

Water Neutral Development

by

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MALAYSIA WATER RESOURCES MANAGEMENT (MyWRM) FORUM 2012



“Time for Solutions”

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Malaysian Water
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Department of Irrigation
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The Malaysian Water
Association



Water Association of Selangor,
Kuala Lumpur and Putrajaya

CONTENT

1. Introduction
2. Water conservation
3. Local water resources
4. Water reclamation
5. Rainwater harvesting
6. Integration of water system
7. Success stories
8. Take-away messages

CONTENT

1. Introduction

Objective

Why?

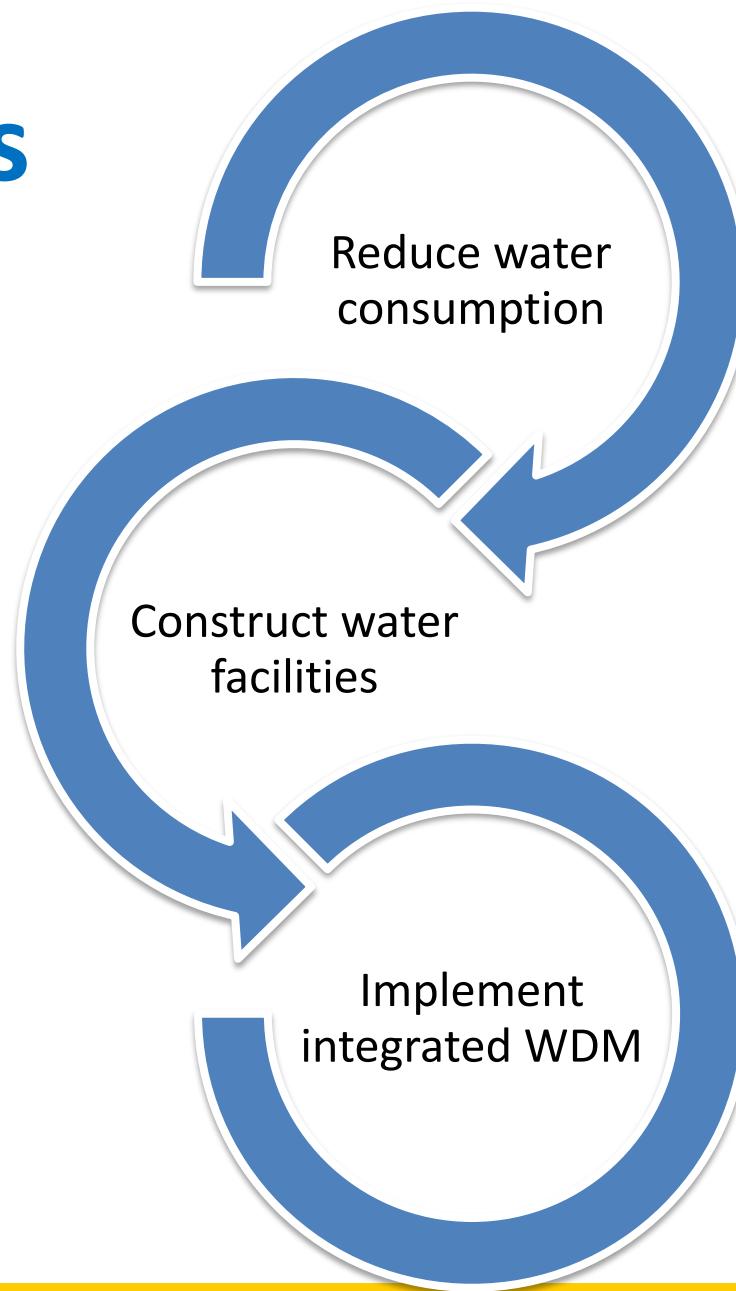
How?

Where?

When?

Objectives

- for rainwater harvesting, groundwater abstraction and stormwater and greywater



- promote wise water use

- combines the benefits of reduced consumption and good water management with sustainable urban design (SUD)

CONTENT

1. Introduction

Objective

Why?

How?

Where?

When?

Why? – to address urbanisation issues

1

Increased runoff

- Flash floods and flooding in downstream areas
- Reduced groundwater recharge



2

Polluted rivers

- Wastewater
- Solid waste



3

Transformation

- Same water system becomes inappropriate with increased urbanisation



4

Urban climate

- 'Heat-island' causes larger amounts of heavy rainfall
- Air pollution also have the same effect



CONTENT

1. Introduction

Objective

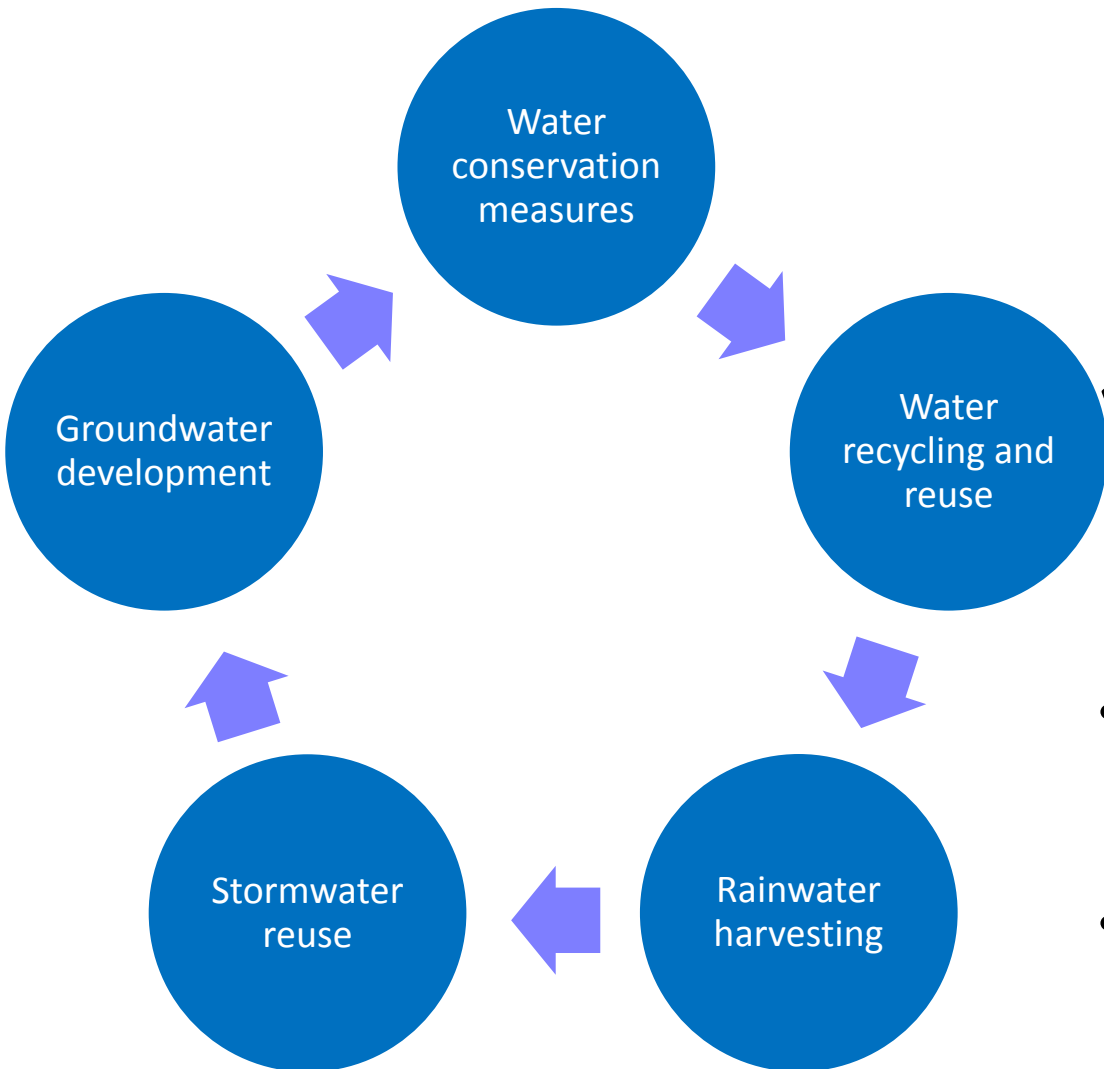
Why?

