

# What is this “*Water Sensitive Urban Design*” thing?

Tim Fletcher

# Outline

- Terminology
- Key principles; what are we trying to achieve?
- Who is playing?
- Why would we do it?
- WSUD tools; a “fuzzy” toolbox
- Where are we heading? A water sensitive city
- My WSUD dream-team

**Water Sensitive Urban  
Design (WSUD)**

**Integrated Urban Water  
Management (IUWM)**

**Water Sensitive Cities  
(WSC)**

**Alternative Techniques**

**Low Impact Design (LID)**

**Sustainable Urban  
Drainage Systems (SUDS)**



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# Simply...

1. Minimise impacts; protect and restore waterways
2. Rainwater / stormwater / wastewater as a resource!
3. Integrate stormwater into landscape
4. Protect water quality, restore hydrology (both together)
5. Add value while minimising infrastructure cost
6. Maximise other benefits (micro-climate, amenity...)
7. Build in resilience and adaptability



# SOME KEY PRINCIPLES

# Principle 1

*Break the connection between impervious areas and receiving waters*

*(give first priority to at-source treatment)*







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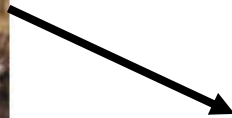




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# Filtration & storage within the urban landscape



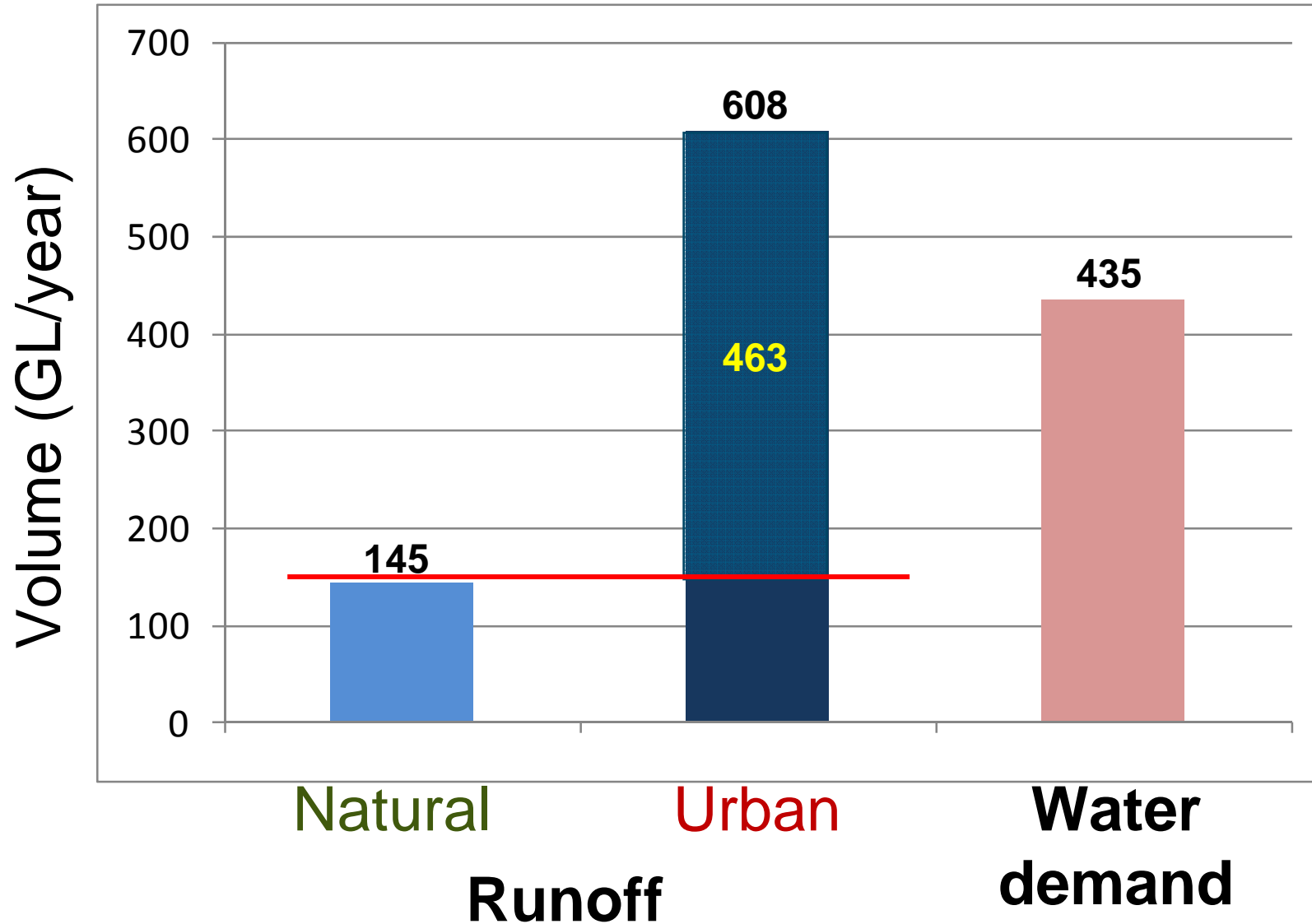


# Principle 2

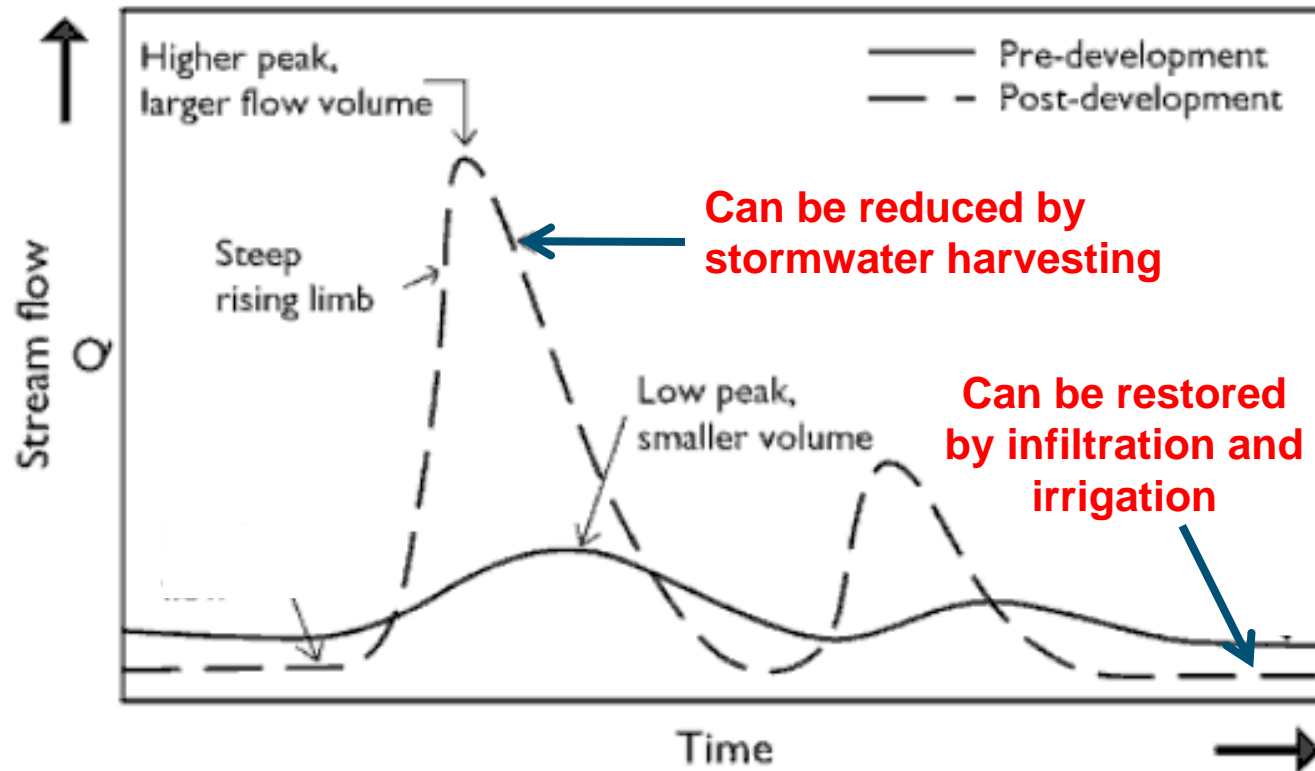
## *Stormwater as a resource*

*(and if we use it, the environment wins!)*

# In Melbourne each year...



# Stormwater harvesting: *must also restore baseflows*



# Principle 3

***Preserve existing natural assets***





# Preserve existing natural assets

## Why?

For their intrinsic values

For their ecosystem services (e.g. nutrient retention, etc)

Use as aesthetic asset



# Principle 4

*Integrate stormwater  
management into landscape*

# Integration into Landscape

Work at a range of scales

Involve other disciplines

- Landscape architects
- Architects
- Urban designers
- Arborists, botanists



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NAB Building Forecourt Wetland

