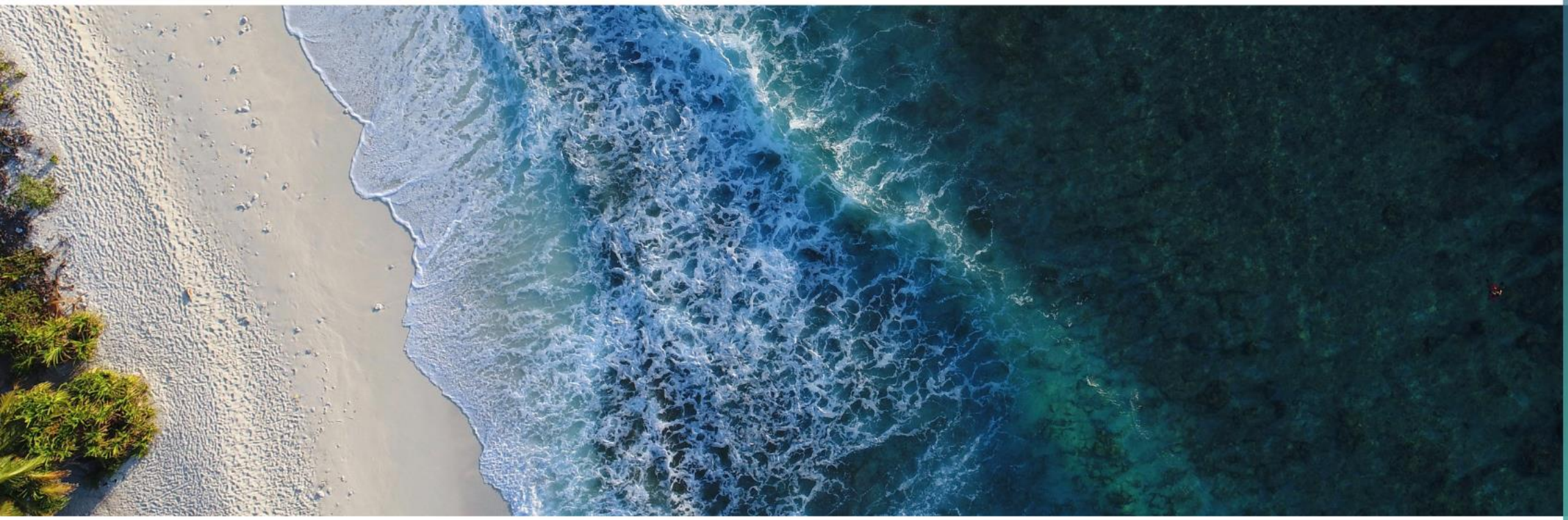
Stormwater Fundamentals Series – Water Sensitive Urban Design

Presented by Brad Dalrymple

22 May 2024



Agenda

- What is Water Sensitive Urban Design ?
- Why is WSUD important ?
- ‘Best practice’ targets
  - (& why they aren’t really ‘best practice’)
- Examples of stormwater treatment assets commonly integrated to help achieve ‘WSUD’

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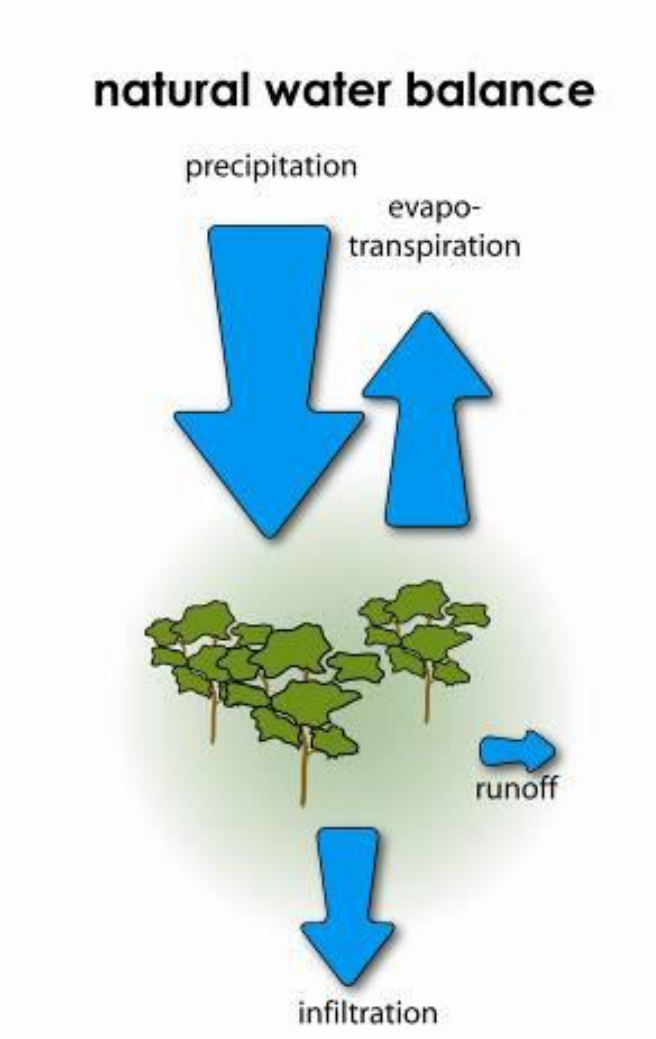
What is Water Sensitive Urban Design ?

What is WSUD ?



