

# Key recommendations for design of biofiltration systems

EDAW

AECOM



FAWB

Facility for Advancing  
Water Biofiltration



MONASH University

# Biofilter Design

Design will depend primarily on

– System objectives

- Pollution control
- Runoff reduction (volume, frequency)
- Stormwater harvesting, etc

– Site characteristics

- Climate
- Available size
- Opportunities & constraints

# 1. Soil Filter Media



# FAWB Filter Media Guidelines

- **Hydraulic conductivity**
  - depends on objectives and site
  - Ks of 100-300mm
  - Must be tested!
  - Design/model at 50% of design value
- **Particle Size Distribution (PSD):**
  - clay and silt fractions (< 6µm) less than 3 %,
  - continuous size grading;
- **Minimal organic matter** and **TP** content **< 100 mg/kg**;
- Soils used in the filter should be **structurally stable**



## 2. Selecting vegetation



# Vegetation

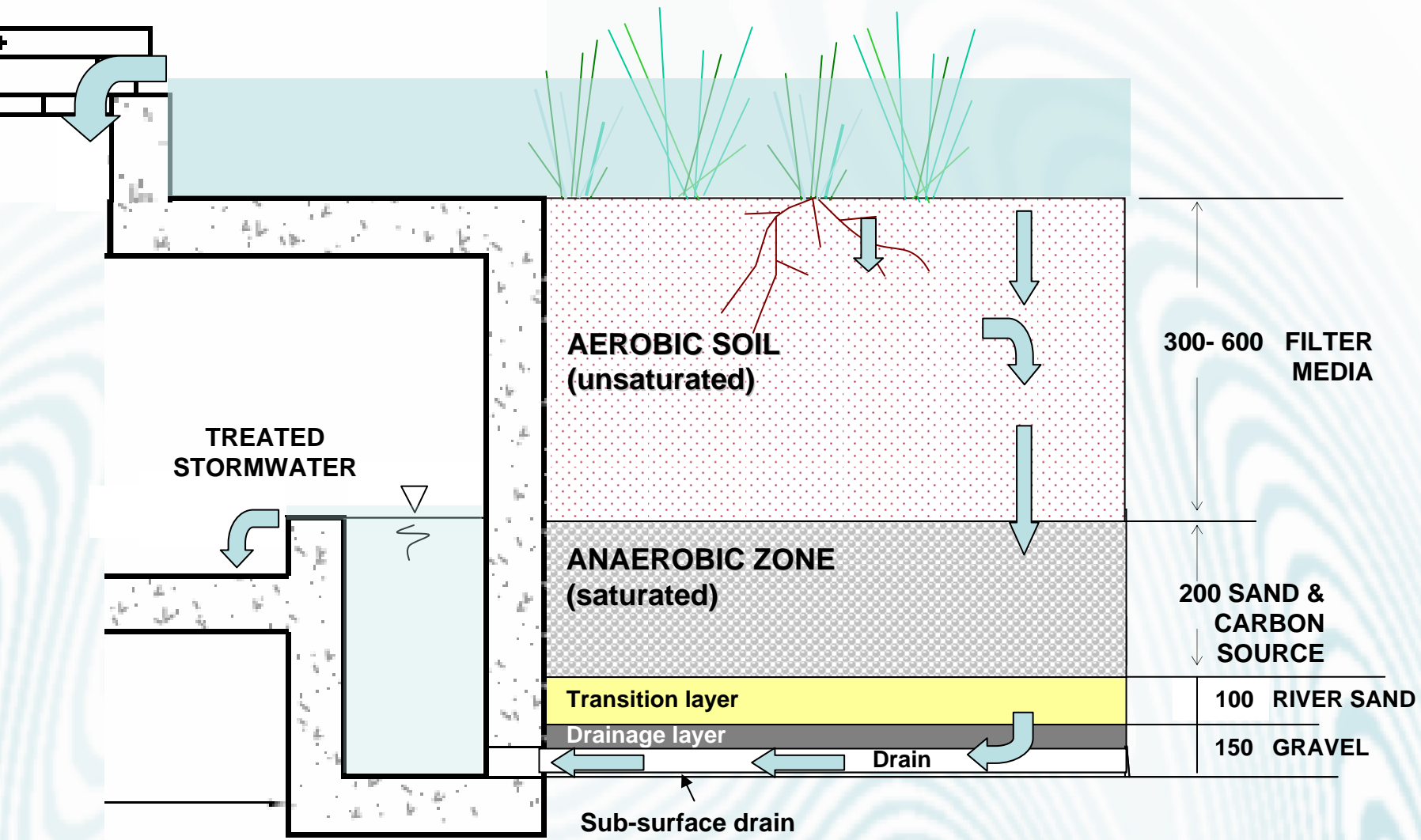
- Plants are critical for nutrient removal & hydraulic conductivity
- Selection for N is critical
  - Best genera so far: *Carex*, *Melaleuca*, *Juncus*, *Goodenia*, *Ficinia*
- Mix required for sustainability