Photos: Tony Wong, Tim Fletcher



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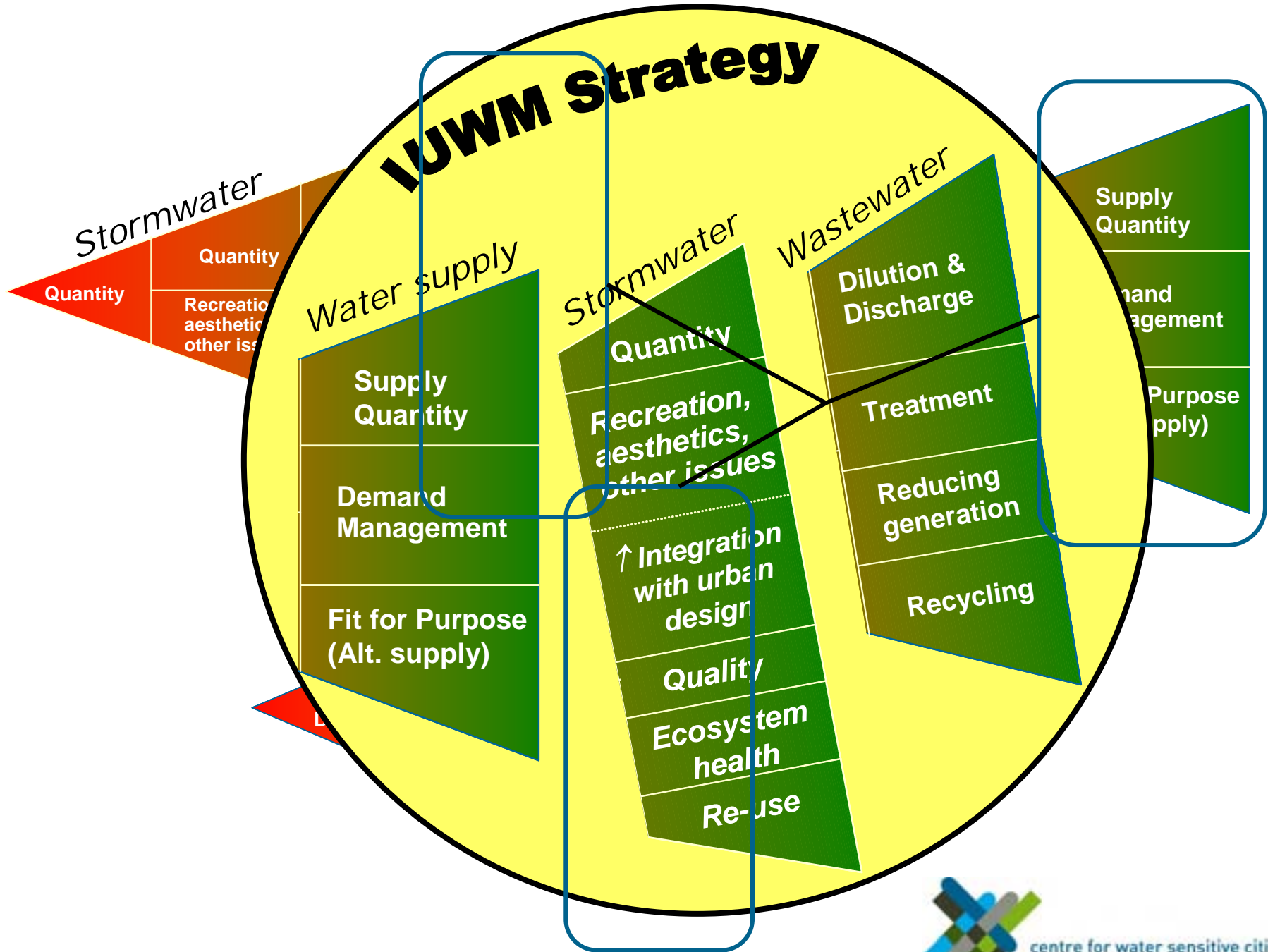
# Match to requirements of local landscape



# Principle 5

*Make stormwater management  