Source: Hoban and Wong (2006)

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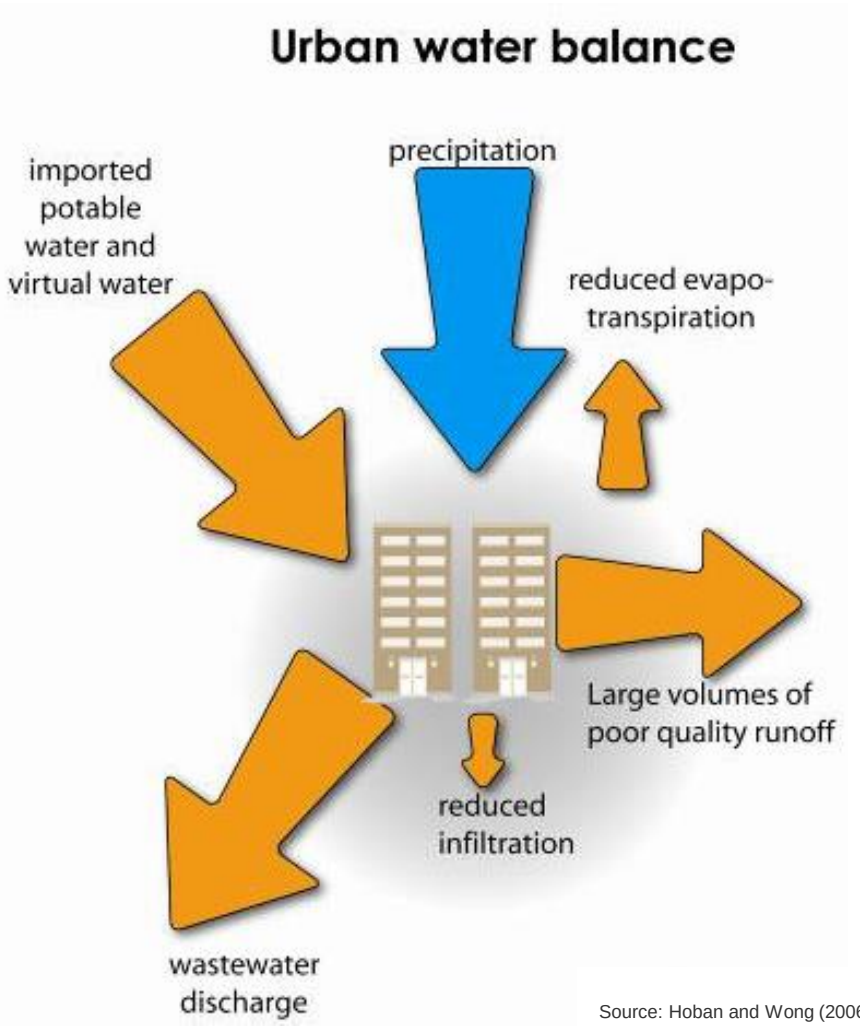
What is WSUD ?



Source: Hoban and Wong (2006)

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What is WSUD ?

How do we make this… function like this?

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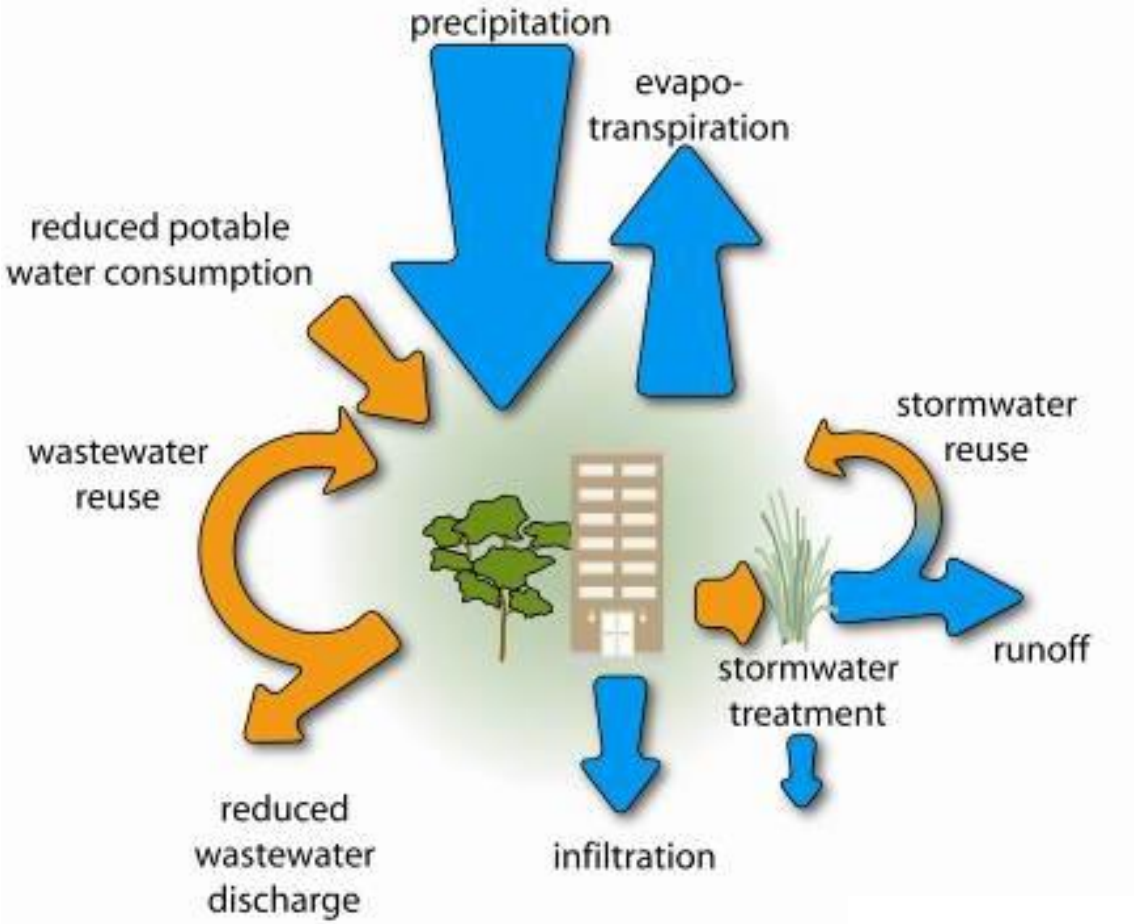
WSUD water balance