How?

Where?

When?

How? – to achieve water neutrality



- The development captures all rainwater, manages all storm water runoff, and re-uses all wastewater
- Area does not require additional water despite new development
- Paradigm shift from “draining water” to “retaining water”
- Same water system can cope with increased development

CONTENT

1. Introduction

Objective

Why?

How?

Where?

When?

Where? – to implement water neutrality

Existing
development

- Reduced water use

New
development

- Water efficiency
- Local water resources

CONTENT

1. Introduction

Objective

Why?

How?

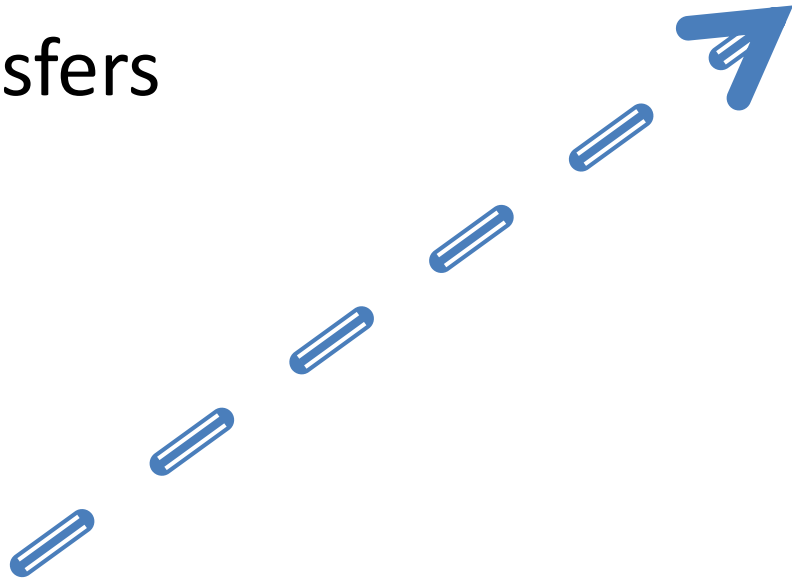
Where?

When?

When? – to implement water neutrality

“LA NI”

- Dams, water transfers
- WTPs, STPs, STFs
- Floods
- Water pollution
- Water shortages



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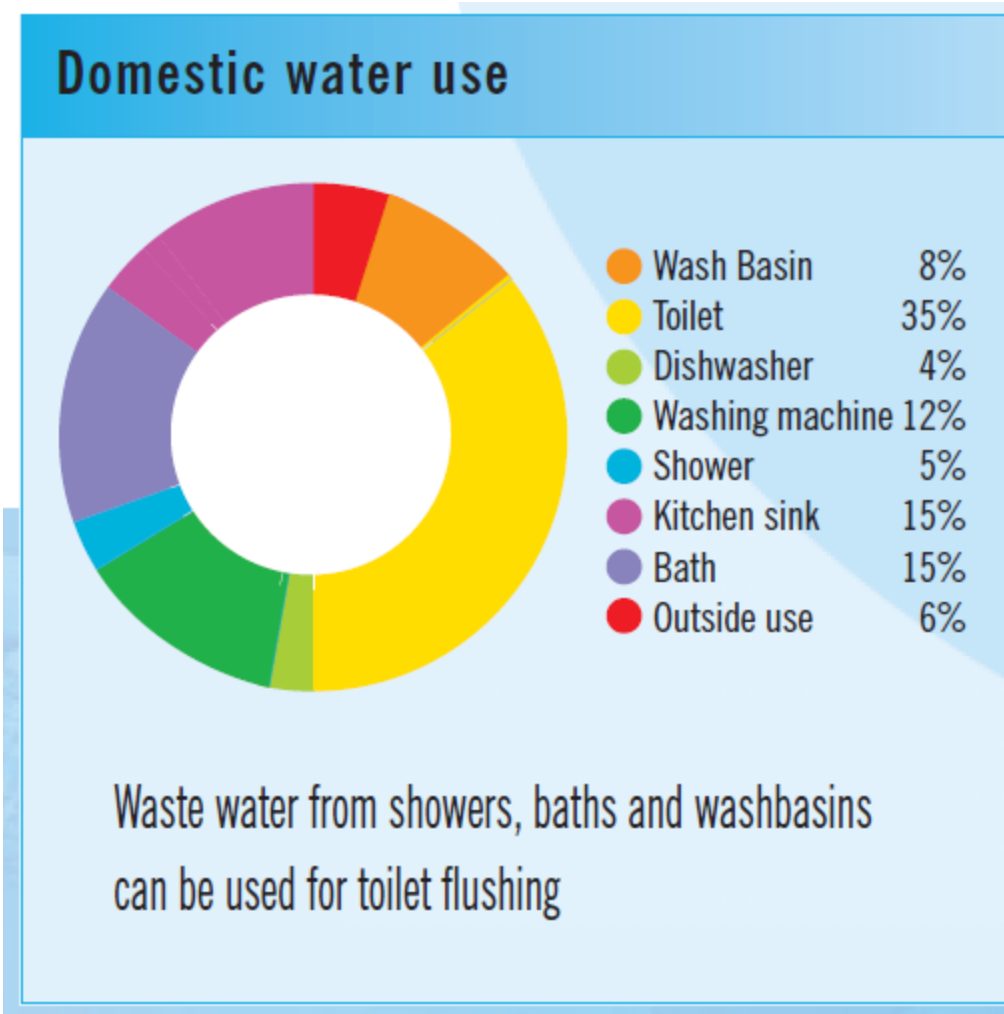
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Potential use of non-potable water and water reuse



