Design Enhancements

Submerged zone

Additives to filter media

Promoting infiltration

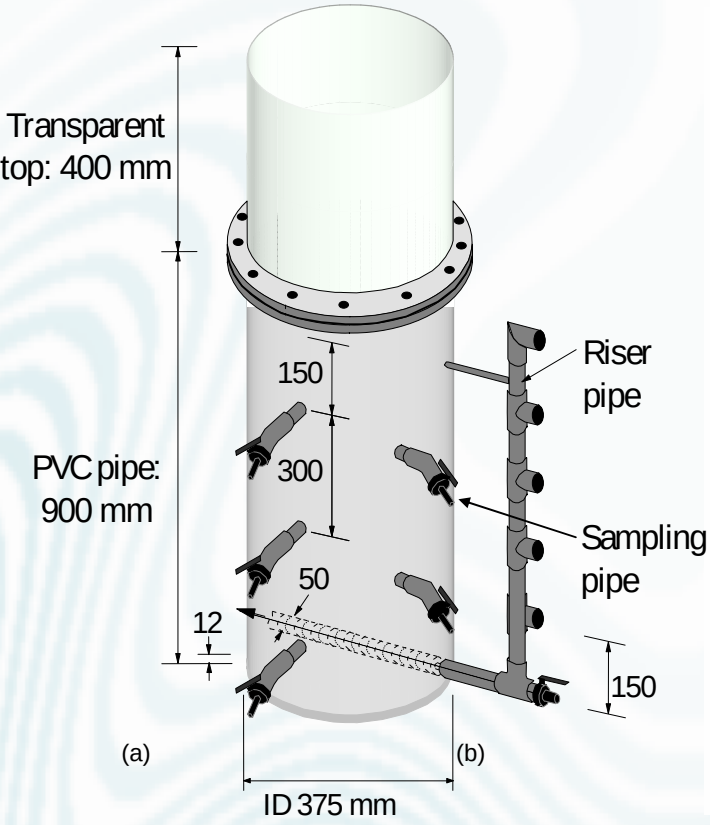
(1) Submerged zone

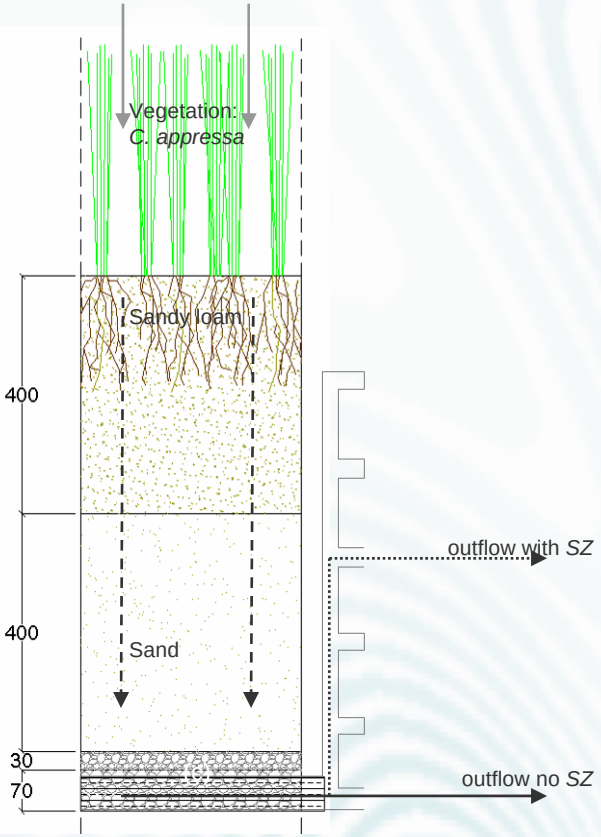
Key Findings

The presence of an approx. **450 mm deep**, permanently submerged zone made from **sand or gravel with a carbon source** (around 5% by volume) will:

- Improve nitrate/nitrite (NO_x) removal, by promoting denitrification
- Improve Cu and Zn removal (to meet ANZECC targets)
- Support plant survival during dry periods and therefore
- Ensure TN removal after dry spells