Source: Hoban and Wong (2006)

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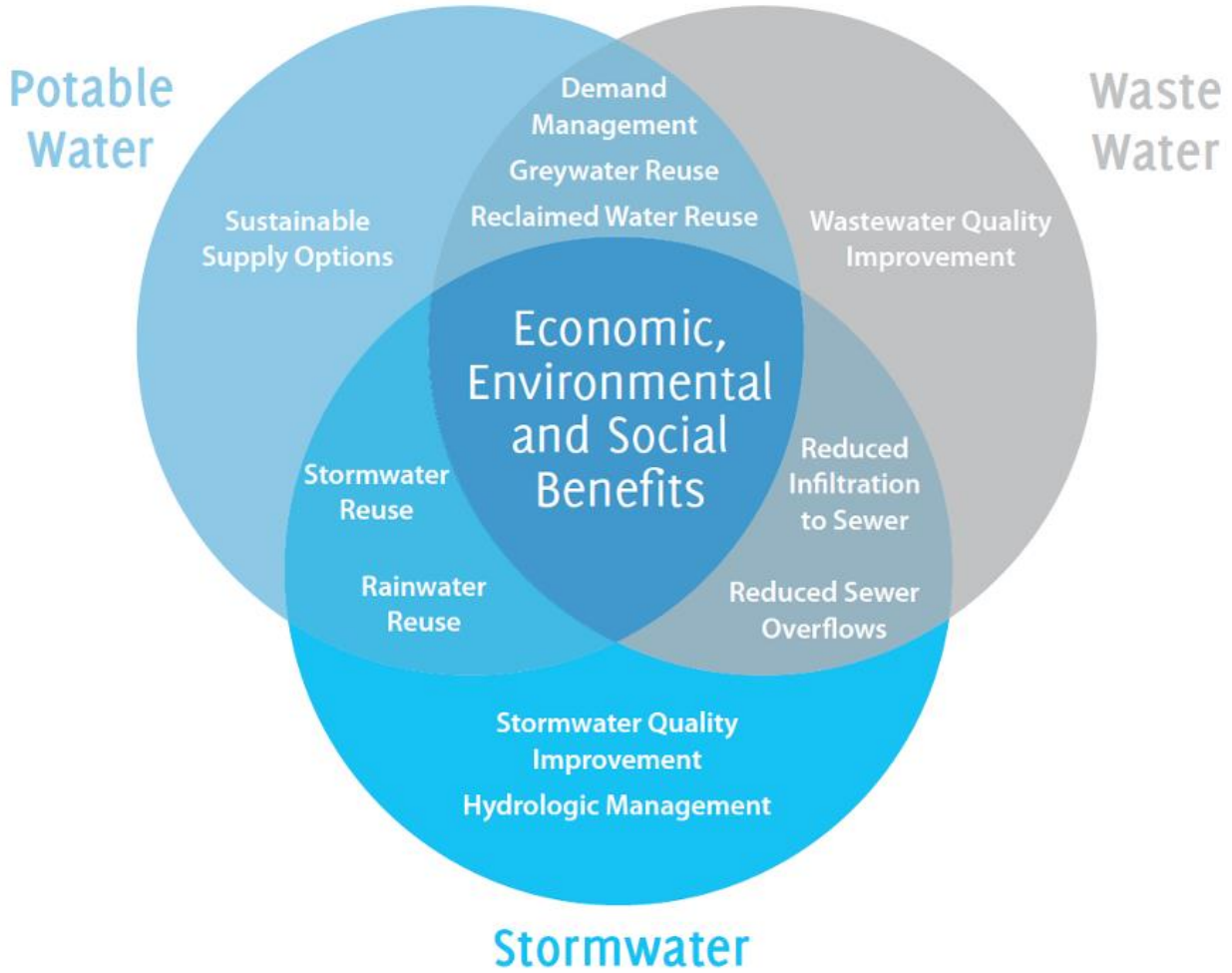

Source: *Concept Design Guidelines* (Water by Design, 2010)