Typically, less than 20% of domestic water is consumed for drinking and food preparation, and a third of all water is used for toilet flushing.

Source: Woking Borough Council, UK

Water use conclusion



Restrooms use the highest percentage of water



DAILY WATER CONSUMPTION BY ONE PERSON		WATER CONSUMPTION IN LITERS PER DAY PER PERSON		POSSIBILITY OF USING RAINWATER INSTEAD OF MAINS WATER DAILY BY ONE PERSON	
	3L	DRINKING AND COOKING	0L		
	8L	WASHING FLOORS (CLEANING)	8L		
	9L	WASHING DISHES	0L		
	9L	BODY HYGIENE	0L		
	11L	GARDEN IRRIGATION	11L		
	17L	WASHING CLOTHES	17L		
	44L	BATH	0L		
	46L	FLUSH TOILETS	46L		
147L			82L		

ALL WATER PROBLEMS ARE LOCAL

Conservation practices and measures

- No running taps – brushing teeth and washing in the sink
- Dual-flush and low-flush toilets
- Water free urinals
- Water-saving showerheads



Conservation alone will not solve the water needs, but it is an important strategy – the cheapest, easiest and most environment friendly means of improving reliability

Conservation practices and measures

- Stop the leak



Rate of leak	Losses (litres)	
	Daily	Monthly
One drop per second	4.3	130
Two drops per second	14	380
Stream breaking into drops	91	2,650
1.6 mm stream	320	9,460
2 mm stream	980	29,520
5 mm stream	1,600	48,260
6 mm stream	3,500	105,000

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Local water resources

	Source	Type of storage	Usage
Rainwater	Roof tops	Tanks	Non-potable use
	Other open areas (stormwater runoff)	Ponds	Non-potable use

	Quantity	Quality	Usage
Groundwater	Insufficient	-	-
	Sufficient	Good	Potable use
		Poor	Non-potable use

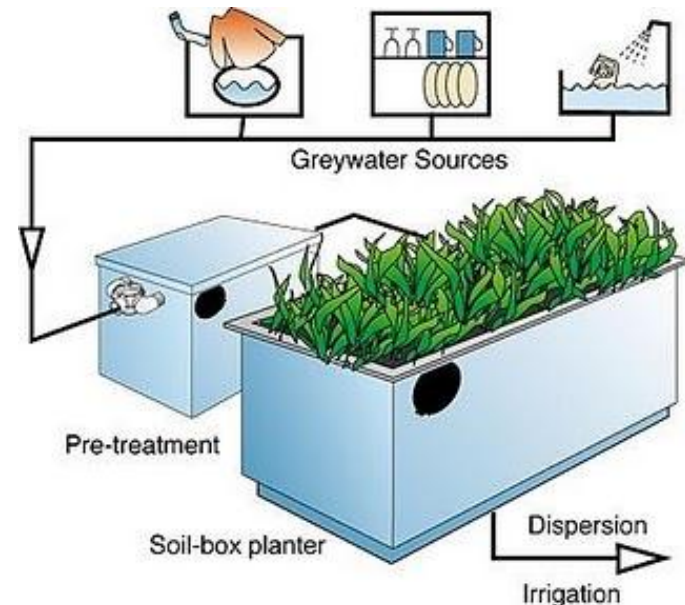
Unconventional sources		Treatment requirement	Usage
Condensate from AC system		Yes	Non-potable use
Wastewater	Grey water	Yes	Non-potable use
	Black water	Yes	Discharge to rivers

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Greywater reuse (GWR)

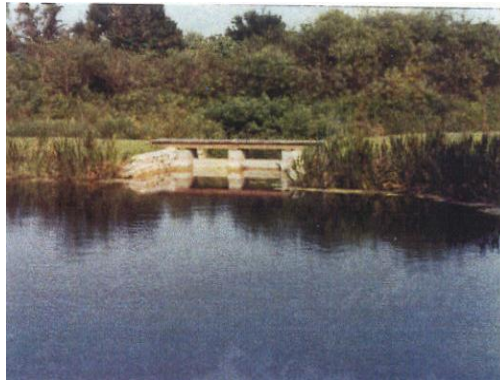
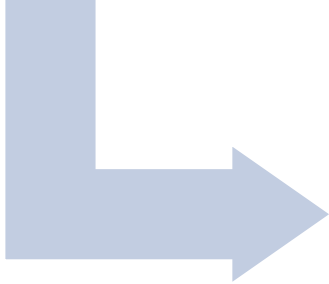
- Greywater - wastewater from baths, showers and wash basins
- Existing buildings - retrofitting GWR is difficult and costly
- New development - many opportunities for GWR



