a fully saturated flow regime requiring horizontal groundwater flow at a **much lower** hydraulic gradient.

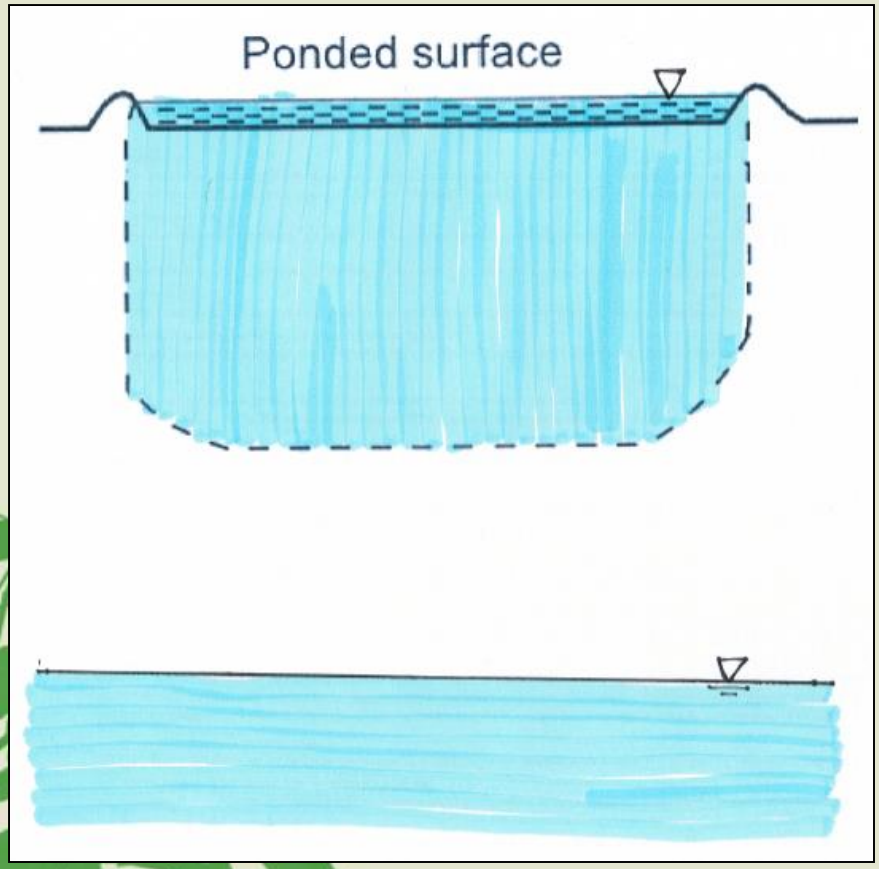
Groundwater Mounding

- Infiltration BMPs can be divided into two distinct categories with respect to groundwater.

- Their classification (Case 1 or 2) will have a major impact on their operation.

Groundwater Mounding

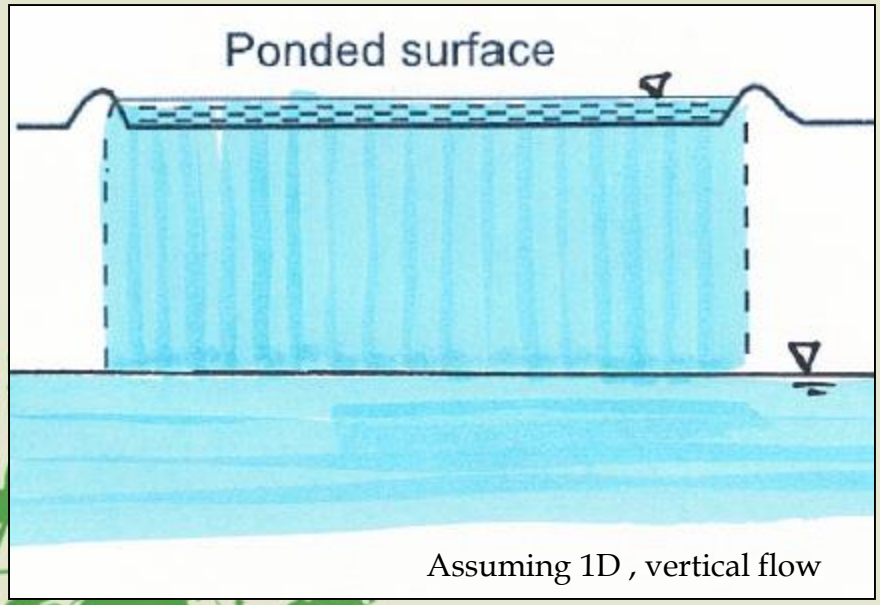
CASE 1: Infiltration BMP is "unaware" of the groundwater table.