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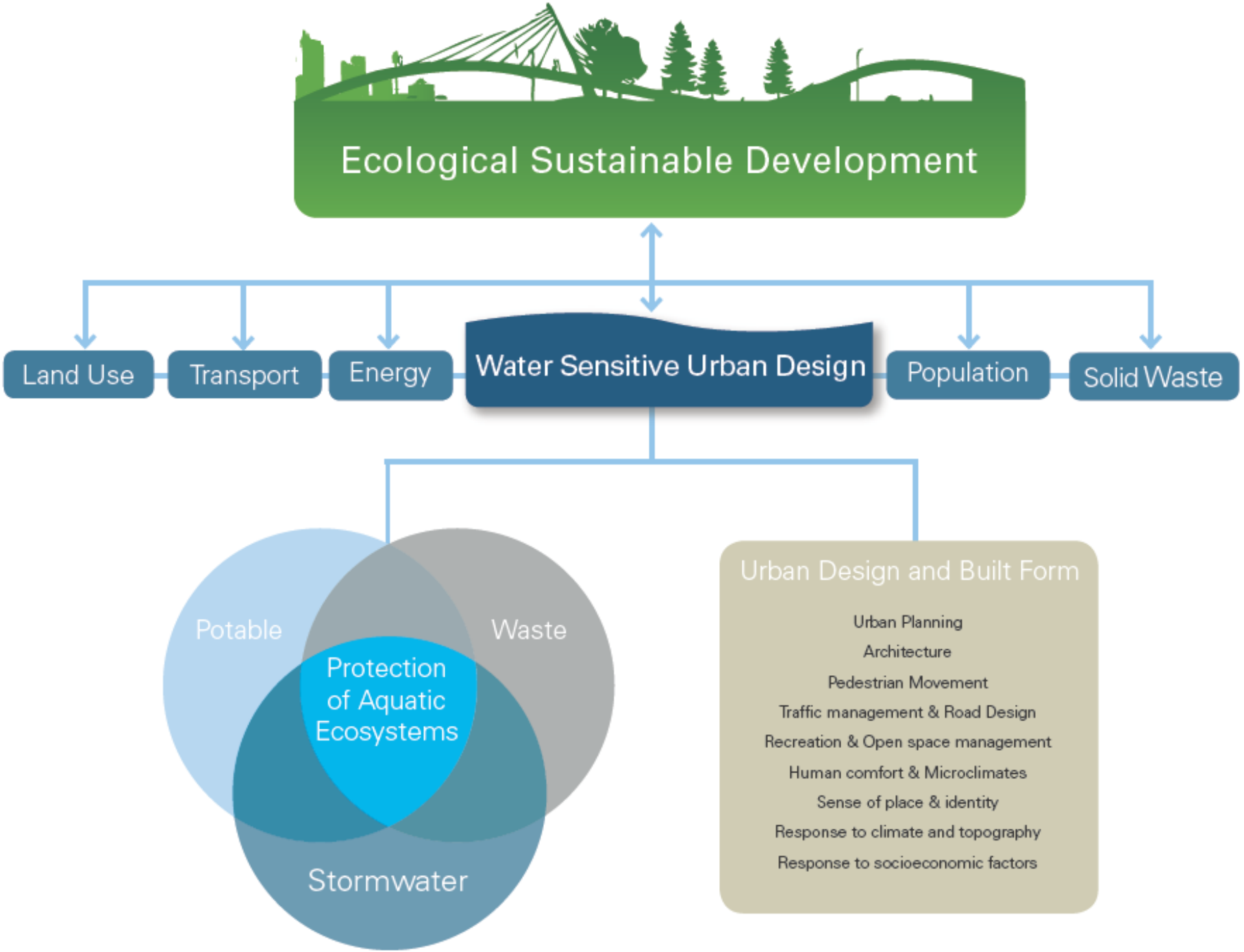

Source: *Concept Design Guidelines* (Water by Design, 2010)

WSUD Defined

- Water sensitive urban design (WSUD) is an approach to urban planning and design that integrates land and water planning and management into urban design

(Engineers Australia 2006)

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Why is WSUD important ?