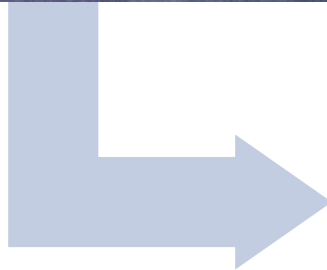
Stormwater reuse



- Collects runoff



- Controls pollution



- Reuses the water

Source: UCF

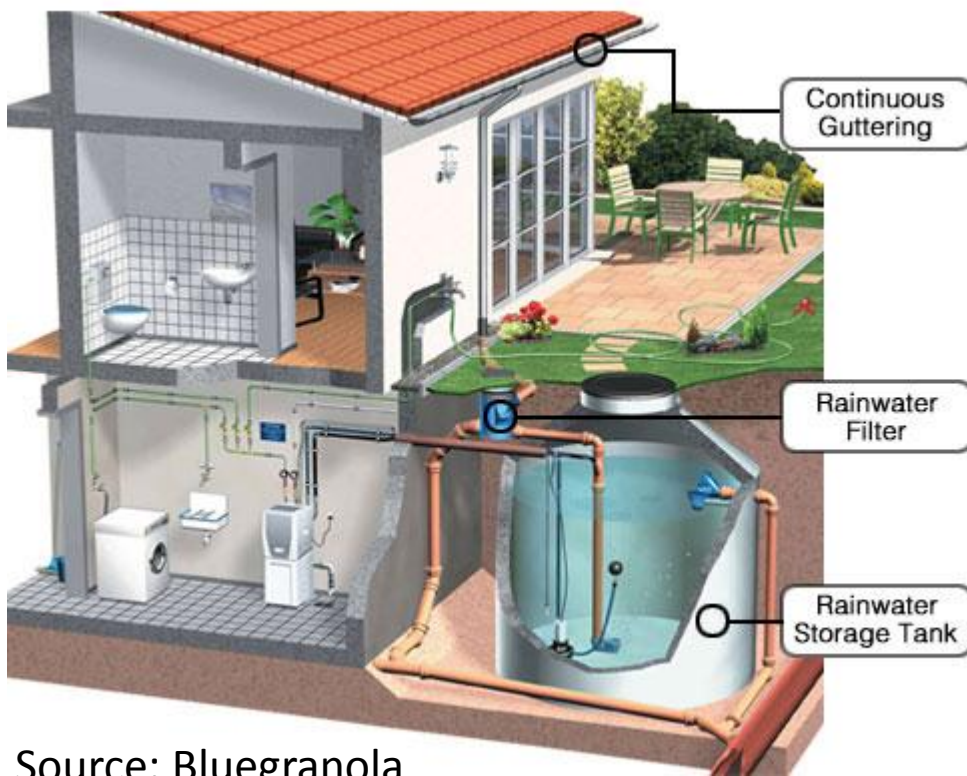
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Rainwater harvesting (RWH)

- RWH facilities can be retro-fitted into existing buildings
- Simplest RWH: rainwater is collected in a tank for garden use
- Advanced RWH can provide water supply for a range of uses:
 - Filtered rainwater for laundry and toilet flushing
 - Purified rainwater for personal hygiene
- Separate pipes are required for rainwater or greywater and mains water back up should be provided

Conventional RWH



Source: Bluegranola



Source: KEN Holding Bhd



- Excavation process



- Formwork



- Casting the tank

Source: EAG Consulting

Communal RWH

Innovative RWH Designs



Coloured gutters and downpipes

Innovative RWH Designs

Downpipe - composition



Source: Dresden rain building

Innovative RWH Designs

Downpipe - composition



Rain chain

Source: Ecofriend

The Green Cast Building Kanagawa Prefecture, Japan – designed by Kengo Kuma and associates