‘Advanced’ Column Experiments





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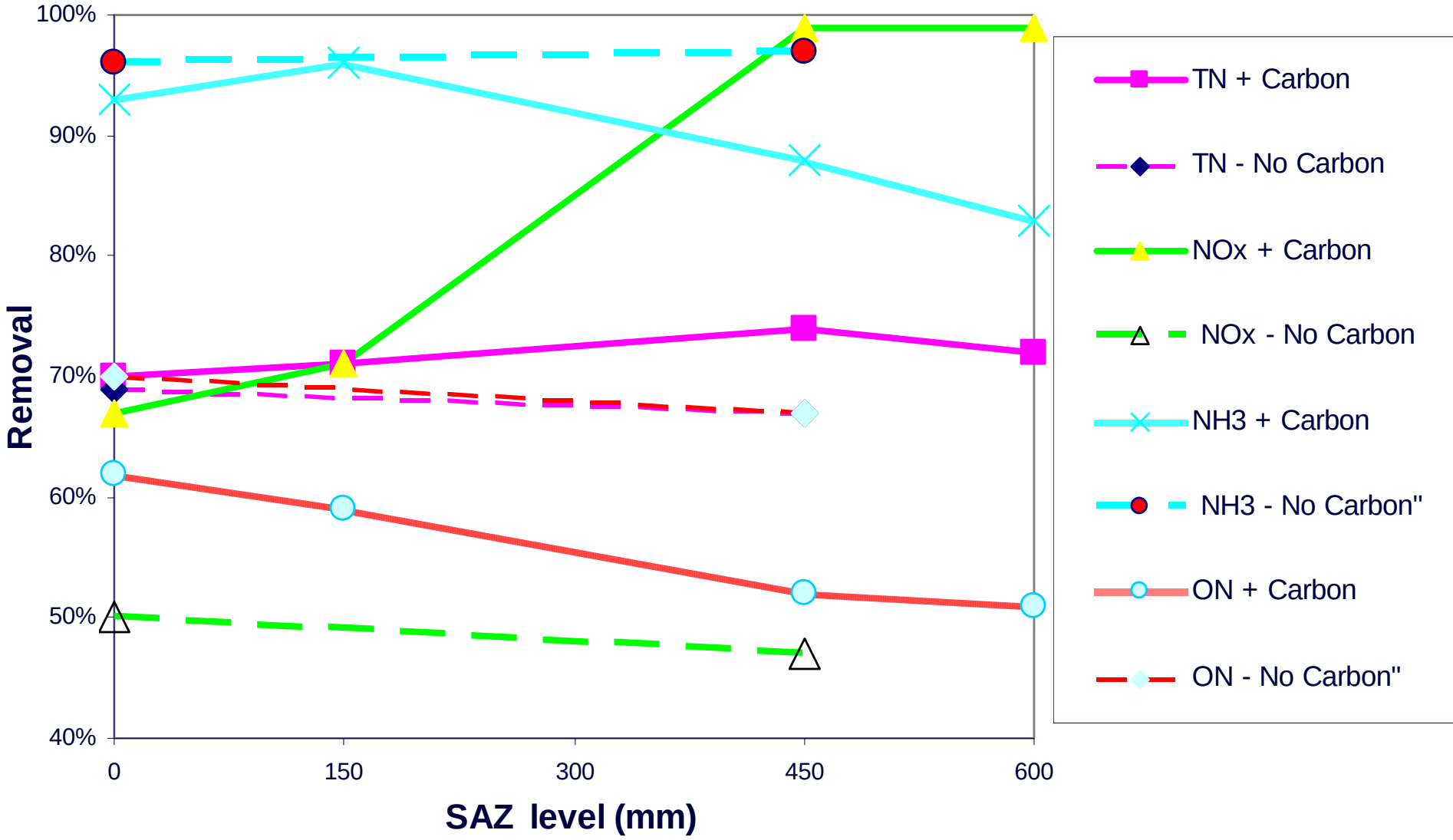
Configuration of *Submerged zone*

Column #	Carbon source	Submerged anoxic zone level (mm, bottom-up)
1-3	none	0
4-6	+	0
7-9	+	150
10-12	+	450
13-15	none	450
16-18	+	600