Challenges – climate change

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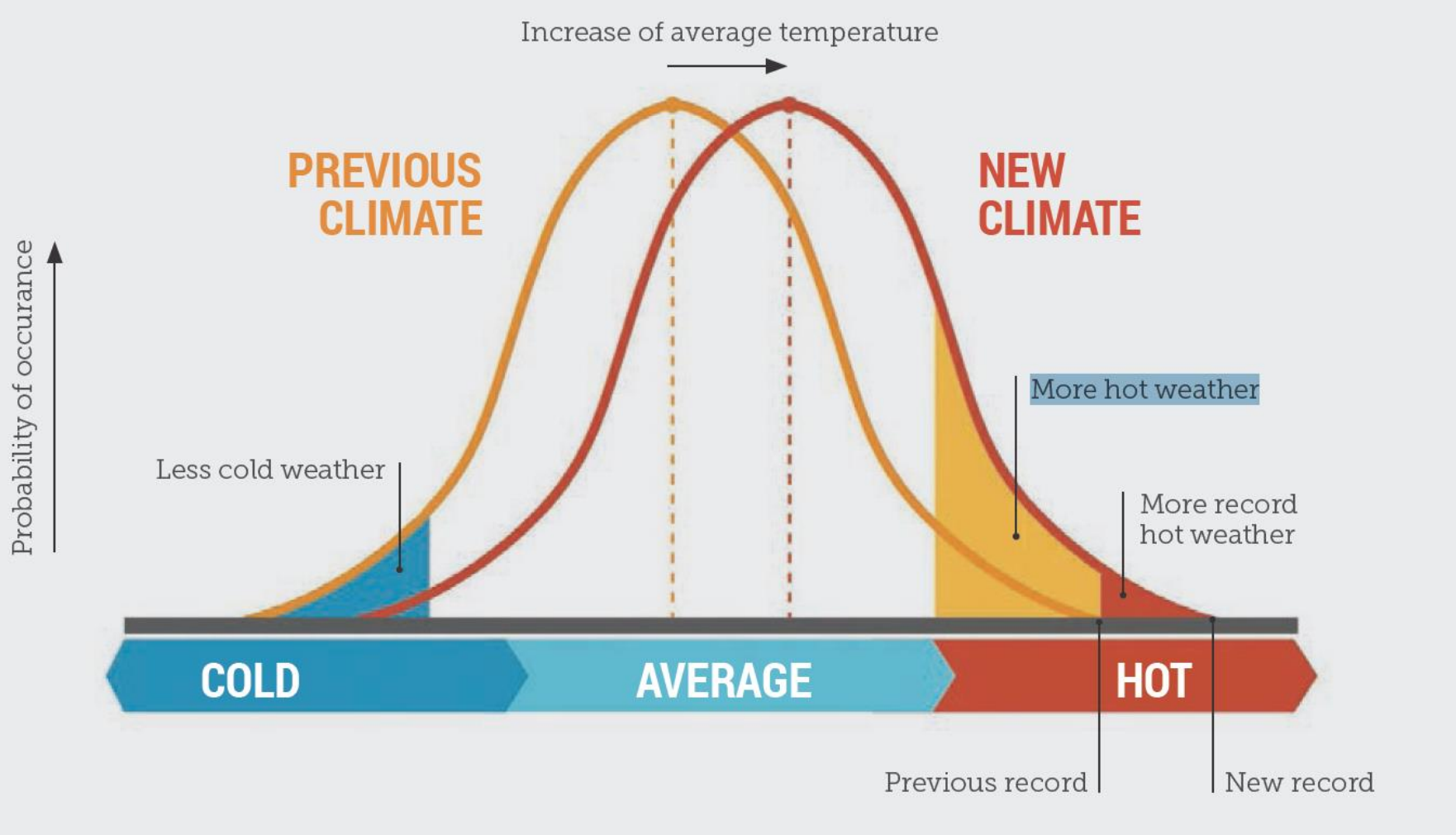
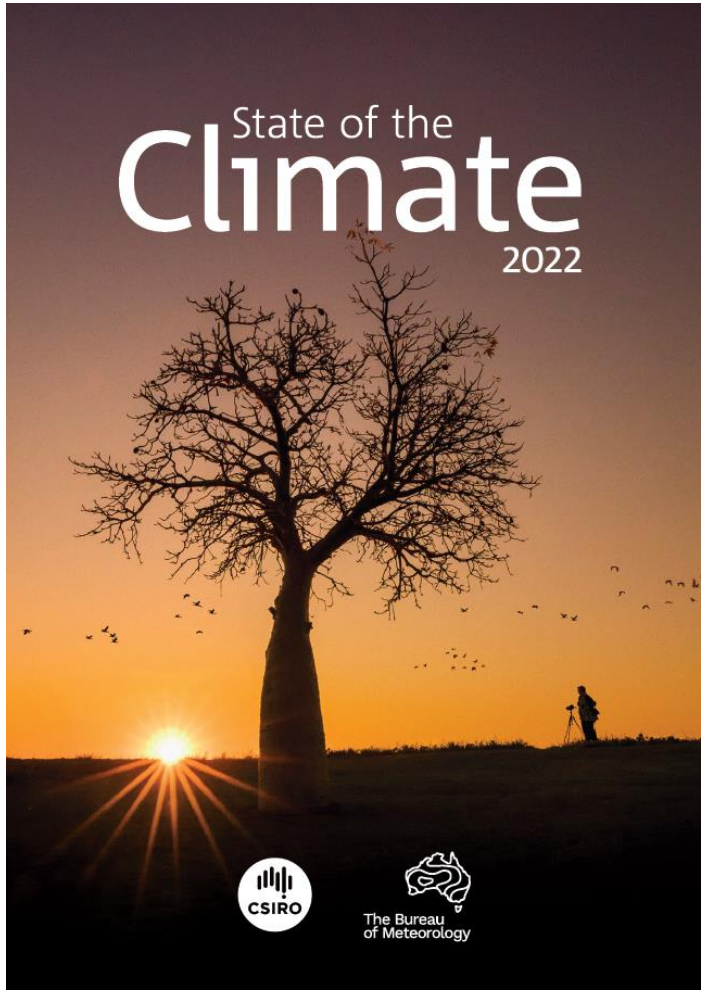
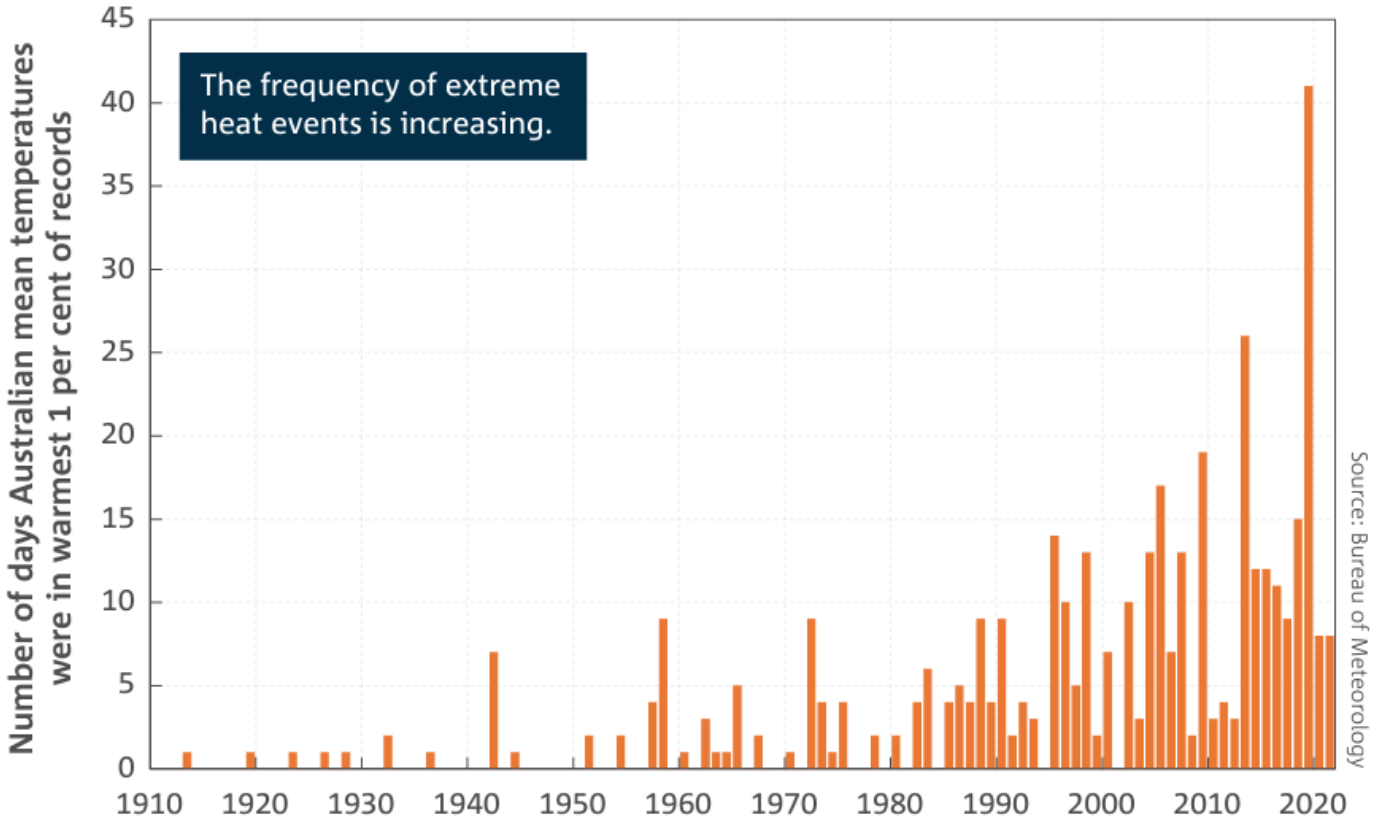
Challenges – climate change