### 3. Saturated zone with carbon to enhance nitrogen removal



# Design Examples: With Anoxic Zone





# Anoxic Zone with Carbon

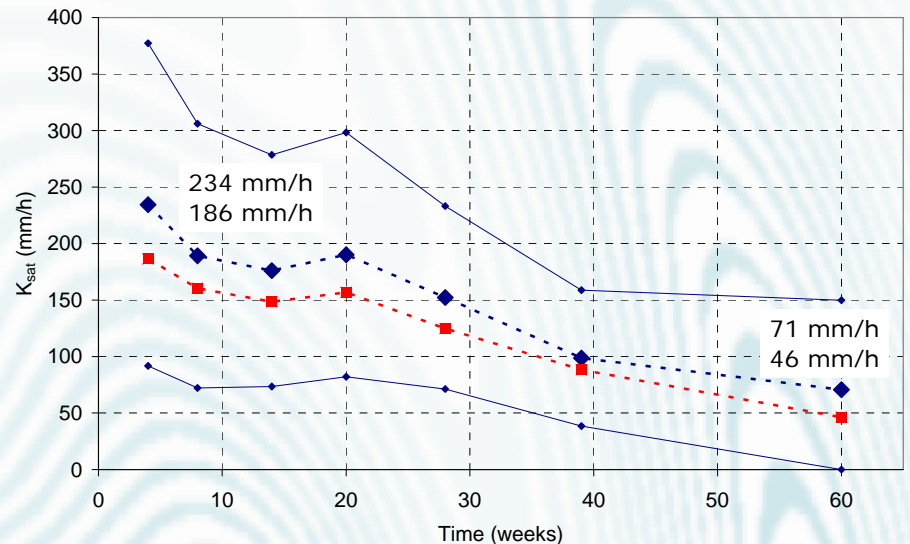
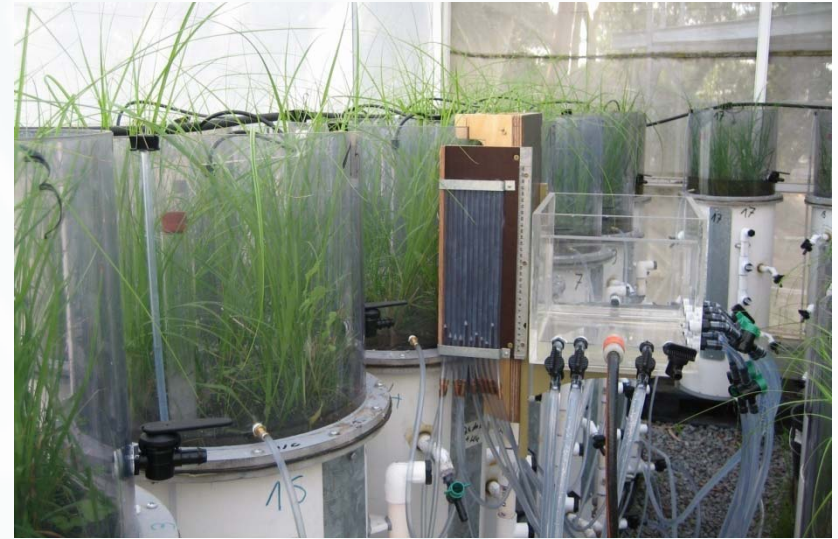
- **450 mm deep** (consisting of sand or gravel) **with a carbon source** such as hardwood chips (5% by volume)
- Help to buffer against dry periods