part of broader “Ecologically  
Sustainable Development”*





# Principle 6

*Keep it cheap and simple where possible!*









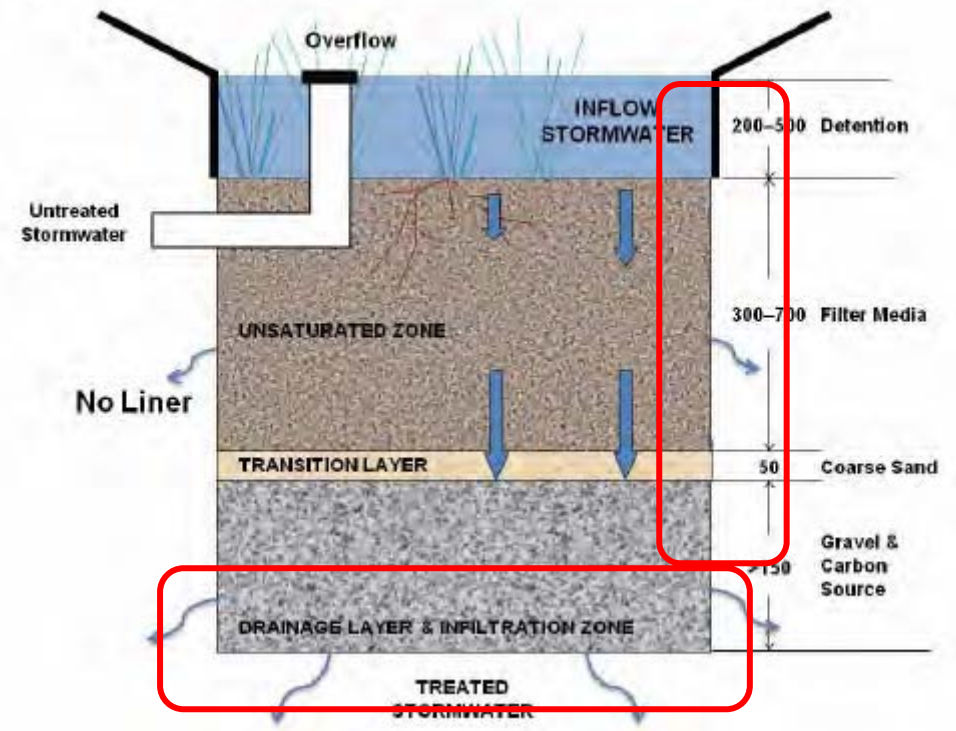
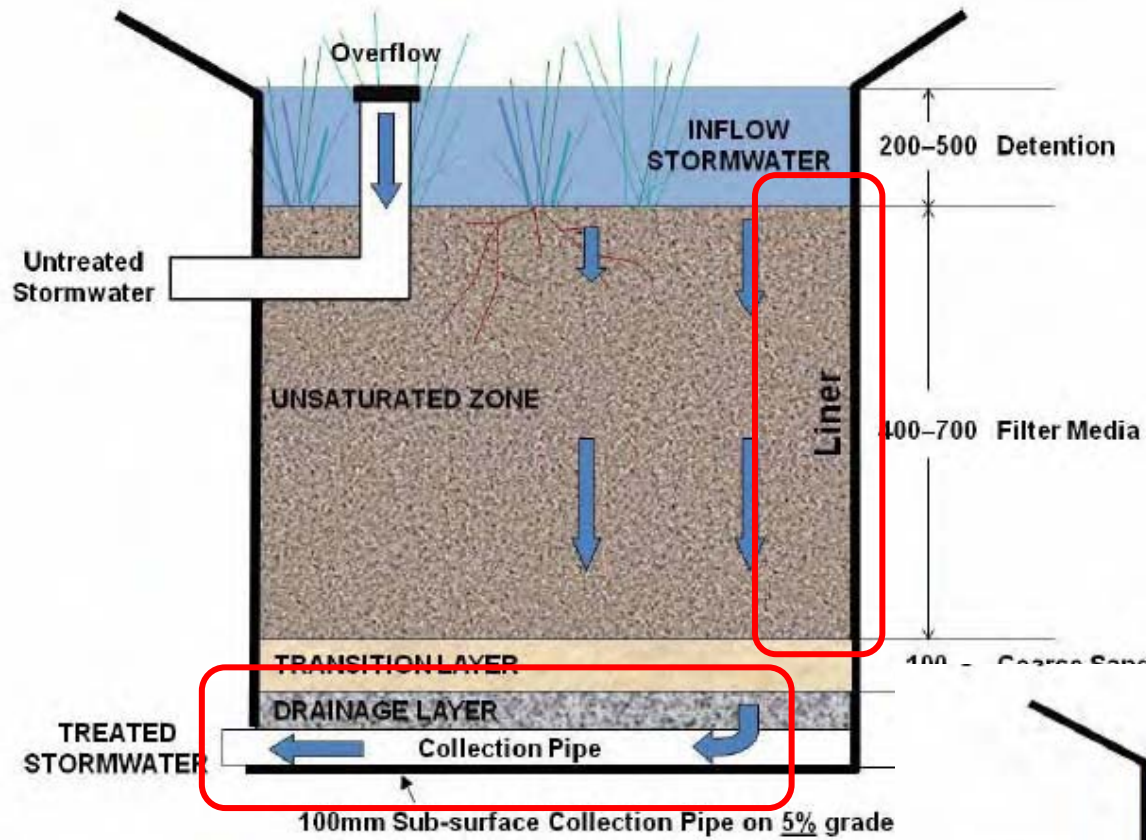