- Infiltration from the BMP flows unimpeded through the unsaturated zone
- Hydraulic gradient is greater than, but approaches one (1)
- K is a good, yet slightly conservative estimate of the recession rate in the BMP

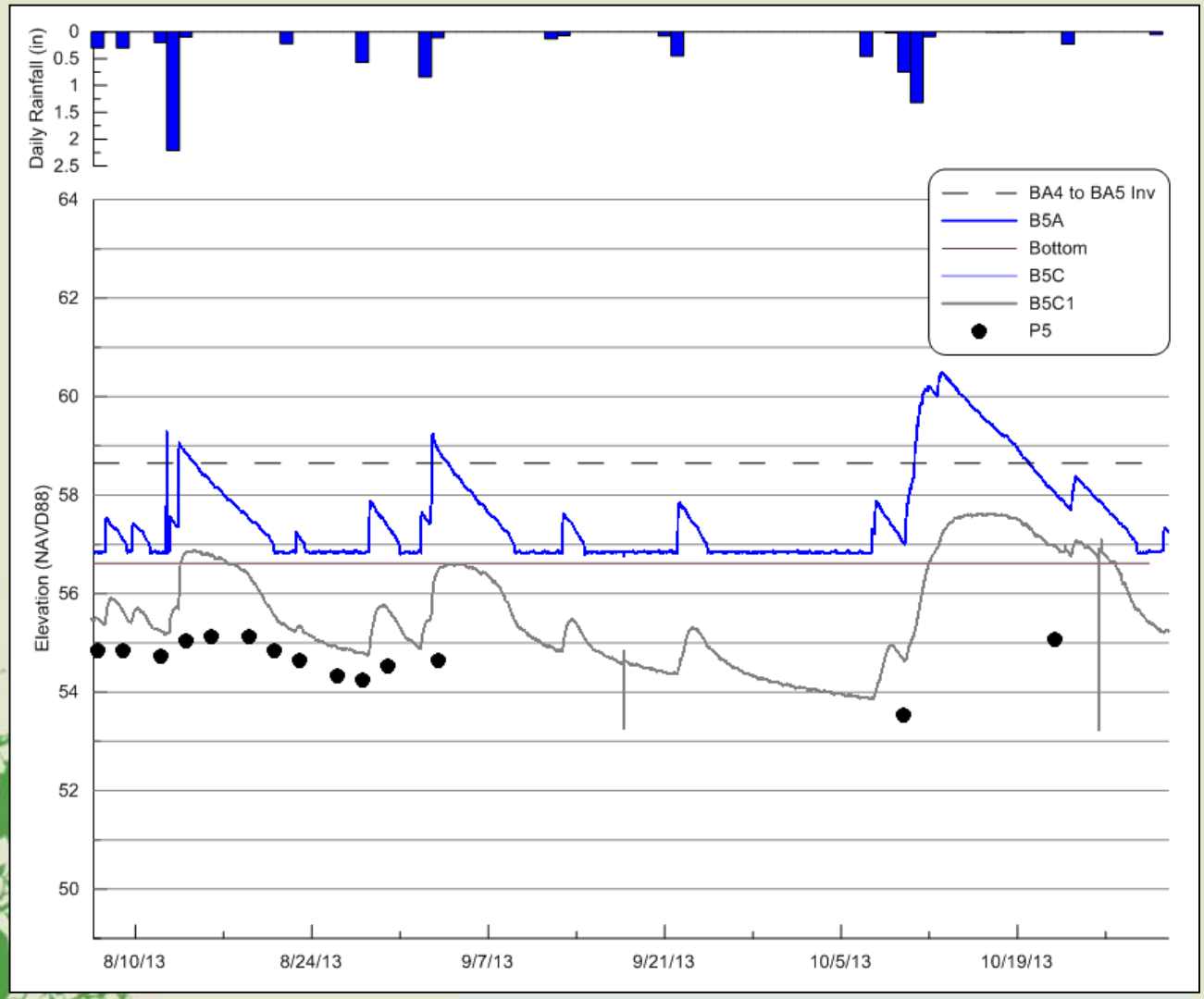
Groundwater Mounding

CASE 2: Infiltration BMP is VERY aware of the groundwater table.