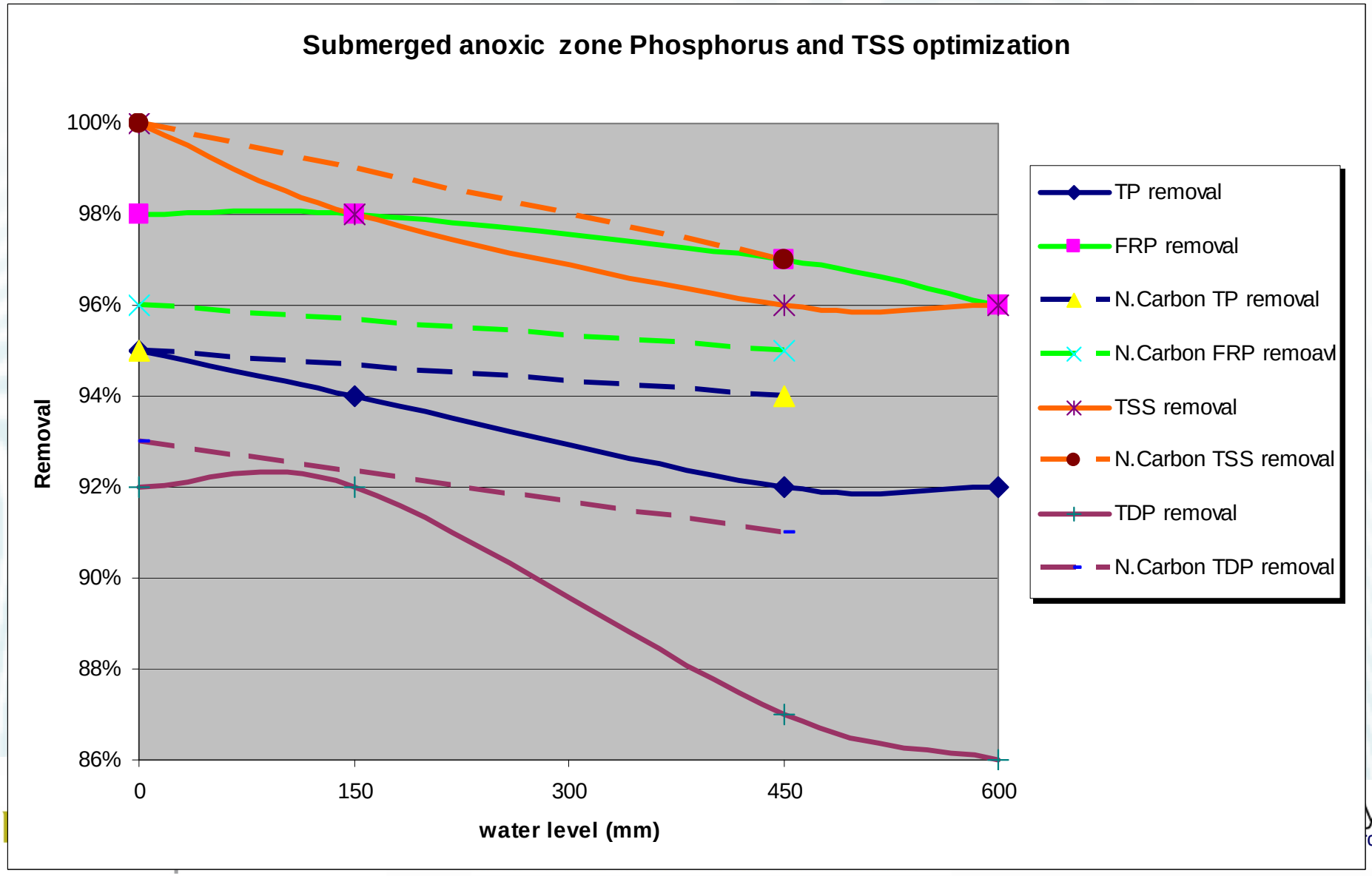
Results: N removal



Results: N removal

- TN removal slightly worse in anaerobic zone without carbon.
- TN removal slightly better in anaerobic zone with carbon.
- NO_x removal: much better in anaerobic zone with carbon

Results: P removal



Results: Heavy Metals