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# Principle 7

*Remember objectives & principles;  
forget design drawings*

*(design, don't duplicate)*



# WSUD

## Why would we do it ?

1. Regulatory drivers
2. Benefits & opportunities

# Regulatory drivers

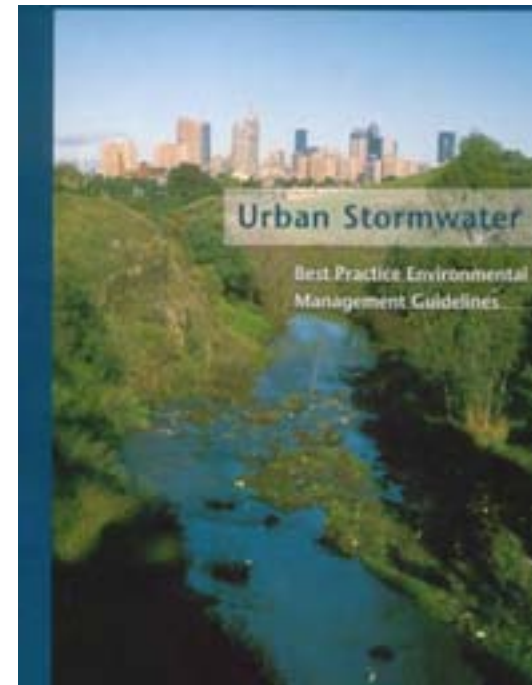
EPA: State Environment Protection Policies (SEPPs):  
protect waterways; sets concentration targets

Practical implementation:

sets load reduction  
(80,45,45% for TSS, TP & TN)

and flow management objective  
(1.5 year ARI to remain unchanged)