# 4. Hydraulic conductivity

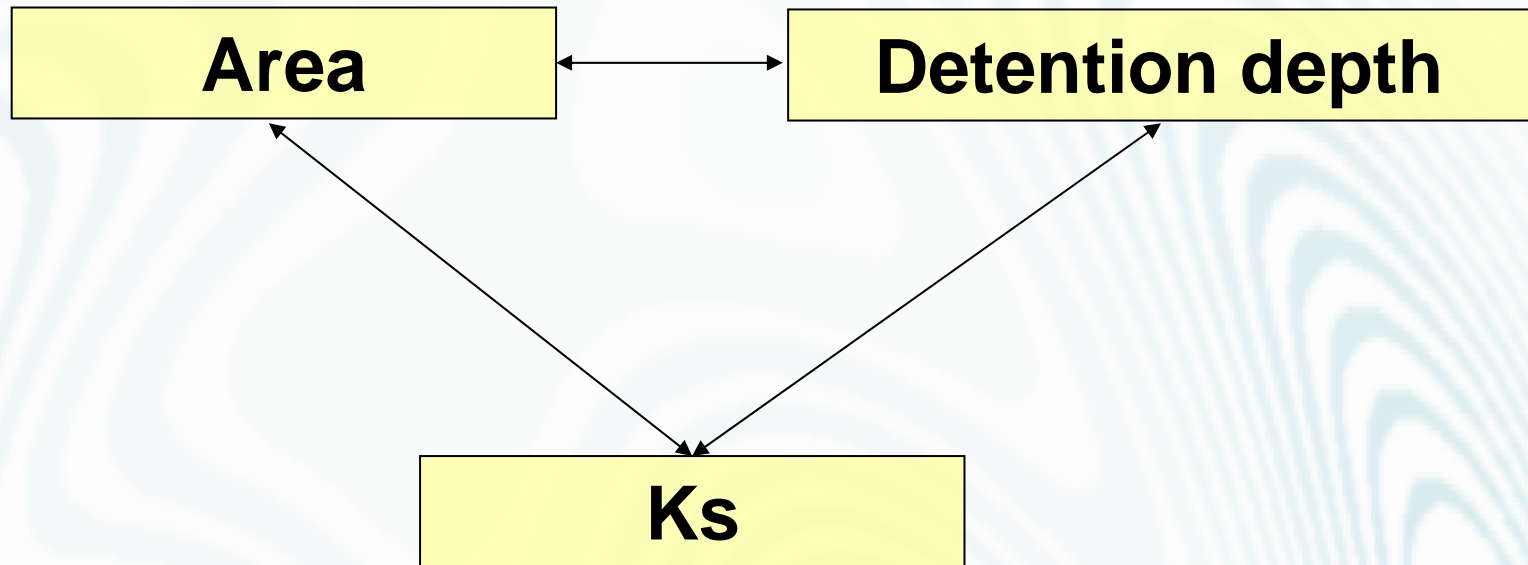


# What governs hydraulic performance?

- **The media type is critical**
  - *Initial  $K_s$  of filter media*
  - *Soil structural stability*
- As well as:
  - *System size*
  - *Inflow with high silt loads*
  - *Presence of thick-rooted vegetation*

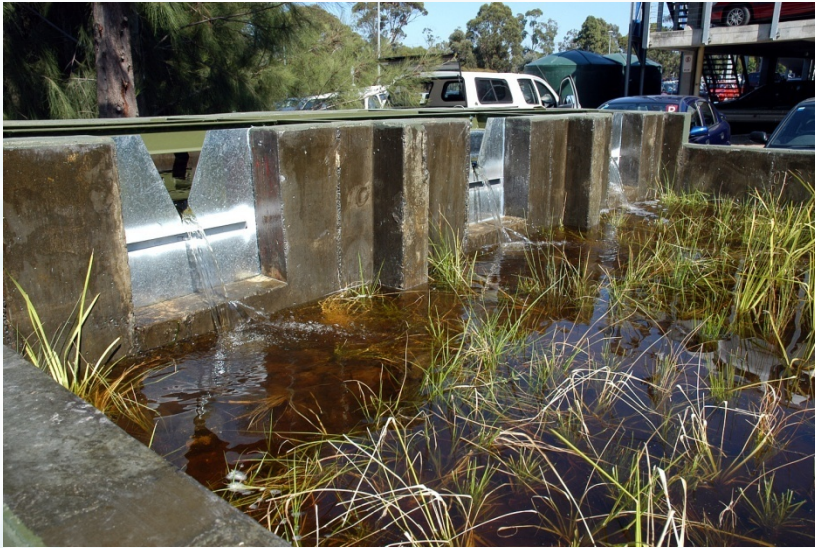


# Consider $K_s$ as one of 3 factors in design



*50% “safety coefficient” in  $K_s$*

# 5. Treatment Performance



# What performance can we expect?

If designed properly vegetated, soil-based biofilters will reduce

- Over **95%** of TSS,
- Over **85%** of TP,
- Over **50%** of TN (even over **70%** for some configurations)
- Over **90%** of heavy metals
- High level of pathogen removal (>80%)