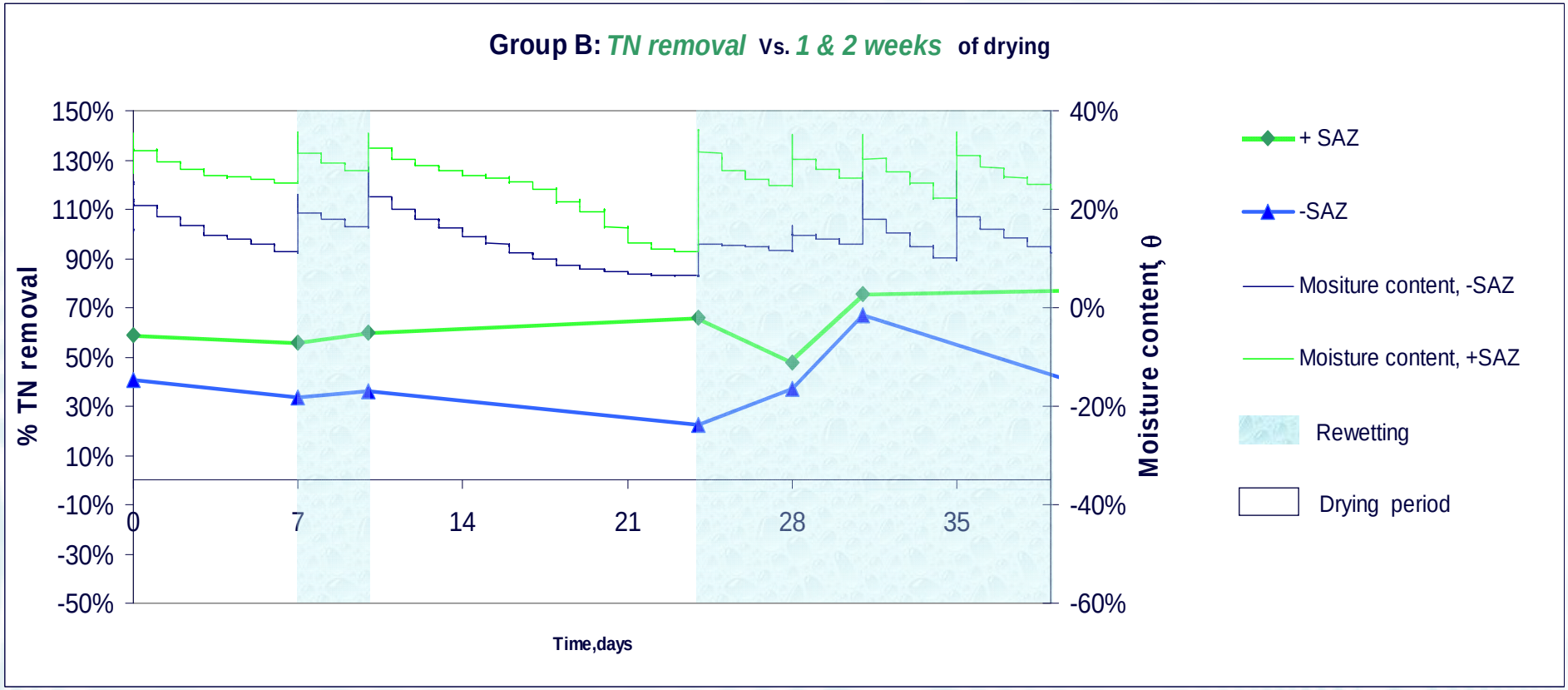
Metal	Carbon	Mean outflow concentrations (B) *SZ* (mm)			ANZECC Level of protection			
		0	450	600	99%	95%	90%	80%
Cu	-	5,6	10,3	—	1	1,4	1,8	2,5
	+	6,2	1,3	1				
Pb	-	1,5	0,5	—	1	3,4	5,6	9,4
	+	2,4	1,5	0,6				
Zn	-	9,3	6,6	—	2,4	8	15	31
	+	10,3	5,6	4,5				