*Contained within Clause 56.07 of  
Sustainable Neighbourhoods Code*



# Benefits

## The obvious

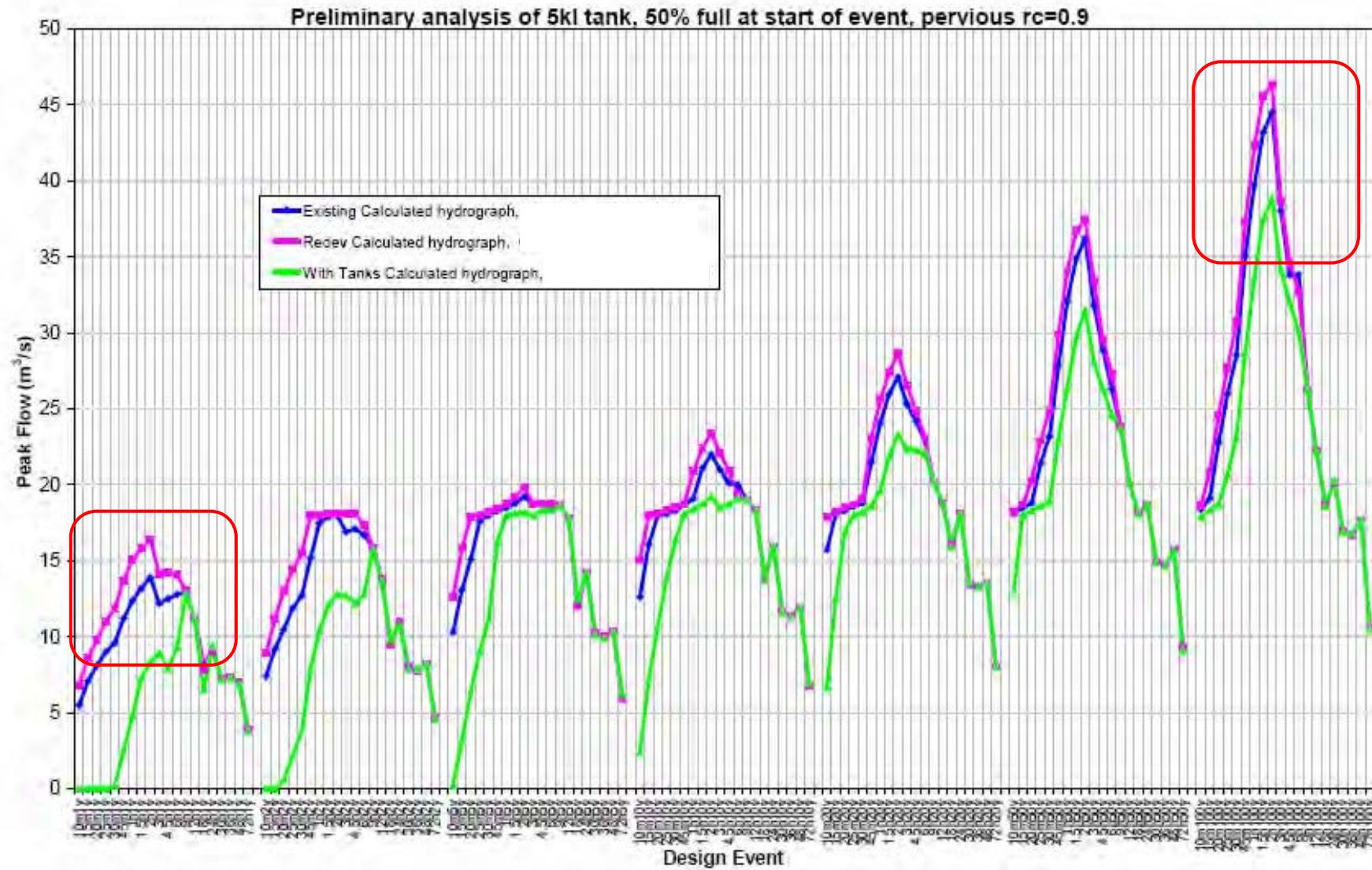
- maintain values of waterways (economic, social, environmental)
- protect Port Phillip Bay
- increase community / landscape values

## *The more 'surprising'*

- *reduce flooding*
- *reduce drainage infrastructure costs*
- *reduce urban heat-island effect*
- *major enhancement in water security*



# Reduced flooding



# Reduced costs

Reduced infrastructure cost (e.g. pipes); direct & external (downstream)