Innovative RWH Designs

Storage tank

- As façade
- As water feature



Innovative RWH Designs



Storage tank

- As water column
- As tank on the wall



Source: Ecofriend

Innovative RWH Designs



Storage tank

- As water wall



Innovative RWH Designs



Storage tank

- As garden furniture



Source: Ecofriend

Innovative RWH Designs



Storage tank

- As garden sculptures

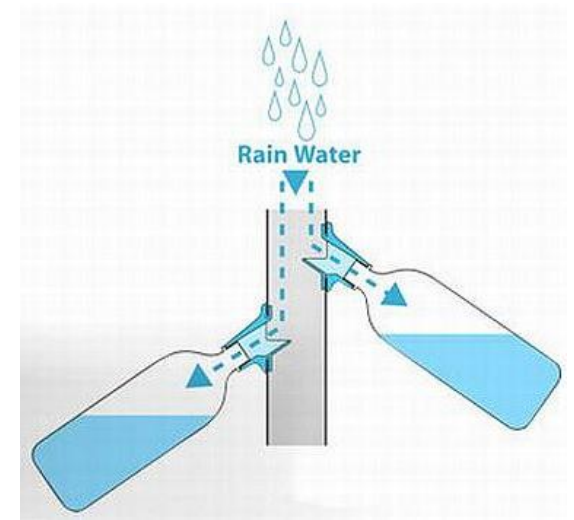


Source: Ecofriend

Innovative RWH Designs

Storage tank