all metal concentrations in µg/L

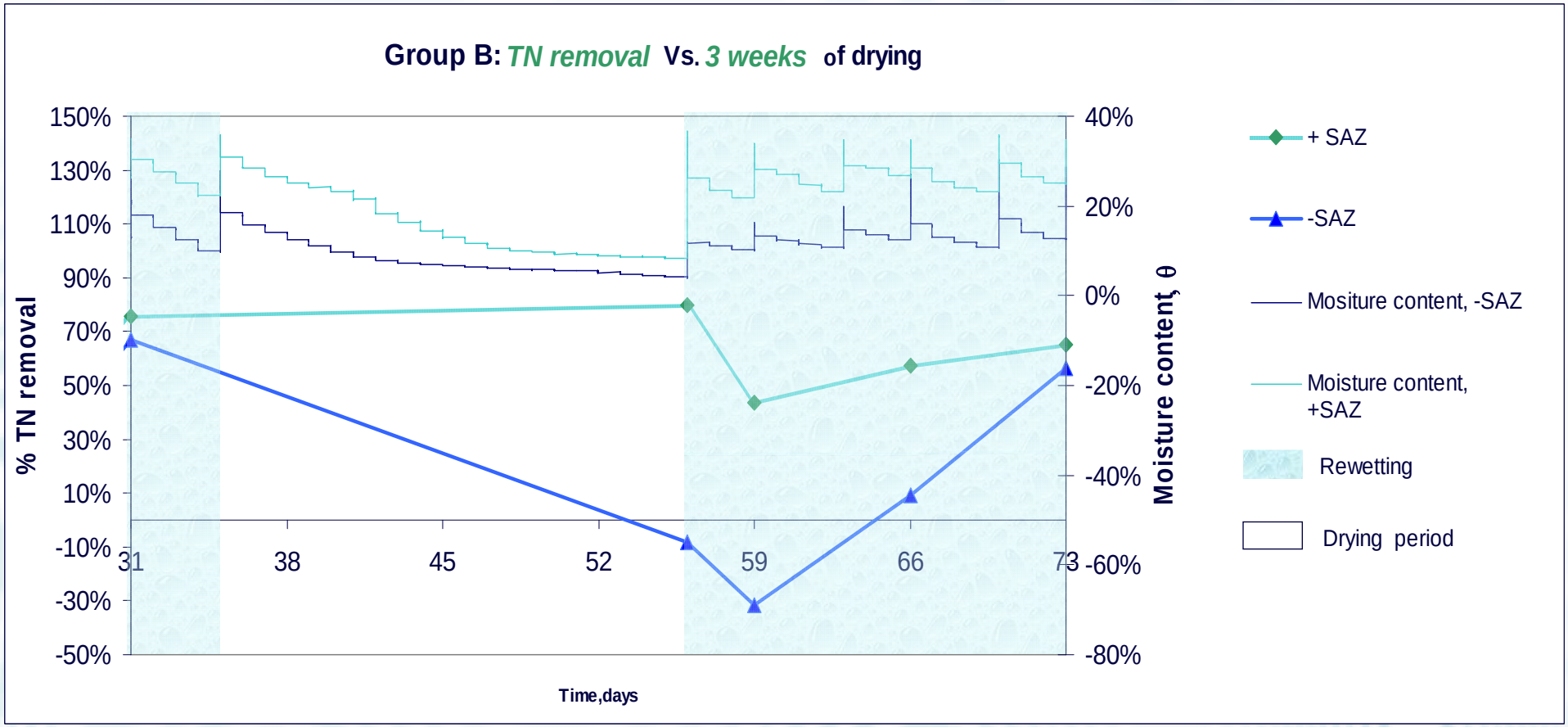
Testing wetting/drying effects

Sans carbon columns #	15,2	13,3	14, 1
Carbon columns #	5,6,11,18	8,9,10,17	12,16,7,4
sampling	Wet	Wet	Wet
	Dry 5d		Dry 3d
			(3d)
		1W (7d)	Wet
	1W (11d)	Wet	Dry 2d
sampling	Wet	Dry 5d	
	Dry 1d		10W
	2W		
		4W	(72d)
	(15d)		Wet
	Wet	(33d)	
sampling		Wet	

Results: N after 1-2 weeks dry weather



Results: N after 3 weeks dry weather



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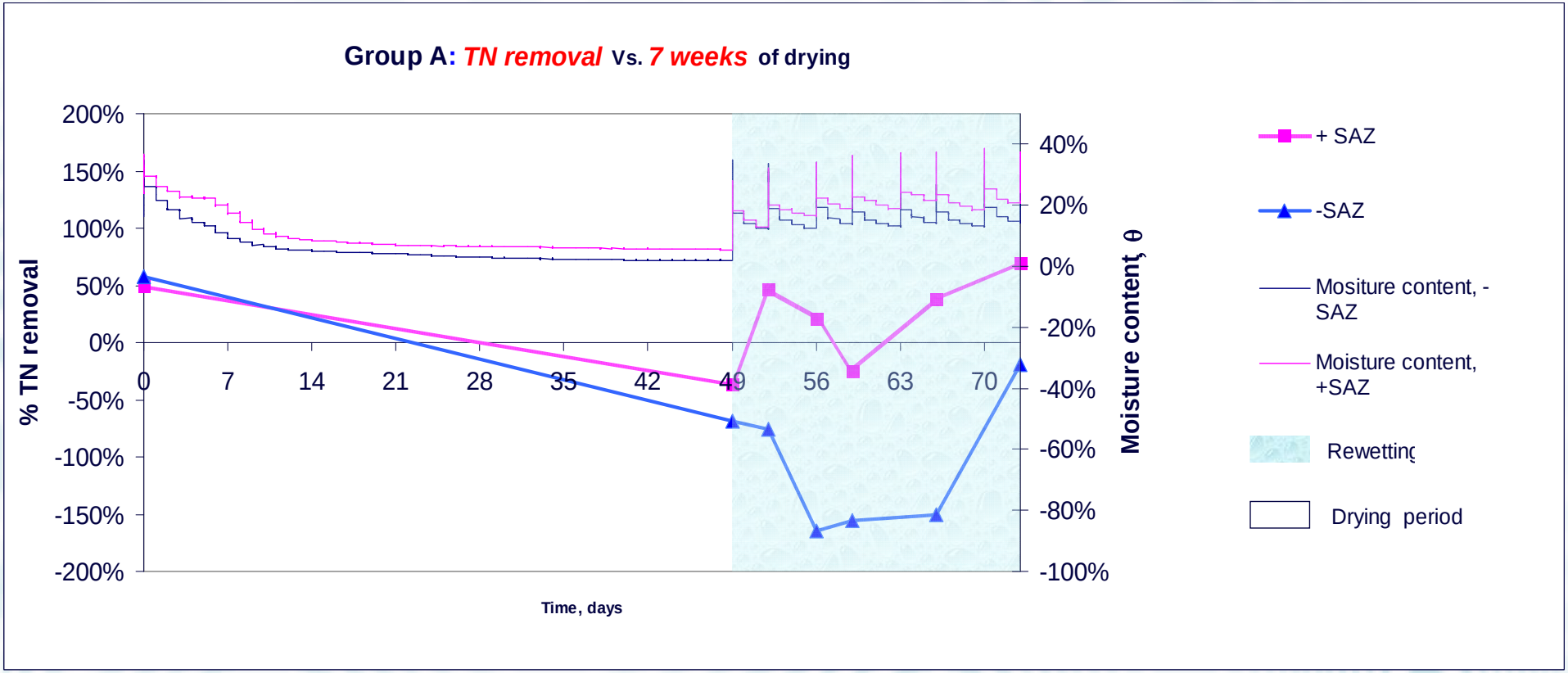
Results: N after 7 weeks dry weather