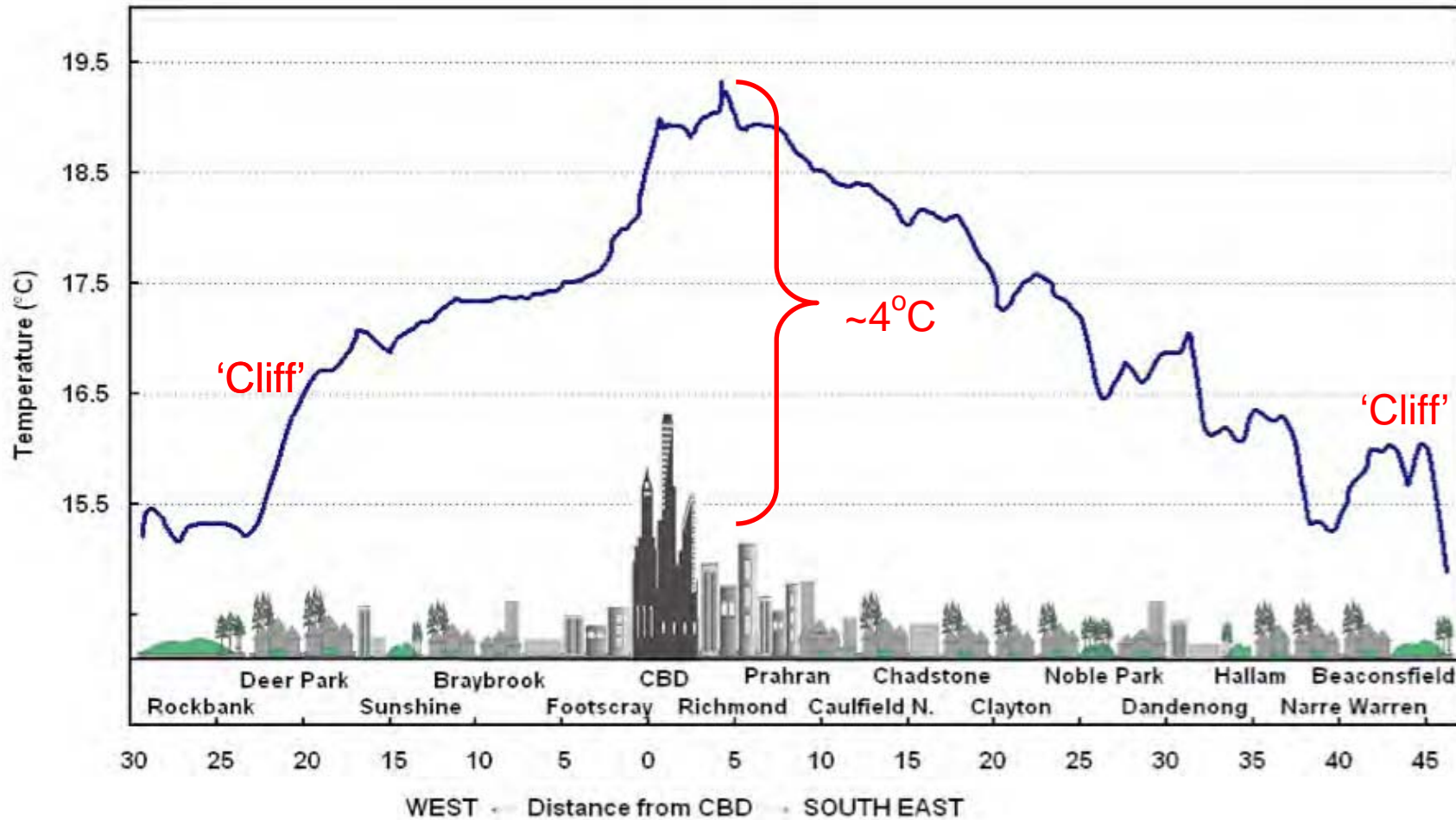
Change in maintenance cost (some increases, some decreases)



# Reduced urban heat island

4 News

THE AGE - MONDAY, NOVEMBER 15, 2008  
theage.com.au



prize Melbourne 2030 — will be hotter than other areas as they gradually build up. This is a concentration of the urban heat island effect. Cities,

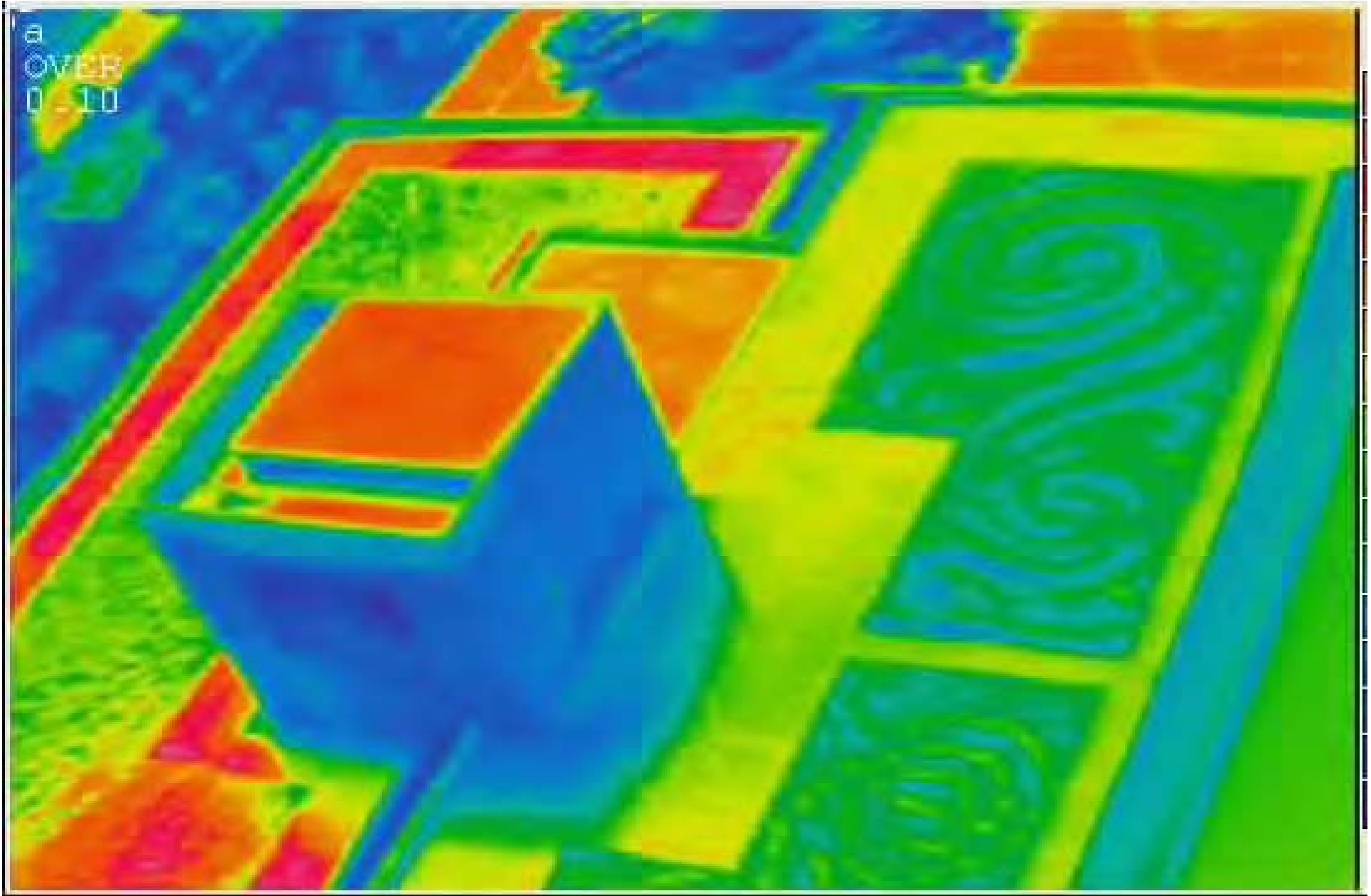
people such as the elderly. Monash University PhD student Andrew Coultts studied several types of suburbs and areas across Melbourne, from