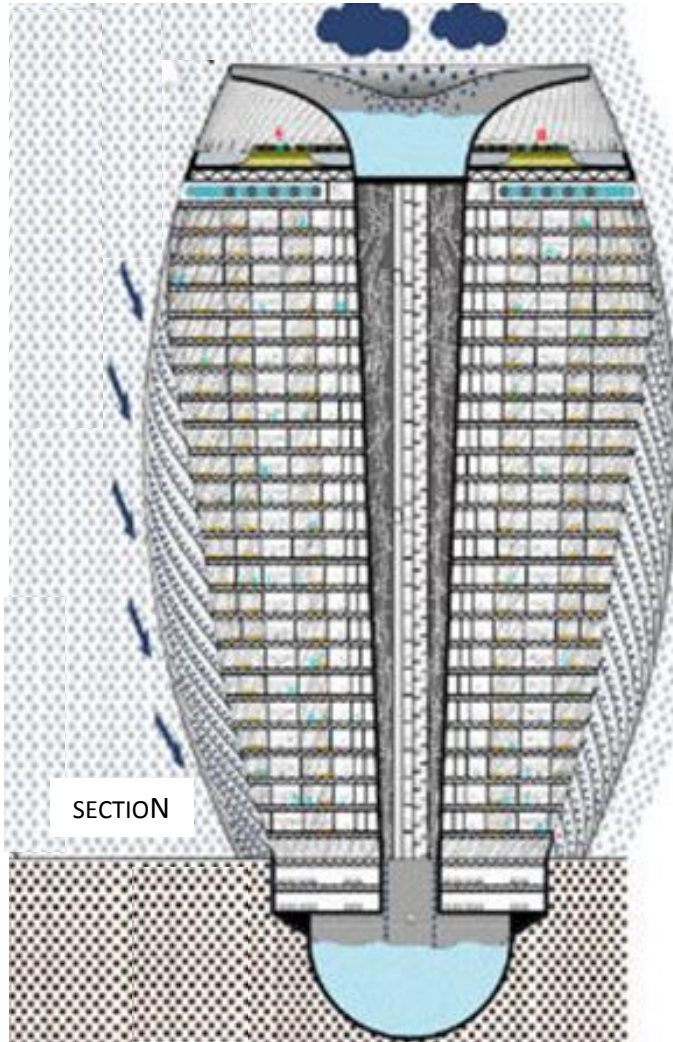
- As wall taps
- As garden taps



Source: Ecofriend



Innovative RWH Designs



Capture the Rain Skyscraper

Source: Open Buildings

www.archdaily.com

Potable rainwater on the go



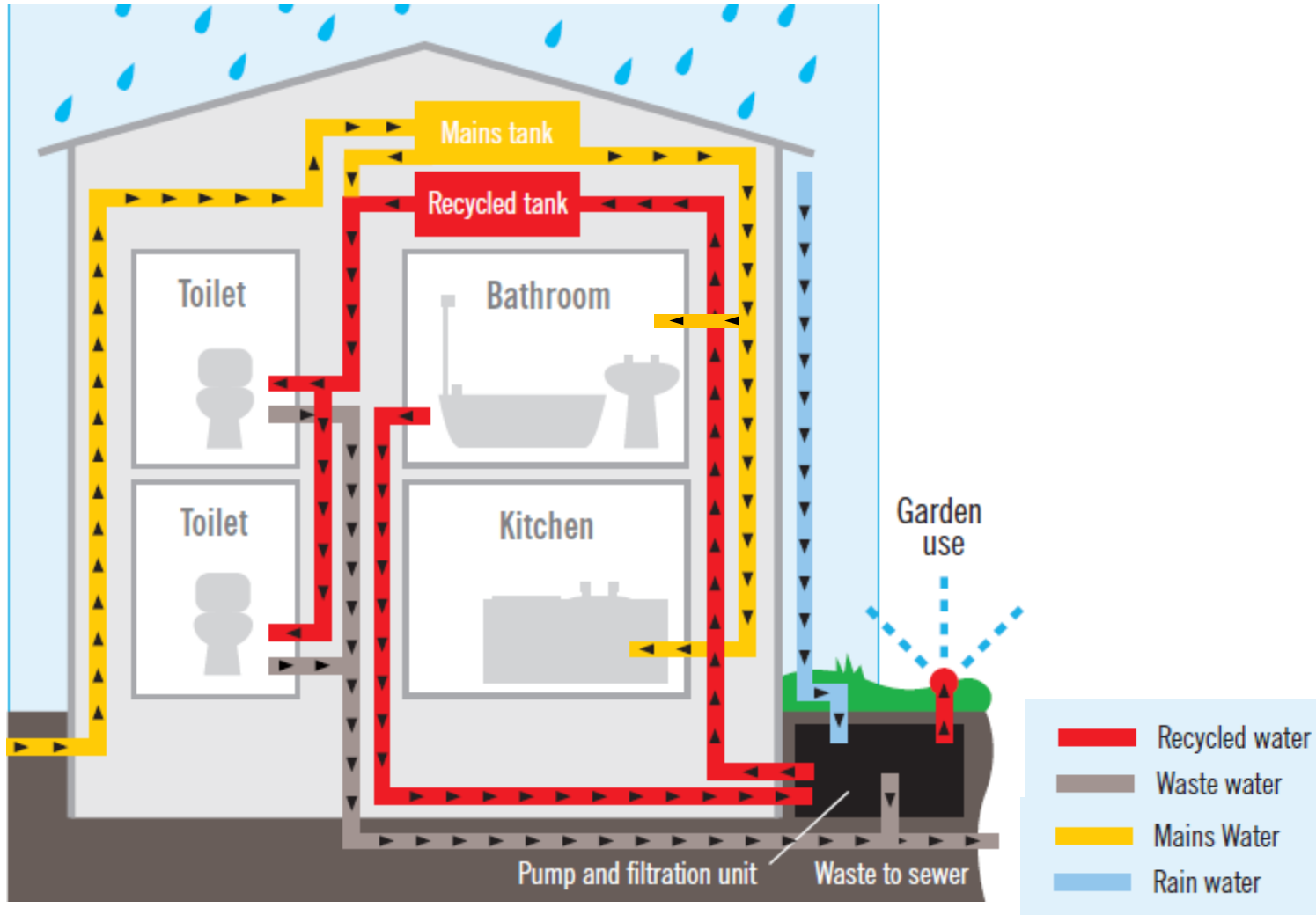
Filterbrella with an activated carbon filter in its hollow rod.

Source: Ecofriend

CONTENT

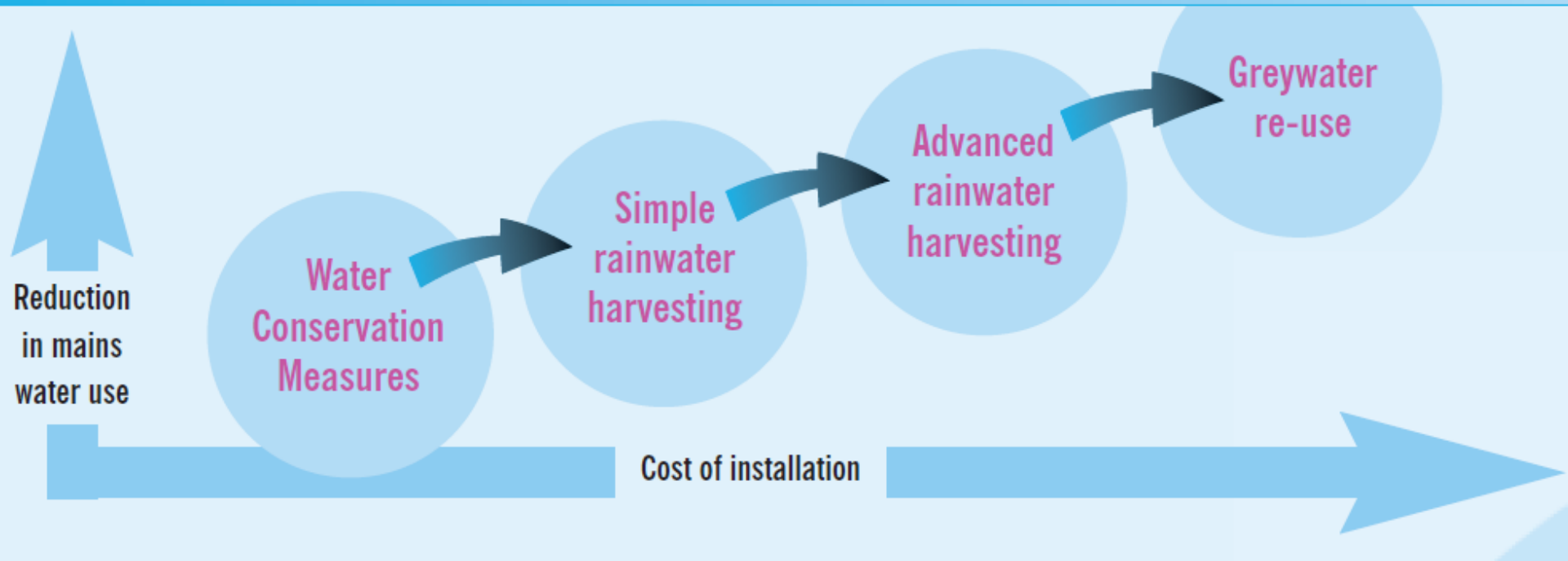
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Integration of water systems



