

# Sizing the Biofilter

*things to consider...*

EDAW

AECOM



FAWB

Facility for Advancing  
Water Biofiltration



MONASH University

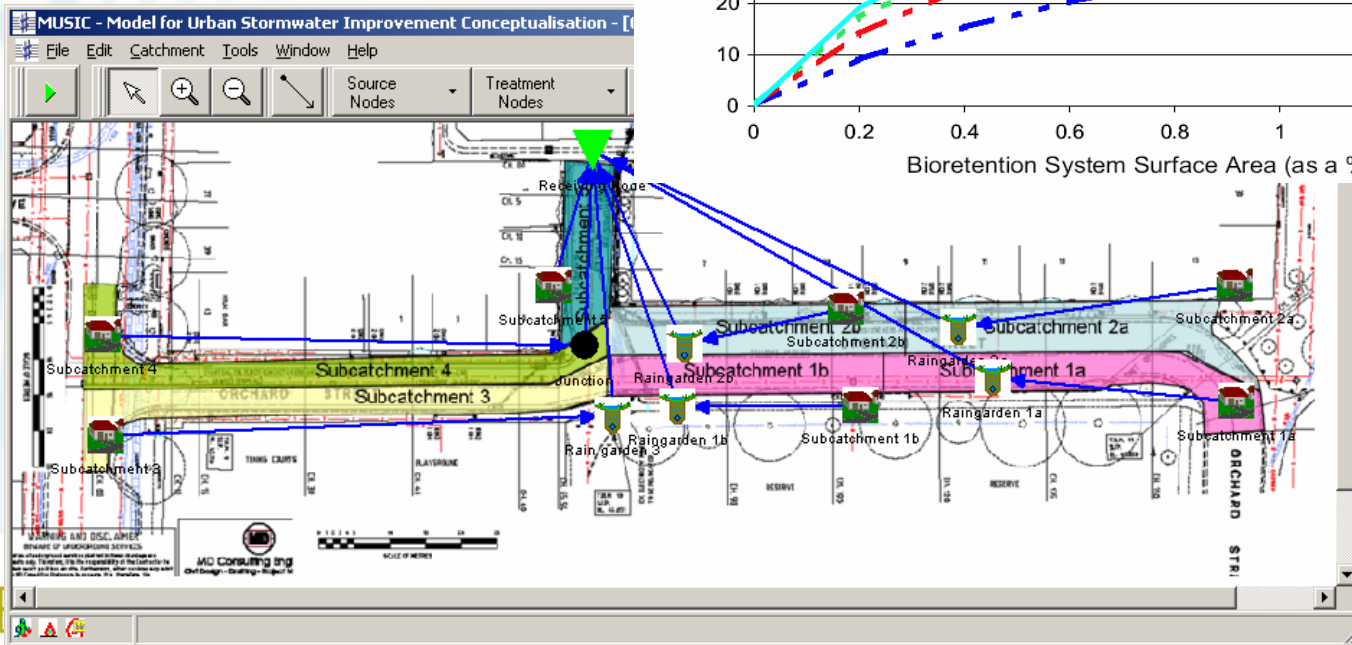
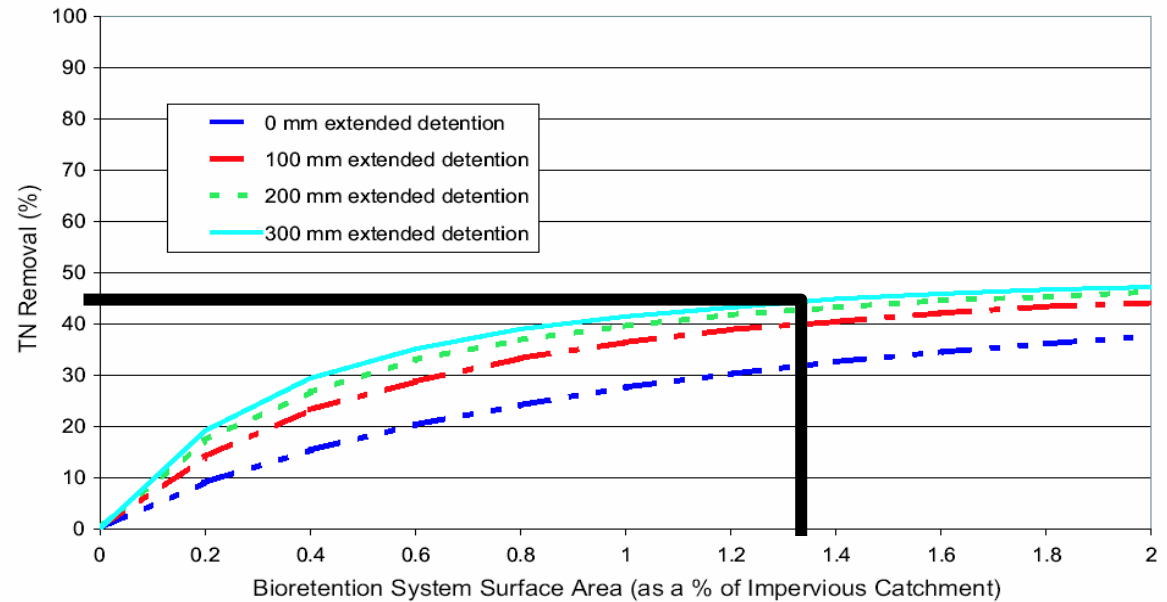
# Outline