©Relationship between average and extremes, showing the connection between a shifting average and the proportion of extreme events. Source: Climate Commission 2013b, modified from IPCC 2007

Challenges – climate change





Number of days each year where the Australian area-averaged daily mean temperature for each month is extreme (extremely warm days). Extremely warm days are defined as those where daily mean temperatures are the warmest 1 per cent of days for each month, calculated for the period from 1910–2021.

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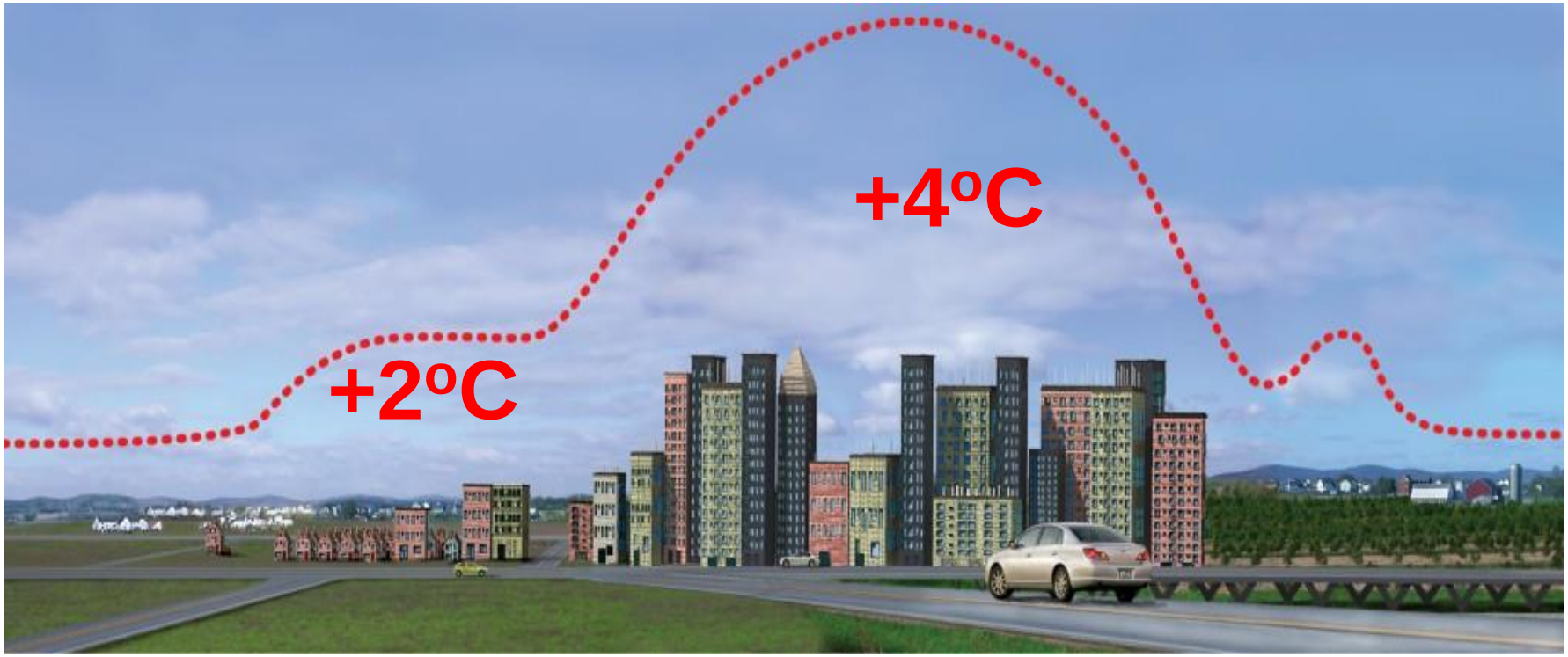
Challenges – climate change + ‘urban heat island’ effect