To plan for this, Mr Coultts, from Monash's School of Geography and Environmental Science, suggested activity centres get more vegetation —

being a cooling agent, have acted like concrete during the city's prolonged drought. "Generally the heat island sits over the CBD and you'll see a

"This will happen especially if it is dry, and might be a more common pattern in the future if we get less rainfall and temperatures increase," she said.

sensitive cities



# Enhanced water security

**Rainfall = 100 L**



**Runoff  $\approx$  10-20 L**

**Rainfall = 100 L**



**Runoff  $\approx$  85-90 L**



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# Some WSUD tools

An infinitely large toolbox...

# Gross Pollutant Traps

## Benefits

- reduce litter, debris, coarse sediment
- pre-treatment for other systems (eg wetlands)



## Considerations

- Can be ugly and/or expensive
- Maintenance: *capital vs. maintenance cost*



# Sediment Basins

## Benefits

- Target coarse sediments
- Particularly suitable during construction phase
- Protect downstream elements

## Considerations

- Aesthetics (perhaps vegetation)
- Safety/access





# Rain-gardens

(infiltration, biofiltration, bioretention)

## Benefits

- flexible size, scale
- streetscape & aesthetics
- fine and soluble pollutant removal
- significant flow reduction
- *promote infiltration where possible*

## Considerations

- unsuitable where high groundwater









# Street-tree rain-gardens



# Sand Filters

## Benefits

- Relatively cheap (no vegetation)
- Space-efficient (can be underground)



## Considerations

- Need regular maintenance (because no vegetation)
- Little aesthetic/amenity benefit

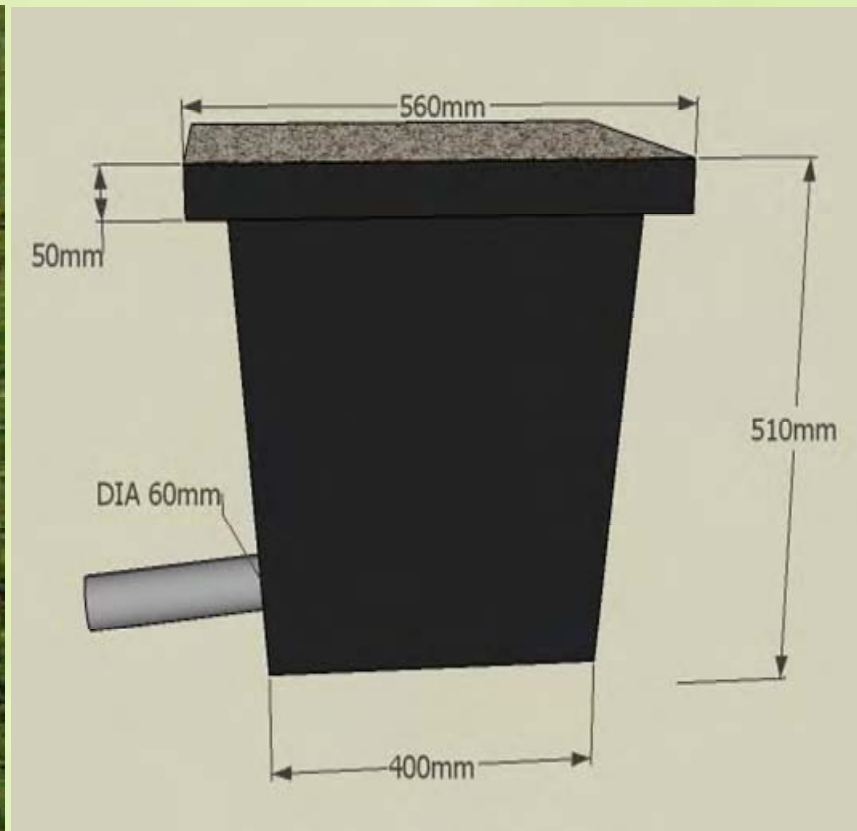


# Porous pavements



# Modular Stormwater Filters

- Granular filtration media for waterway protection or stormwater harvesting



Images: Envis



# Simple Infiltration Systems

Surface systems



Sub-surface systems



# Buffer Strips & Vegetated Swales

## Benefits

- remove coarse and medium sediment
- streetscape benefits
- alternative conveyance system