- Typical approach to sizing
- Key factors to consider
  1. Design objectives
  2. Interactions between Ks and sizing
  3. Robustness
  4. Vegetation selection




# Typical approach

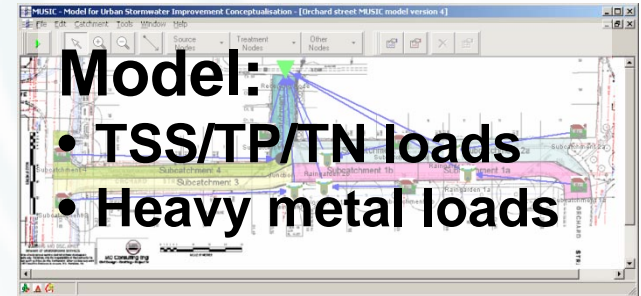
- Modelling
- Lookup tables




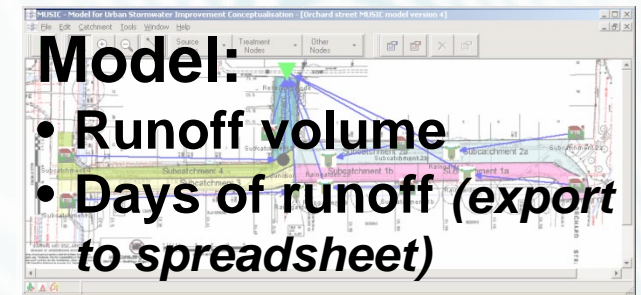


# What are our objectives?

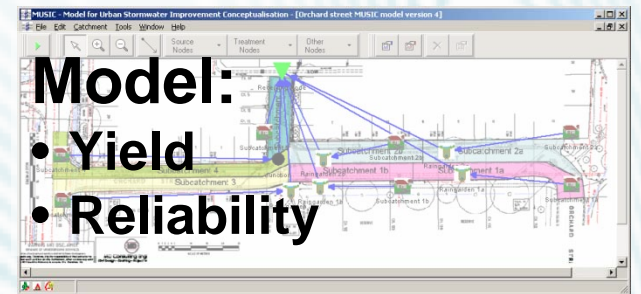
- Pollutant load reduction ? 