Source: http://www2.ecospecifier.org

Challenges – climate change + ‘urban heat island’ effect

ABC NEWS Brisbane Change location

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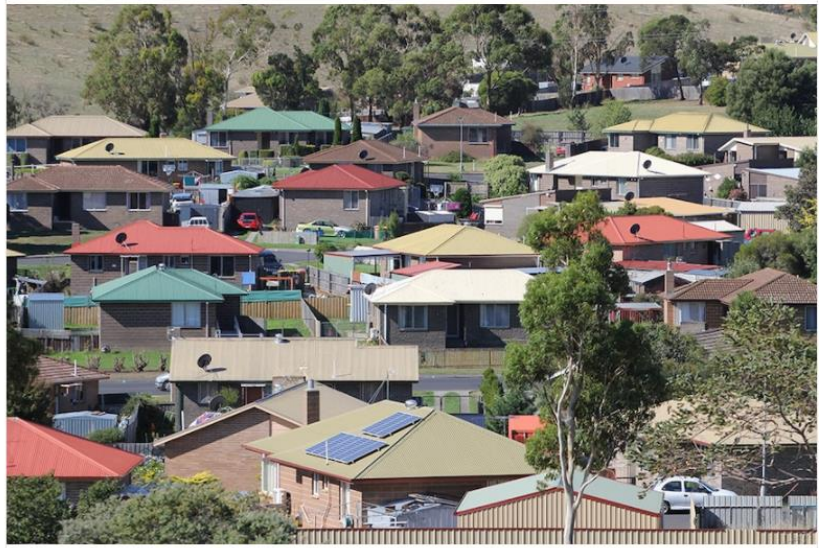
VIC EXPOSURE SITES | Keep up to date with the latest COVID-19 exposure sites in Victoria

Australians face a hotter future if our cities don't do more to cool 'heat islands', report finds

By Stephanie Zillman

Posted Thu 11 Mar 2021 at 5:43am



Planners are being urged to create more green spaces in Australia's major cities. *(ABC News: David Hudspeth)*

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COVID BLOG | Follow our live coverage for the latest news on the coronavirus pandemic

SCIENCE

Heatwaves may mean Sydney is too hot for people to live in 'within decades'

ABC Science / By technology reporter James Purtill

Posted Sun 24 Jan 2021 at 5:12am, updated Mon 25 Jan 2021 at 8:58am

With Australia's largest city facing 50-degree-plus summers, experts say its suburbs need to be radically redesigned and rebuilt in order to remain liveable. *(Getty Images: Jenny Evans)*

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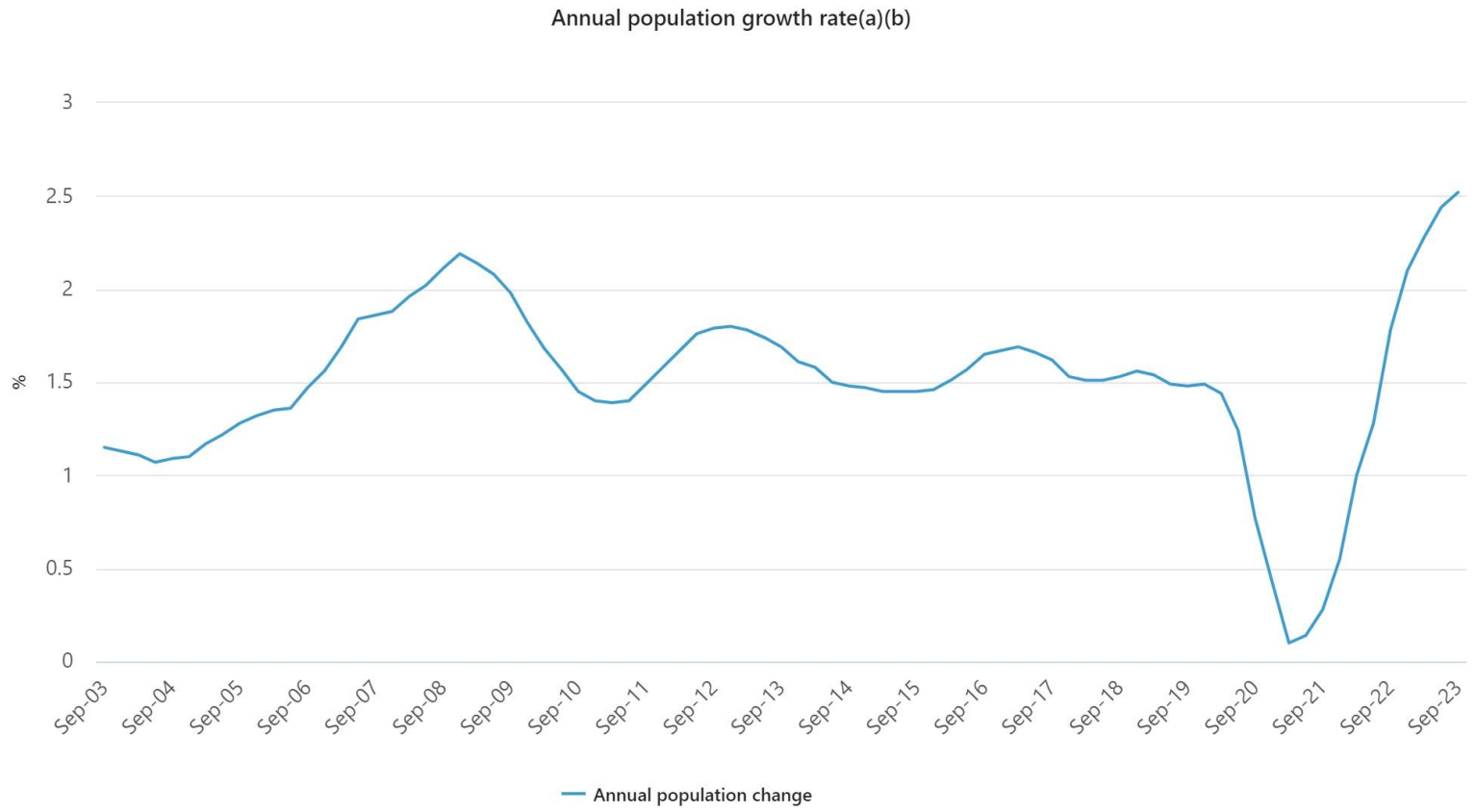
Population growth in Australia



Source: Australian Bureau of Statistics, National, state and territory population September 2023