Integration of water systems

Investment sequence for water conservation and recycling measures



Source: Woking Borough Council, UK

- Substantial savings in mains water consumption can be achieved by integration of water systems

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Integration of water systems

- Woking Borough Council, UK

	Mains water consumption (litres/person/day)
Standard construction	170
Water conservation measures only	102
Water conservation measures + treated rainwater for personal washing, laundry, dishwashing and outdoor use	55
Water conservation measures + treated rainwater for personal washing, laundry and dishwashing + untreated greywater (toilet and outdoor use)	21

Source: Woking Borough Council, UK

Integration of water systems

Zero reliance on mains
water can be achieved by



Developing groundwater
resources

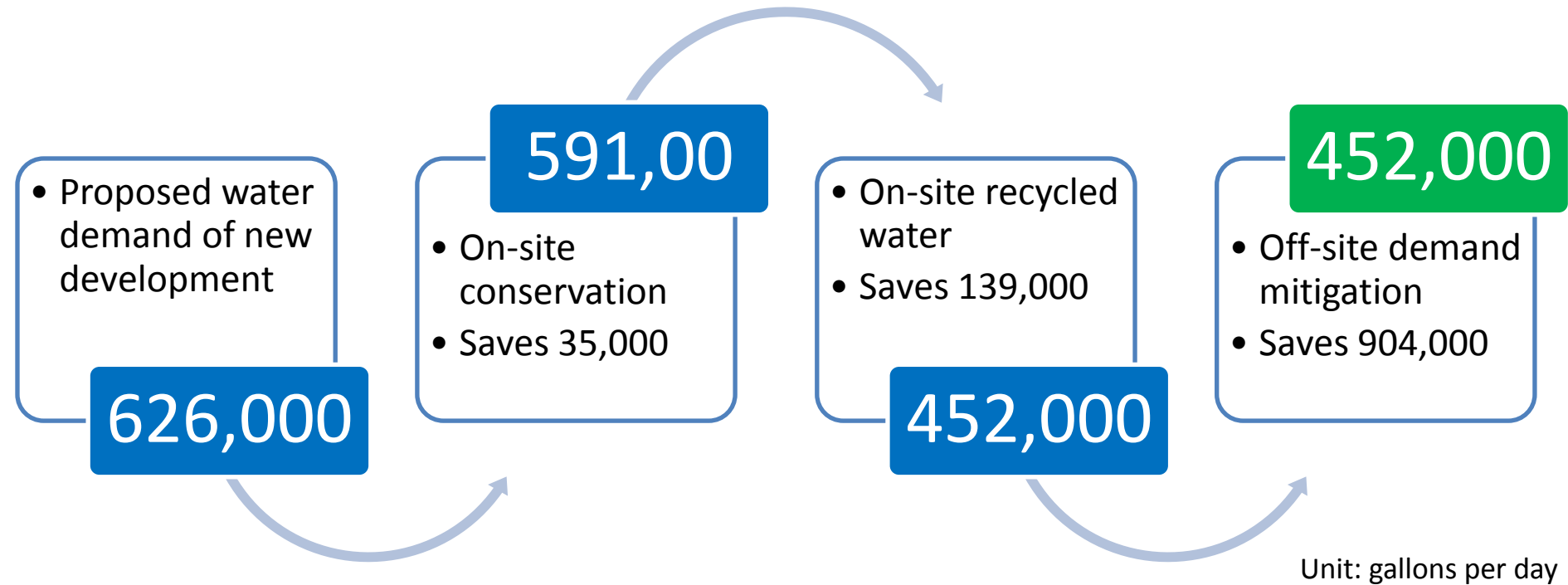


Water Neutral Development

Does not result in any additional demand on mains water

Water neutral development

- Camino Tassajara, California, USA



The new development results in a net water gain to existing users

Source: Planning and Conservation League, Sacramento

Water neutral development

- Llyod Crossing, Portland, Oregon, USA

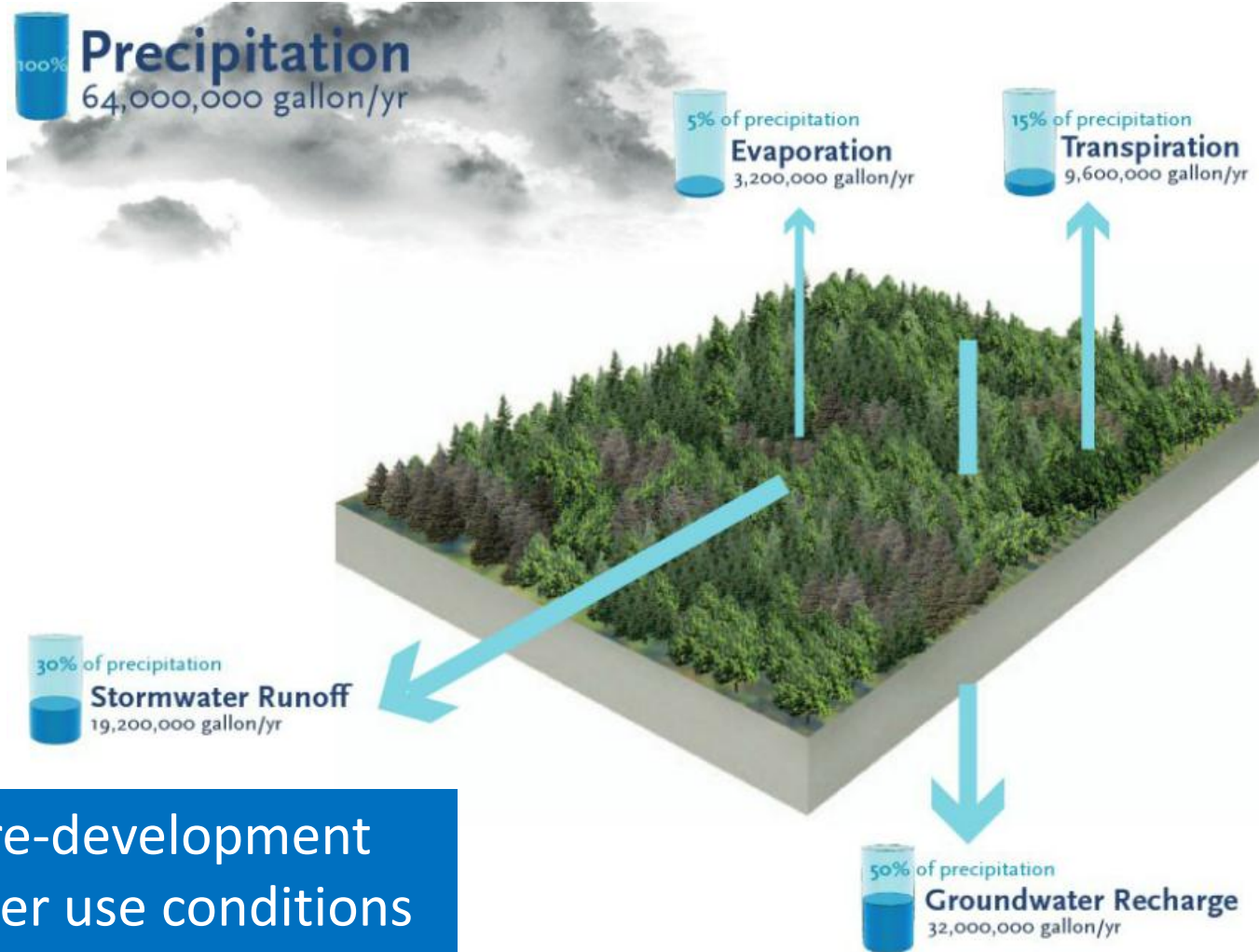
- The implementation of Sustainable Urban Design (SUD) Plan over a period of 45 years with the objective of producing an urban ecosystem that is similar to pre-development conditions with respect to habitat, water and energy.