## Considerations

- Restricted to mild slopes (1-4%)
- Interactions with driveways, footpaths





# Ponds and Wetlands

## Benefits

- Particulate & dissolved pollutants
- Amenity and aesthetics
- Storage for reuse
- Can incorporate flood retarding function
- Wildlife habitat

## Considerations

- Cost (esp. vegetation)
- Space requirements (but scaleable)





# Rainwater Tanks

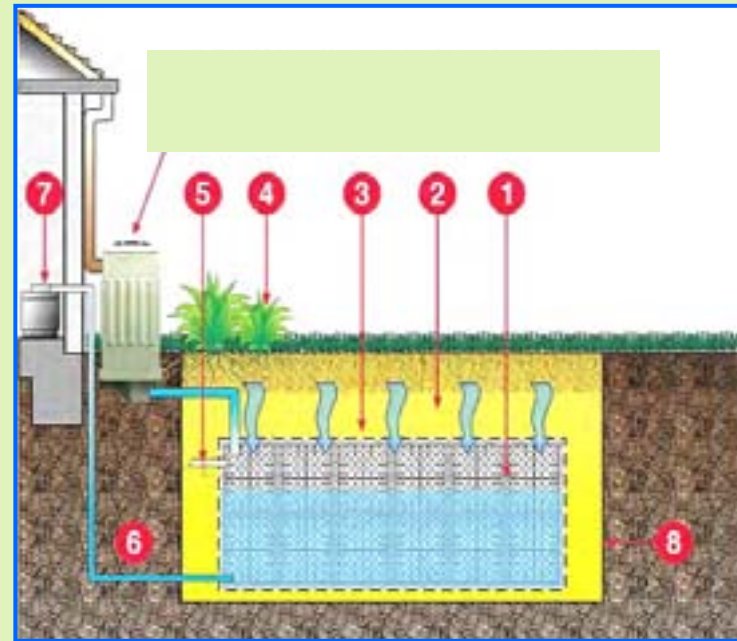
## Benefits

- Triple benefit:
  - *potable water substitution*
  - *peak flow reduction*
  - *reduced pollutant load*
- Flexible (scalable)
- Well suited to urban areas



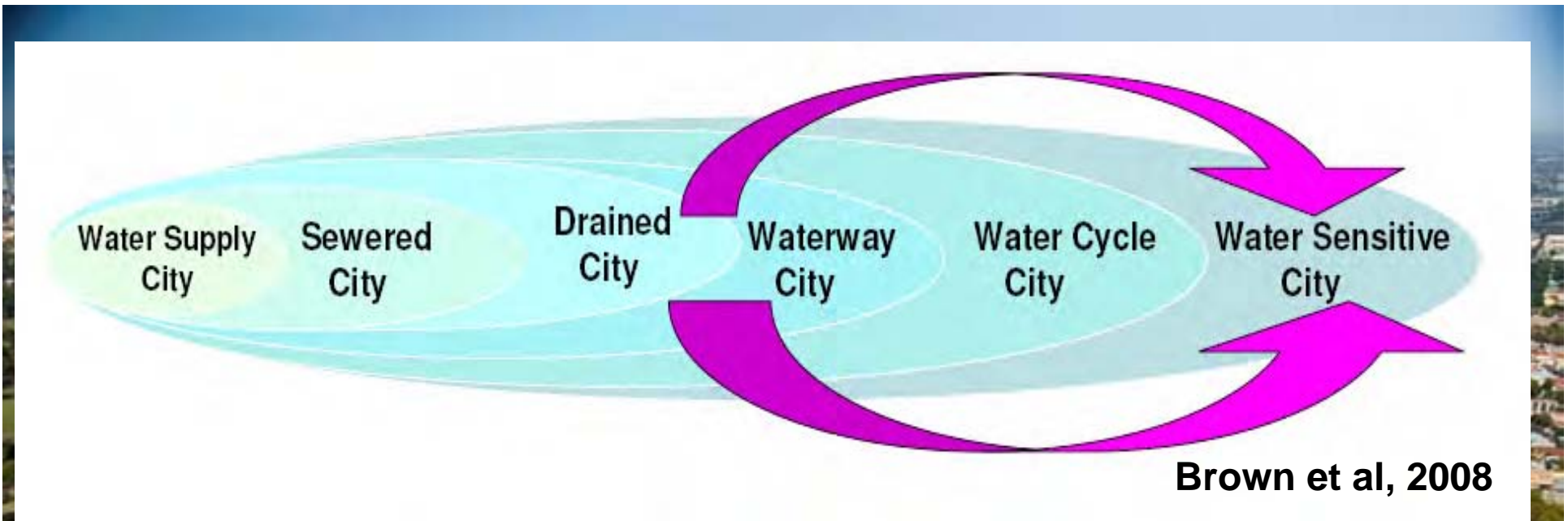
## Considerations

- Cost
- End-use quality requirements
- Plumbing to end-use



The big picture....

Towards a Water Sensitive City



*Resilient & adaptable*

*Protecting ecosystems & providing ecosystem services*

*Socially, ecologically & economically sustainable*



# My WSUD dream-team

Hydraulic engineer

Landscape architect &/or urban designer

Maintenance officers

Community liaison expert

Traffic engineer

Councillor

Plant / biodiversity expert

*An economist and a sociologist*

An optimistic fool & a grumpy old bastard