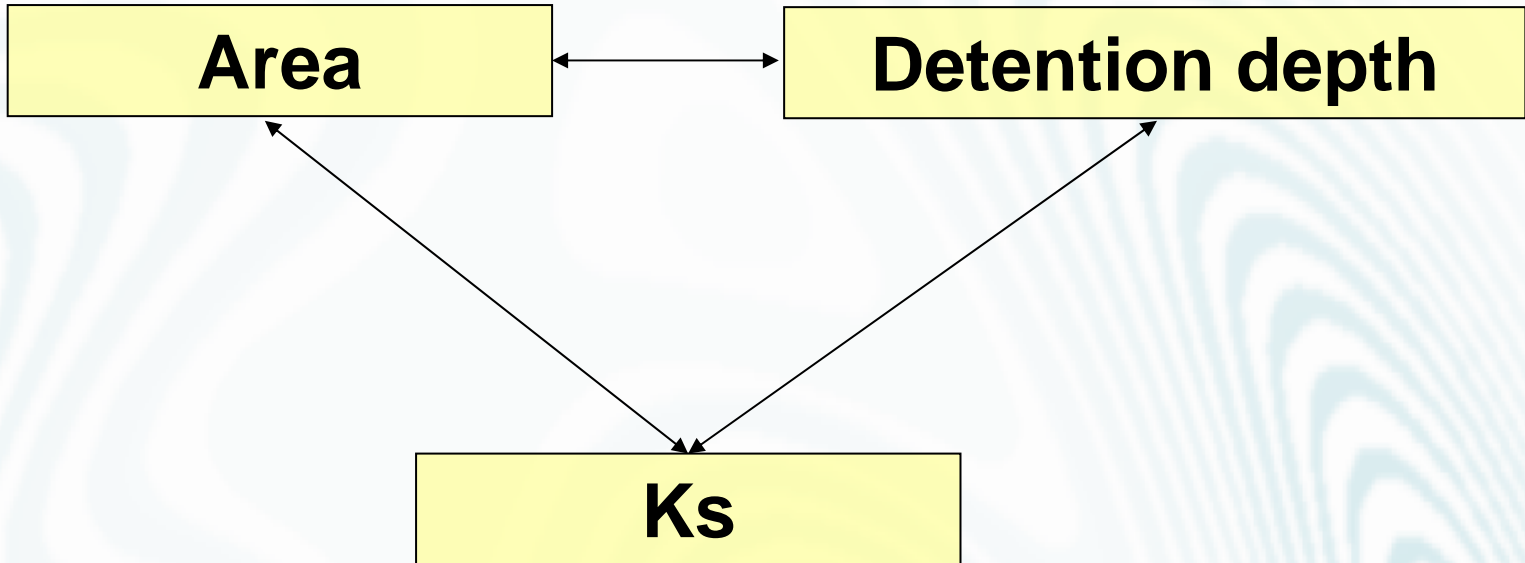
- Runoff reduction ? 
  - Volume
  - Frequency



- Pre-filtering for stormwater reuse? 