Source: Mithun

Water neutral development

- Llyod Crossing, Portland, Oregon, USA



Source: Mithun

Water neutral development

- Llyod Crossing, Portland, Oregon, USA



2004 water use conditions

Source: Mithun

Water neutral development

- Llyod Crossing, Portland, Oregon, USA



2050 per Code
water use conditions

Source: Mithun

Water neutral development

- Llyod Crossing, Portland, Oregon, USA



Water neutral development

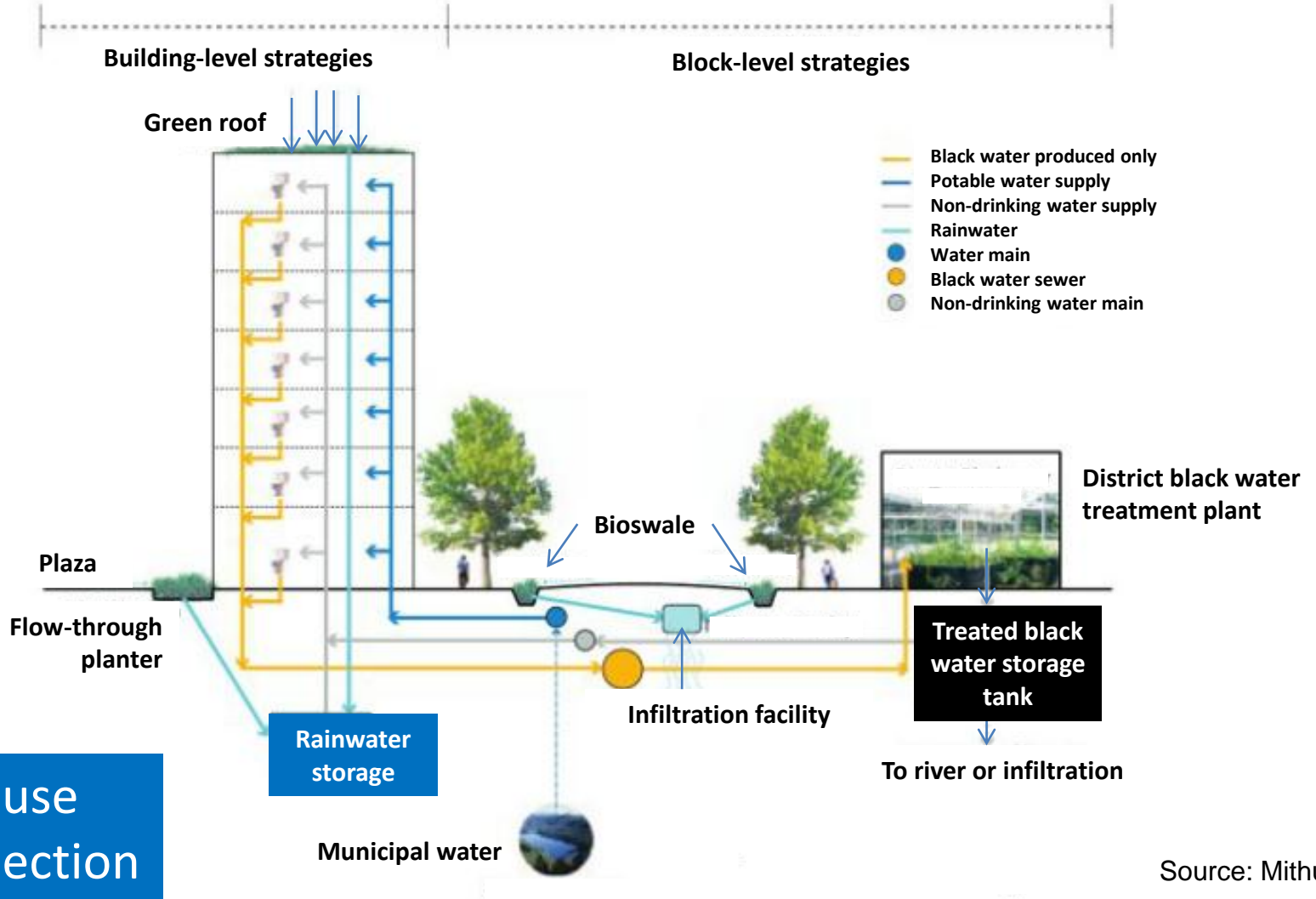
- Llyod Crossing, Portland, Oregon, USA

Source: Mithun

	Pre-development		2003 Existing		2050 per Code		2050 per Plan	
	Millions of gal. per year	% of rainfall	Millions of gal. per year	% of rainfall	Millions of gal. per year	% of rainfall	Millions of gal. per year	% of rainfall
Inflows								
Rainfall	64.0	100%	64.0	100%	64.0	100%	64.0	100%
Potable water	0.0	0%	23.0	36%	160.4	251%	57.7	90%
Total inflows	64.0	100%	87.0	136%	224.4	351%	121.7	190%
Outflows								
Runoff	19.2	30%	57.6	90%	57.6	90%	28.8	45%
Sanitary sewer	0.0	0%	20.7	32%	144.3	226%	52.0	81%
Groundwater	32.0	50%	0.0	0%	0.0	0%	22.4	35%
Transpiration	9.6	15%	1.3	2%	1.3	2%	6.4	10%
Evaporation	3.2	5%	6.4	10%	6.4	10%	3.2	5%
Total outflows	64.0		85.9	134%	209.6	328%	112.8	176%
System loss	0.0		1.0		14.8		9.0	
% of total inflows	0%		1%		7%		7%	

Water neutral development

- Llyod Crossing, Portland, Oregon, USA



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Summary of water neutral development

Harvest local water resources

- Rainwater
- Stormwater
- Groundwater

Efficient water use

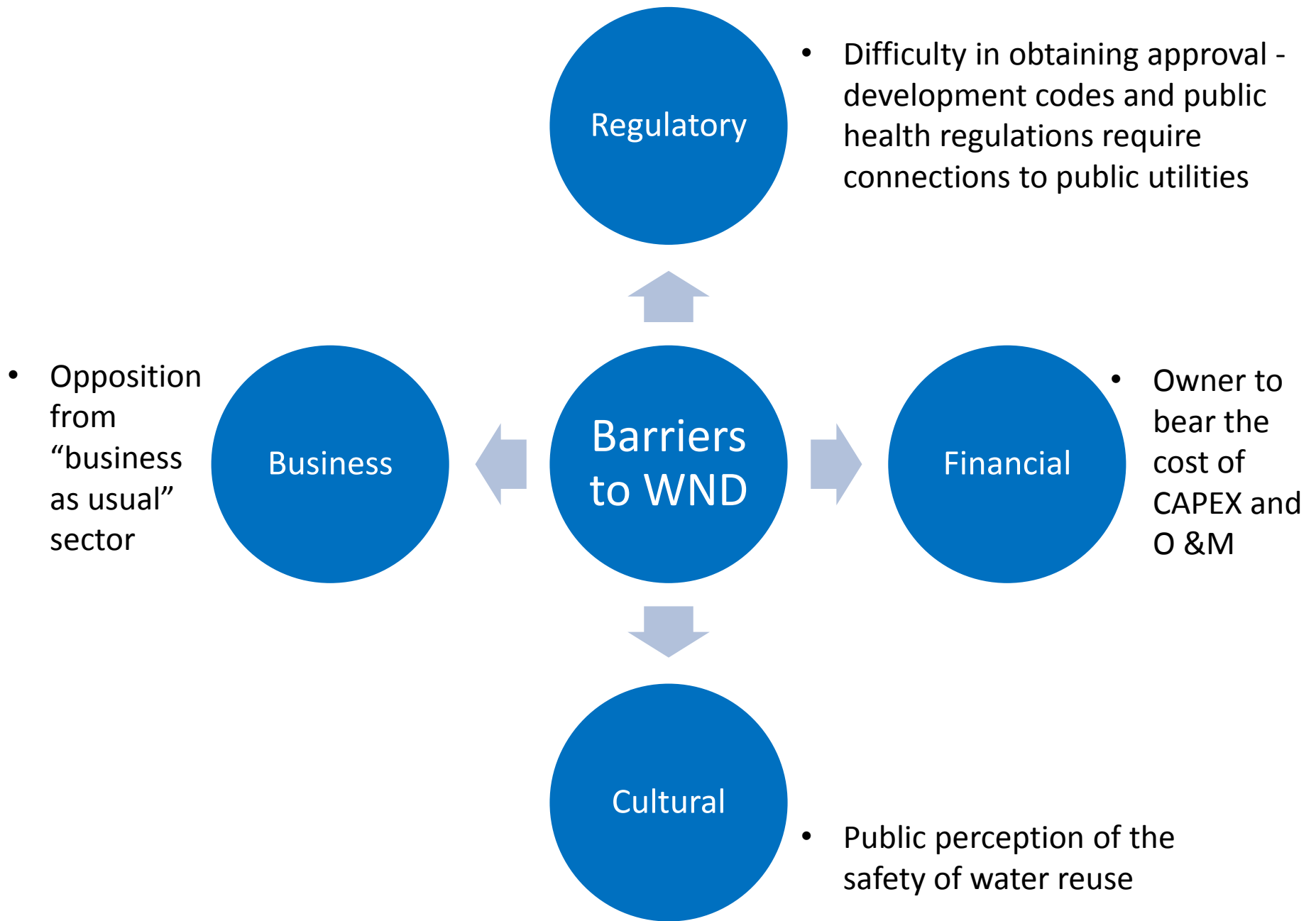
- Potable use
- Non-potable use
- Efficient fittings
- Wise water use habit
- Conservation tariff

To be coupled with other green building initiatives

Treatment of wastewater

- Reclaimed
- Managed aquifer recharge
- Discharge to water bodies

- Mimic natural watershed characteristics
- Live within on-site rainfall volume
- Satisfy all non-potable water demand through water reuse
- “Disconnect” from municipal mains, sewer and stormwater drain



Factors to ensure success of WND

- Political will – shift “business as usual” approach to WND
- Promotion of WND – public acceptance
- Facilities of appropriate scale – O & M contract
- Maintenance of facilities – to be addressed early
- Joint implementation of water and carbon neutral – holistic green infrastructure

Everybody should be water conscious and put access to clean water before profit or politics

Thank-you