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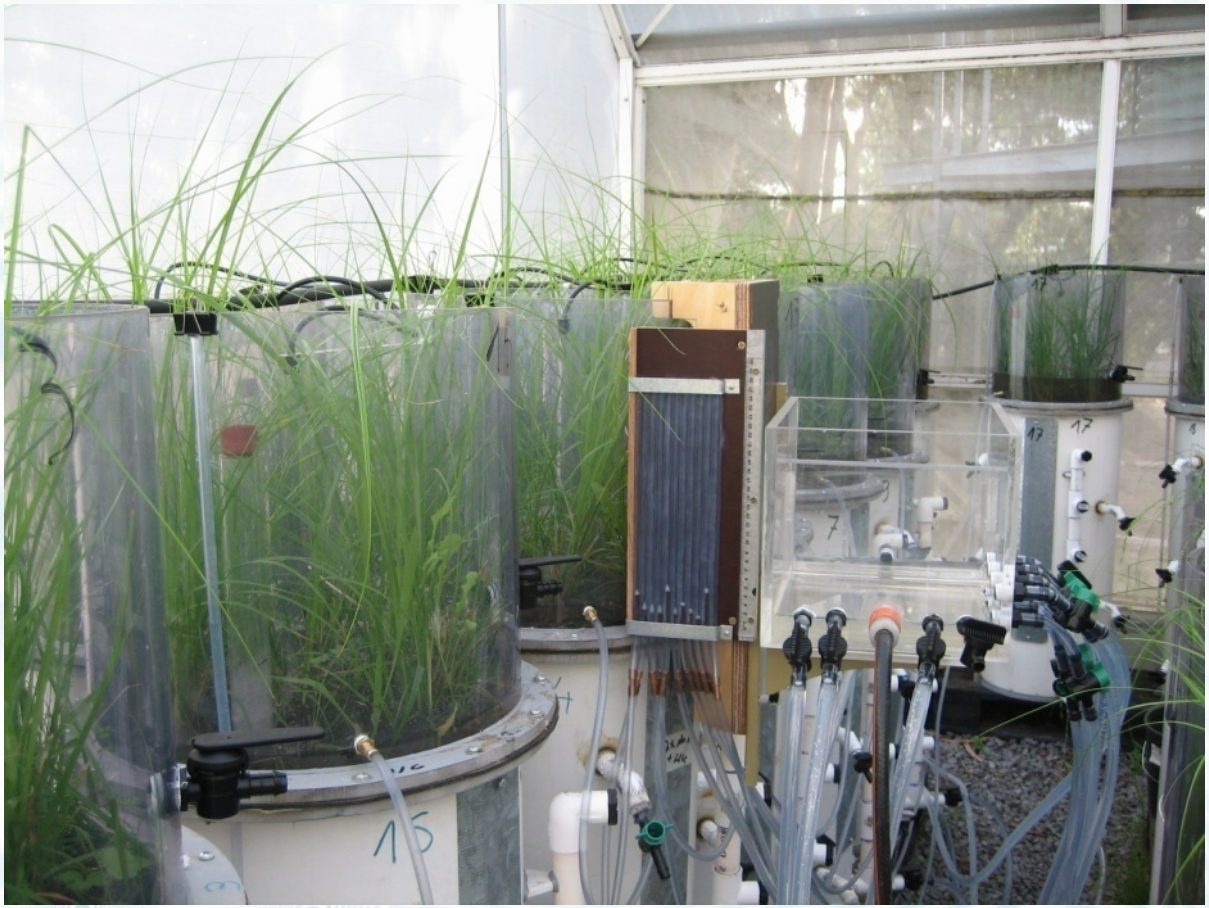
Key Findings

The presence of an approx. **450 mm deep**, permanently submerged zone made from **sand or gravel with a carbon source** (around 5% by volume) will:

- Improve nitrate/nitrite (NO_x) removal, by promoting denitrification
- Improve Cu and Zn removal (to meet ANZECC targets)
- Support plant survival during dry periods and therefore
- Ensure TN removal after dry spells