# Interaction of area, depth & Ks



To meet the design objective

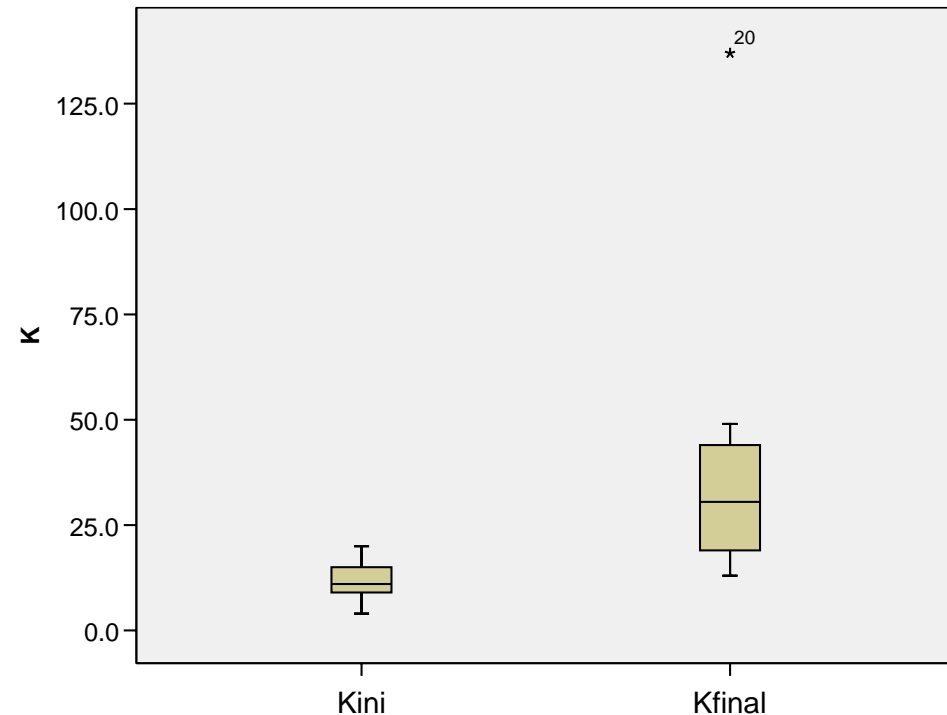
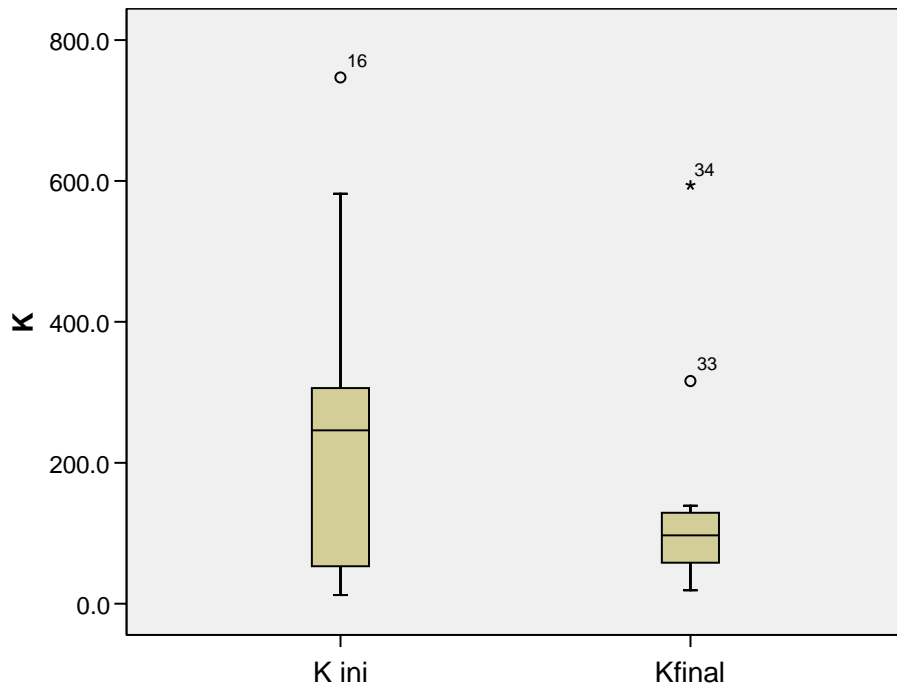
- Recommended range for Ks: 100 – 300 mm/h

# Designing robust systems

- Design using all 3 parameters:
  - $K_s$
  - Area
  - Detention depth
- Consider what will happen if  $K_s$  drops

# Field results: Hydraulic conductivity

- Observed '2 groups':
  - Those with high initial conductivity (halved)
  - Those with low initial conductivity (unchanged)