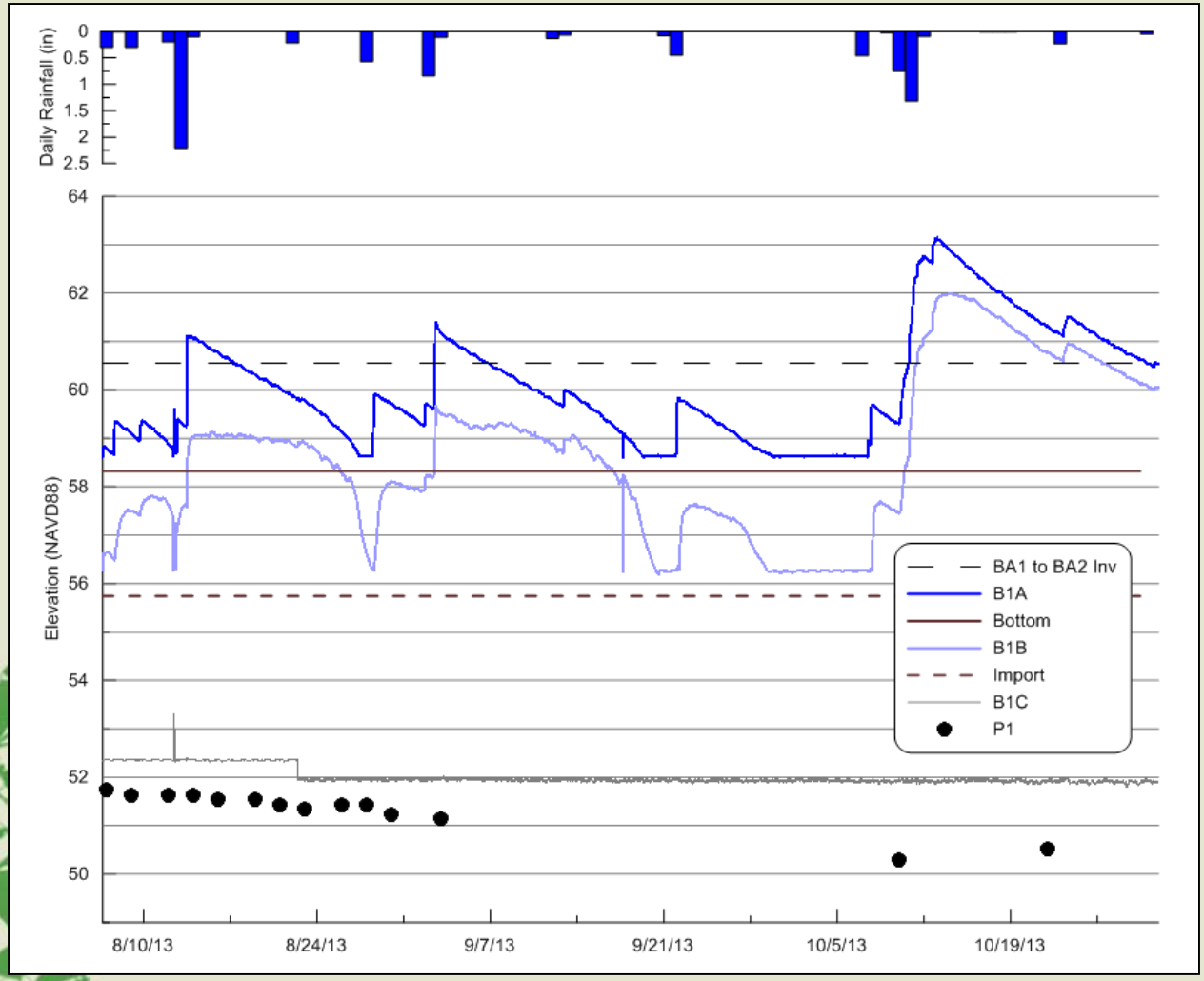
- Saturated groundwater mound intersects basin bottom
- If only vertical (1D) flow is considered, the hydraulic gradient is zero (0), no flow
- K is a gross overestimate of the recession rate in the BMP

Groundwater Mounding



Groundwater mounding in action.

Groundwater Mounding



Transient internal groundwater mound impacting basin operation.

Soil Temperature

Soil Temperature – soil permeability may decrease when the ground is partially or fully frozen and impact the infiltration rate.

Considerations:

1. In my opinion runoff to an infiltration basin with a frozen ground surface is a rare enough event to not warrant any consideration.
2. The performance of infiltration BMPs varies seasonally due to expected temperature induced viscosity changes of water.
3. Seasonal variation due to viscosity change should be expected to be a factor of two (2).