(2) Additives to media

Activity 1.02 (b) – *Optimisation of standard biofilter design*



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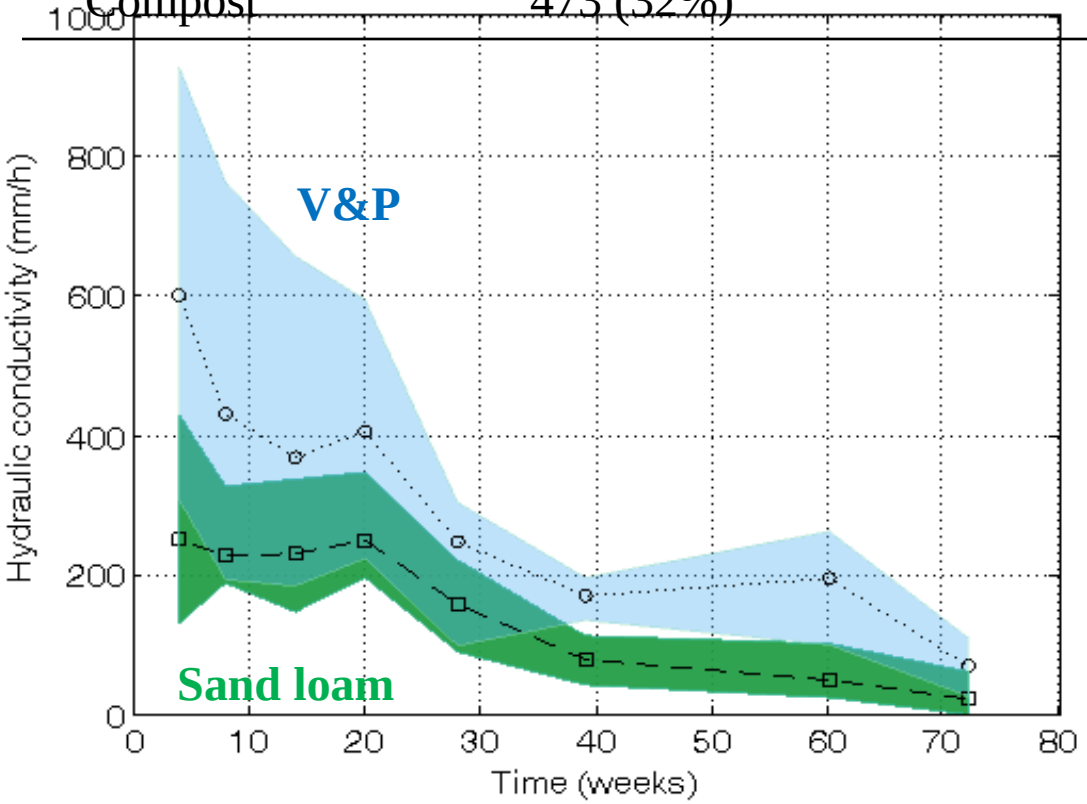
Results: Hydraulic Conductivity

	K_{ini} (4 weeks) (mm/h)	K_{final} (60 weeks) (mm/h)	P
Sand loam	**251 (49%)**	**51 (65%)**	**0.009**
V&P	**599 (44%)**	**196 (33%)**	**0.041**
Compost	473 (32%)	174 (24%)*	0.023



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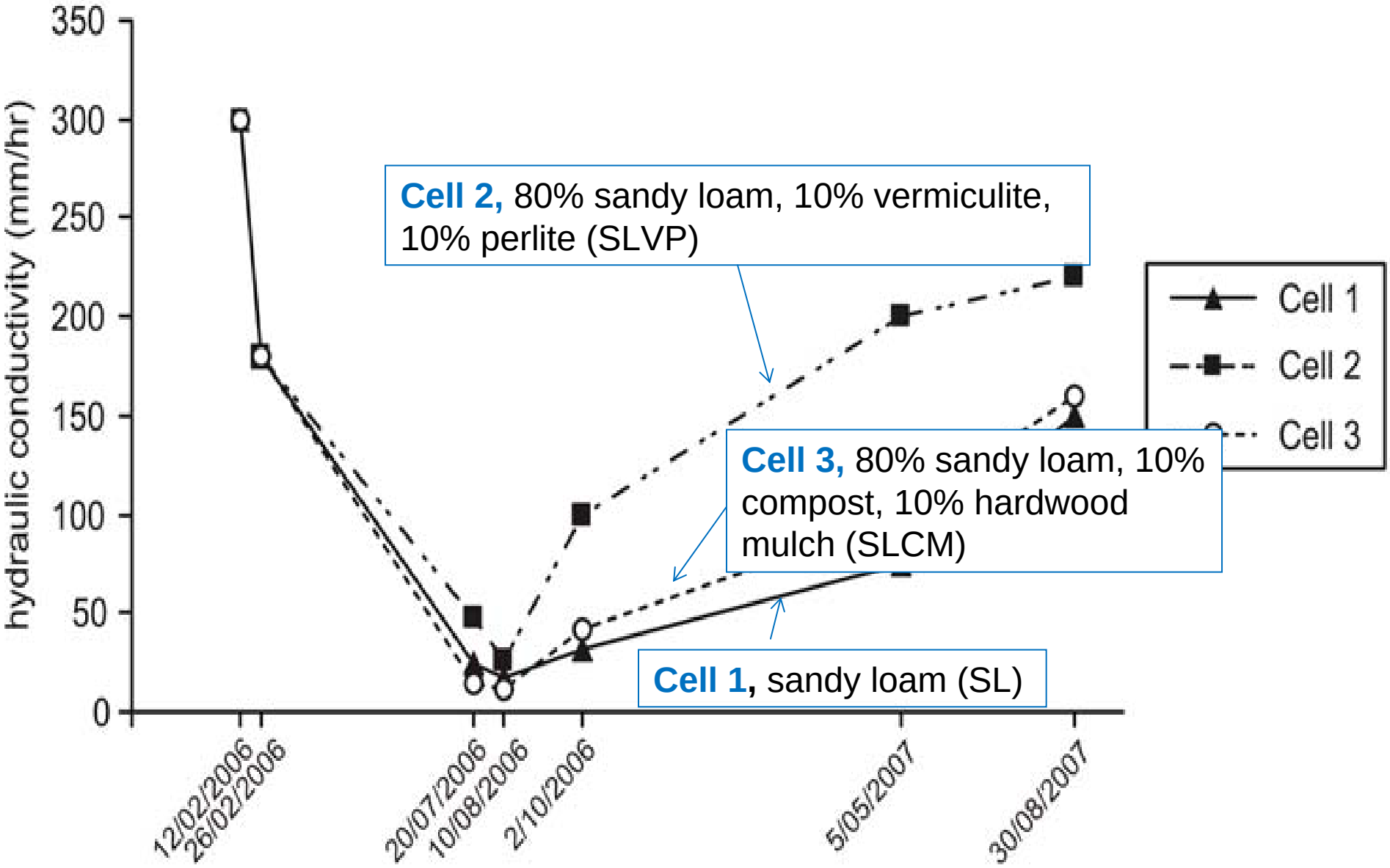
Results: Metals