241 mm/h

Type

127 mm/h

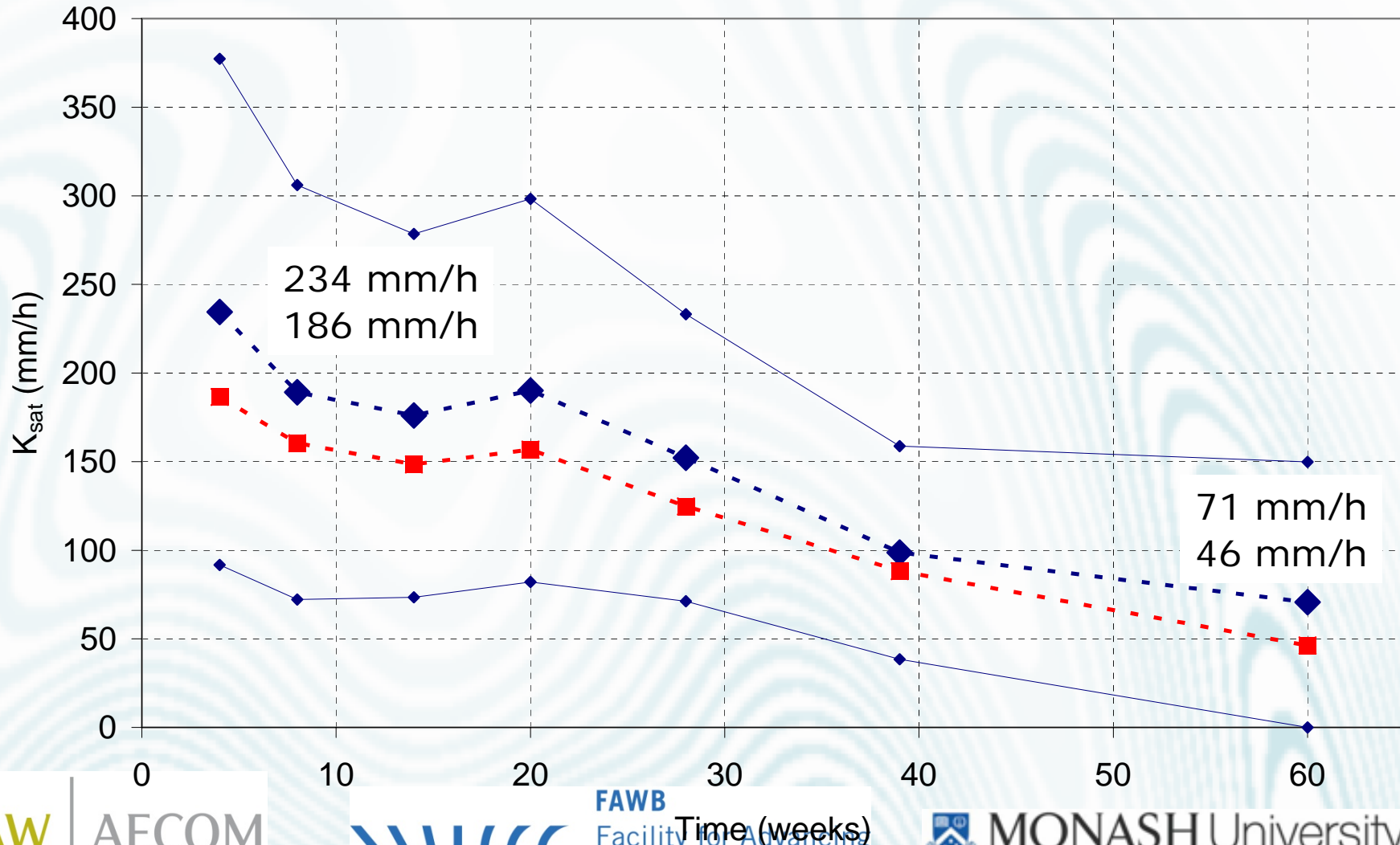
Water Biofiltration

12 mm/h

Type

37 mm/h