# 6. Combining WQ & flow management

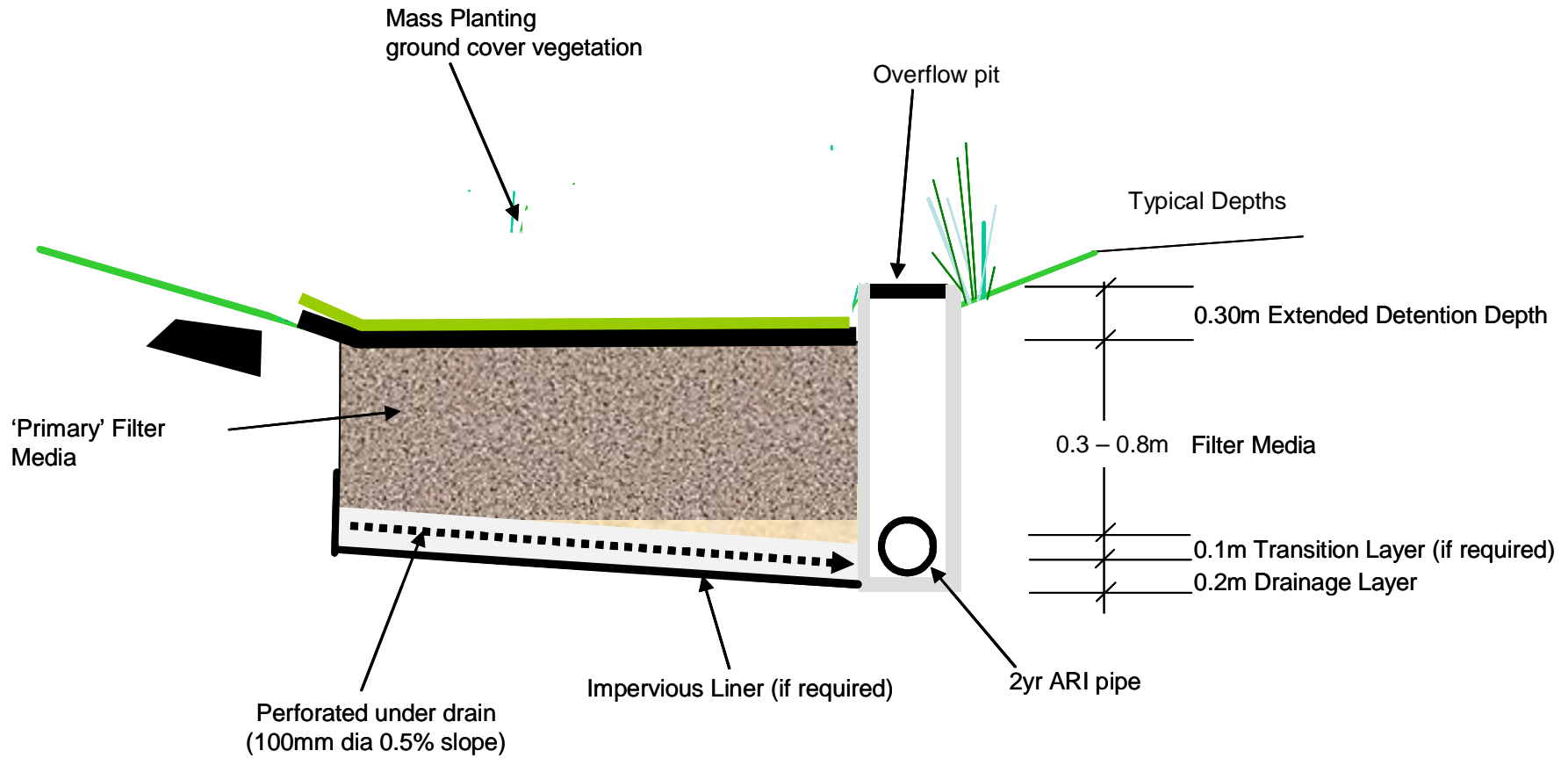
- Aim is generally to manage both water quality and flow impacts of urbanisation
- Design features to help flow management:
  - unlined wherever possible
  - maximise opportunity for infiltration and evapotranspiration
    - Elevated outlet or no overflow only (infiltration)

# 7. Construction and Maintenance





# BIORETENTION BASINS – Stage 1



# Key findings from field studies

- Some **leaching of silt and nutrients** during establishment phase (2-6 months).
- Effective communication between **designers and construction contractors is essential**
- **Maintenance requirements** initially high but reduces as vegetation grows (higher planting density helps)

# Last chance for Discussion