Adding vermiculite or perlite to filter media will:

- Not change removal of metals, but in the case of Cu
  - It reduced slightly Cu removal, possibly due to reduced organic content level in media
- We are still to analyse results from break-through tests!

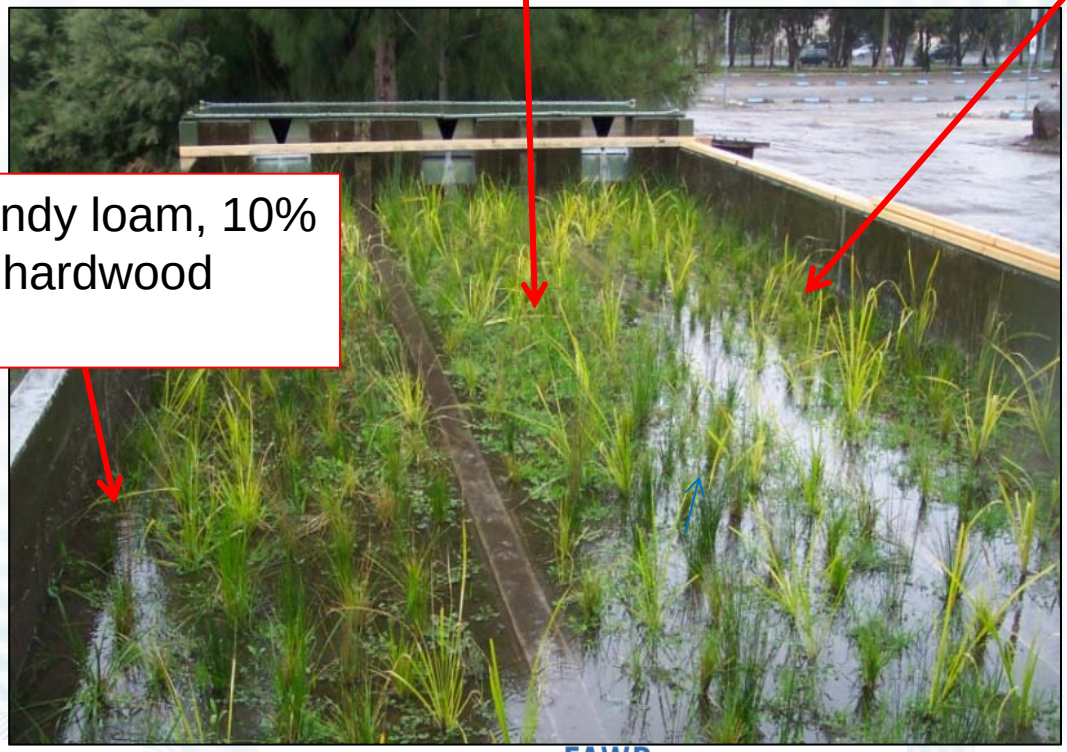
Activity 4.02 – Monash Biofilter, ***Melbourne***



Activity 4.02 – Monash Biofilter, ***Melbourne***

Cell 2, 80% sandy loam, 10% vermiculite, 10% perlite (SLVP)

Cell 1, sandy loam (SL)



Cell 3, 80% sandy loam, 10% compost, 10% hardwood mulch (SLCM)

Key findings

Adding vermiculite or perlite to filter media will

- Increase hydraulic conductivity of media at the start

- Probably increase the life span of media (in relation to metal removal)

(3) Promoting infiltration

Key Findings

- Infiltration (flow losses) will have multiple benefits for receiving waterways:
  - Reduce volumes (restore natural hydrology)
  - Reduce loads

- Infiltration should be avoided for:
  - systems that are used for harvesting
  - near urban infrastructure