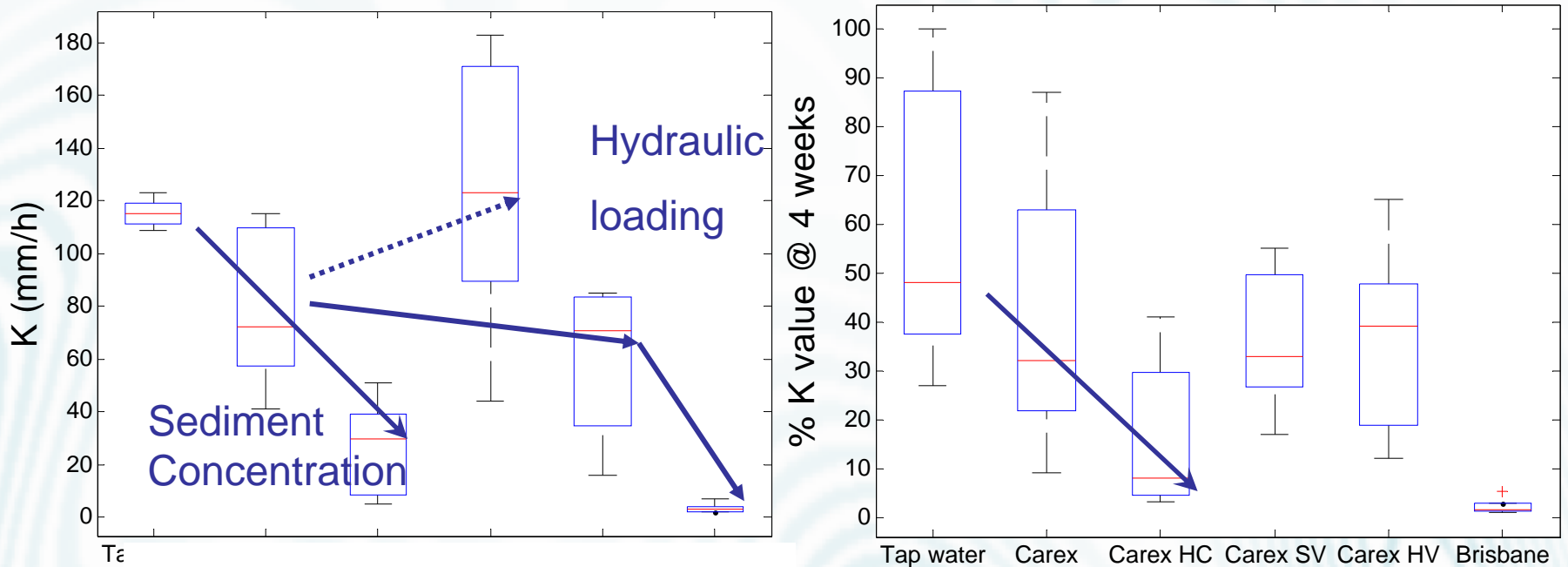
# Lab results: 125 biofilters – 60 weeks of ‘intense dosing’