Soil Temperature

$$K(T) = k \times f(T)$$

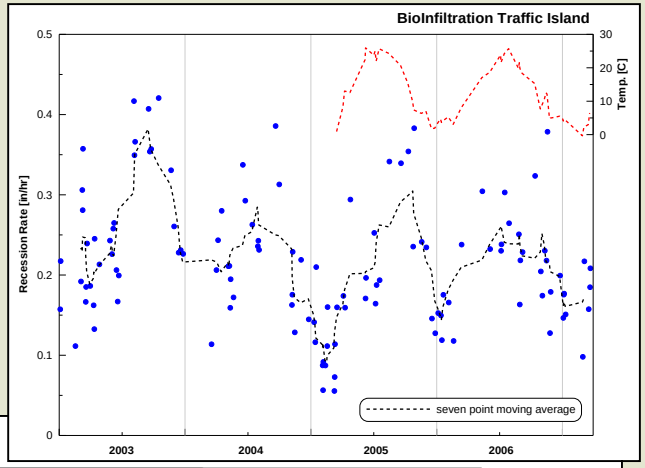
Where:

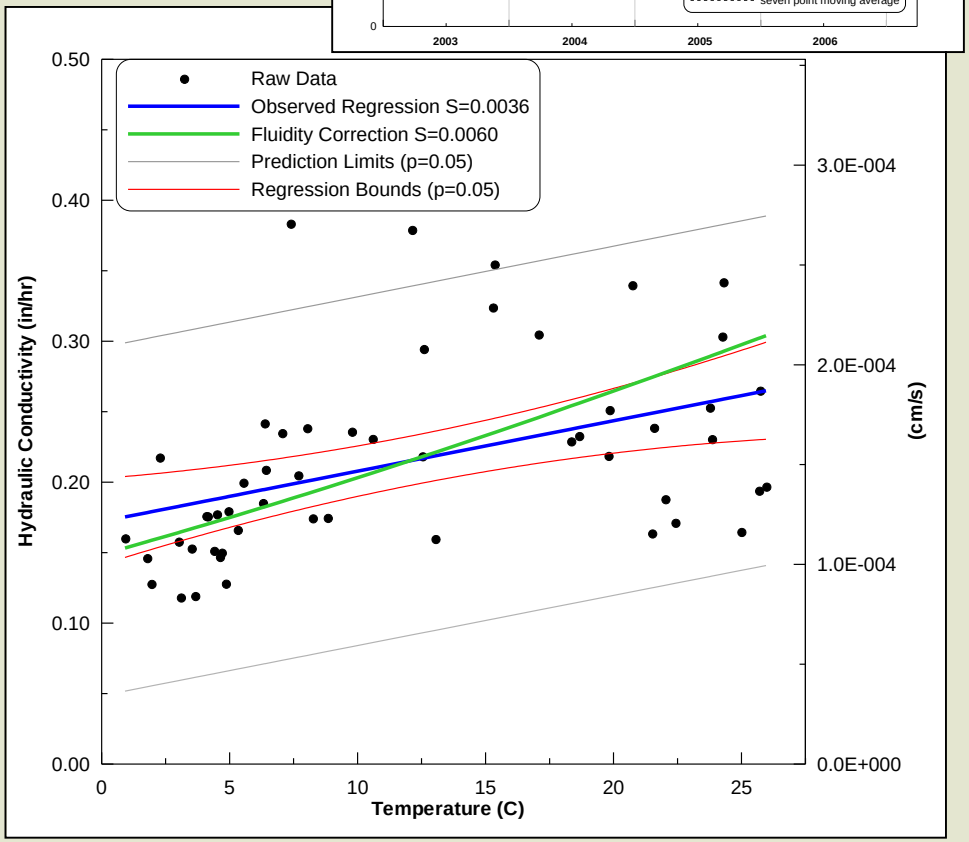
K [LT^{-1}] = hydraulic conductivity

k [L^2] = intrinsic permeability

f [$L^{-1}T^{-1}$] = fluidity = f (temp.)

$$f(T) = \frac{\rho(T) \times g}{\mu(T)}$$





Emerson, C.H., Traver, R.G., "Multi-Year and Seasonal Variation of Infiltration from Stormwater Best Management Practices" ASCE Journal of Irrigation and Drainage Engineering, Vol. 134, No. 5, pgs. 598-605 September/October 2008.

Soil Temperature