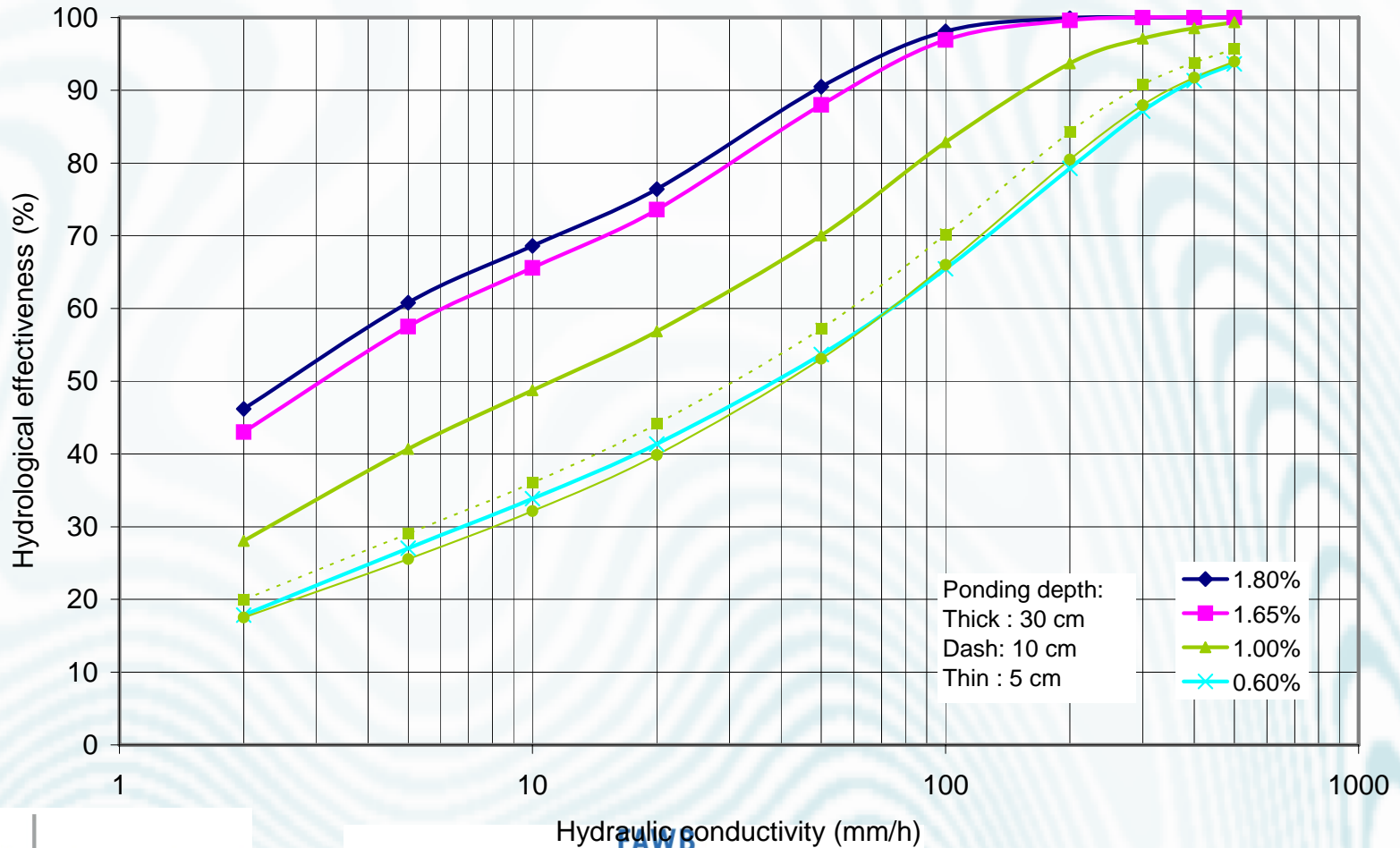
# Influence of loading $\approx$ *biofilter size*

- Laboratory study (Le Coustumer *et al.*, 2007)



— *High sediment C and high hydraulic loading (= small biofilter relative to catchment) decrease K*

# Using area and ponding depth to 'buffer' variations in Ks



# Given these results...

- Design and model based on Ks of half the design value

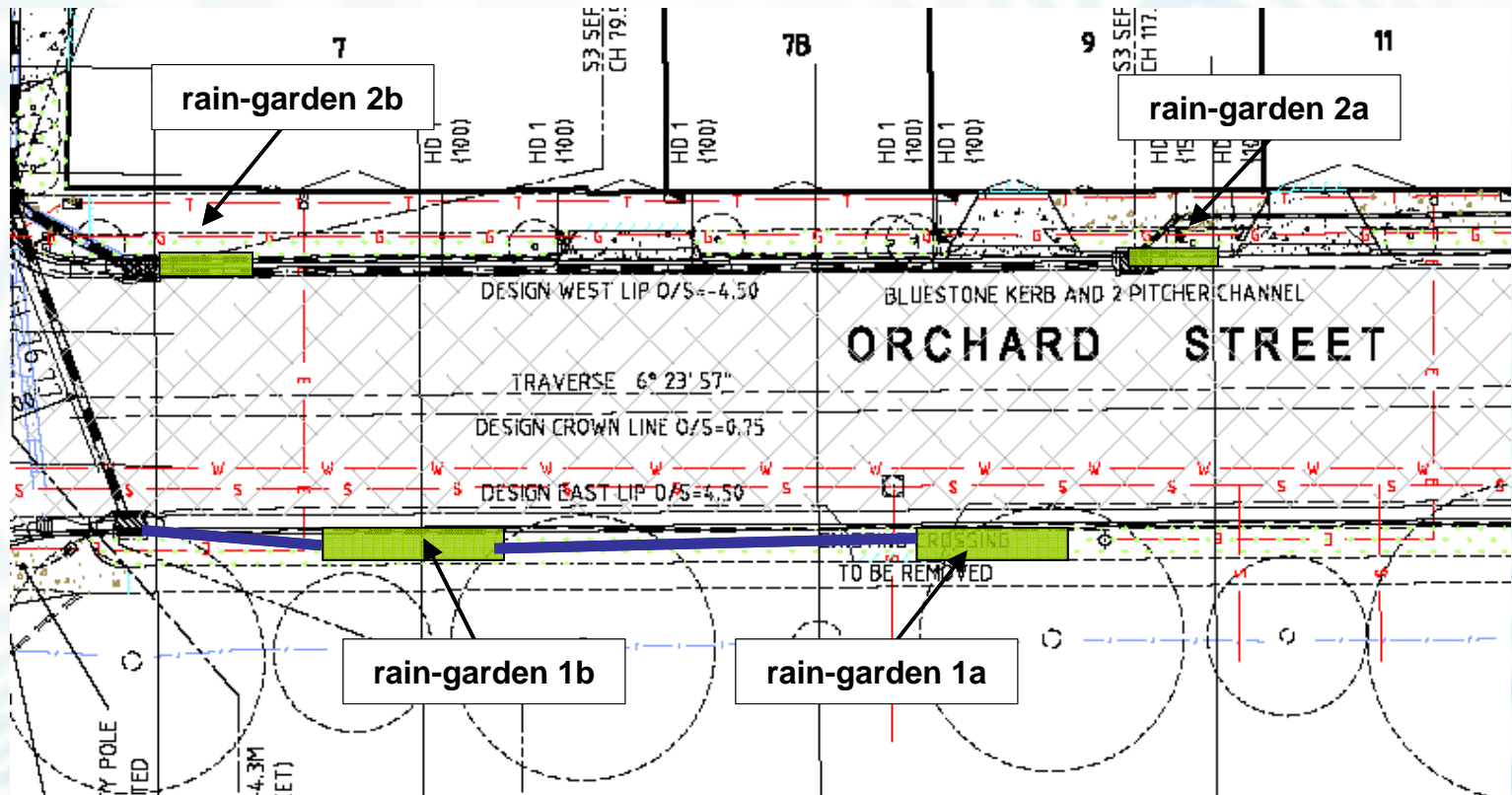
The screenshot shows a software dialog box titled "Properties of Bio-Retention". It contains several sections of input fields:

- Location:** Bio-Retention
- Inlet Properties:**
  - Low Flow By-Pass (cubic metres per sec): 0.000
  - High Flow By-pass (cubic metres per sec): 100.000
- Storage Properties:**
  - Extended Detention Depth (metres): 0.25
  - Surface Area (square metres): 3.4
  - Seepage Loss (mm/hr): 0.36
- Infiltration Properties:**
  - Filter Area (square metres): 4.8
  - Filter Depth (metres): 1.0
  - Filter Median Particle Diameter (mm): 0.45
  - Saturated Hydraulic Conductivity (mm/hr): 90** (highlighted with a red box)
  - Depth below underdrain pipe (% of Filter Depth): 0.0
- Outlet Properties:**
  - Overflow Weir Width (metres): 2.0

Buttons at the bottom include "Fluxes...", "Notes...", "More", "Cancel", "Back", and "Finish".

# Ideas to increase effective size

- Breaking up the catchment





# Ideas to increase effective size

- Breaking up the catchment
- Increase ponding depth
  - Use novel design to ensure safety



# Biofilter Sizing: Key messages

- Infiltration performance is a function of 3 design parameters
  - $K_s$ , Area, Ponding Depth
  - Systems must be designed/modelled in an integrated way considering all 3 factors
- Larger systems will be more robust against variations in  $K_s$ 
  - consider breaking up catchment if area is limited
- Consider hydrologic effectiveness during design