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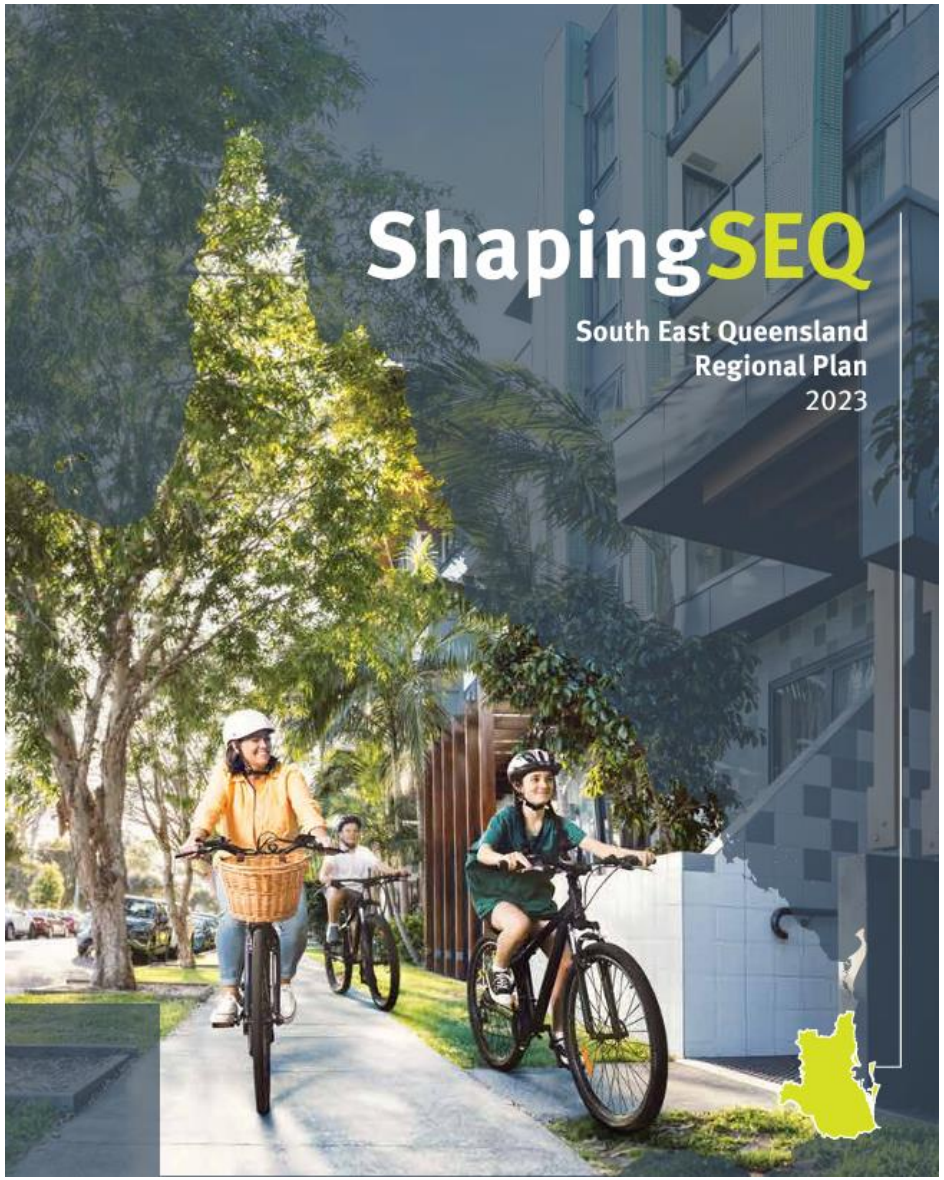
- SEQ Regional Plan 2023:
  - *"By 2046, our population is expected to be about six million. That's an additional 2.2 million people requiring almost 900,000 new homes…"*



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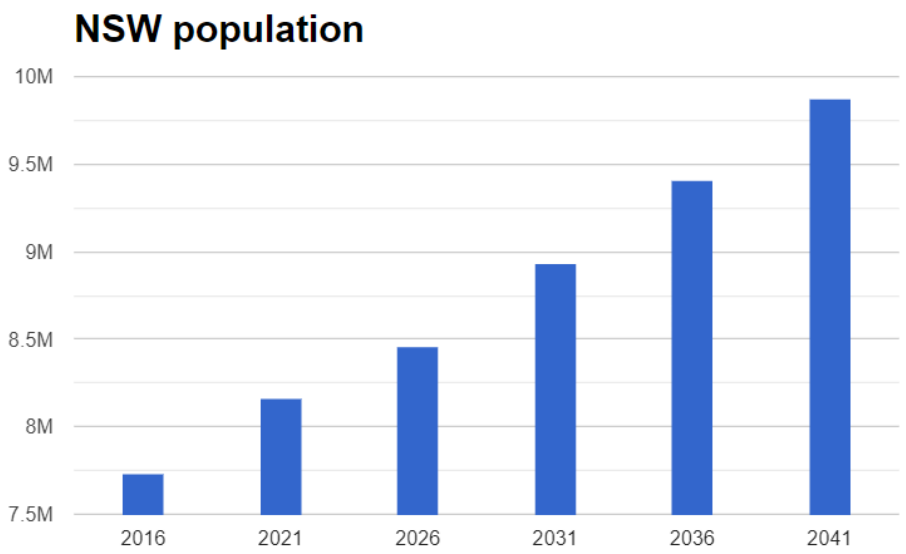
NSW GOVERNMENT Planning



- The 2022 NSW Population Projections show:
  - NSW is expected to grow on average by over 85,000 people each year until 2041.
  - Based on recent trends regional NSW's population will increase by 570,000 to 3.7 million in 2041.
  - Greater Sydney's population will grow to approximately 6.1 million by 2041 – over a million more people than currently live in the region.

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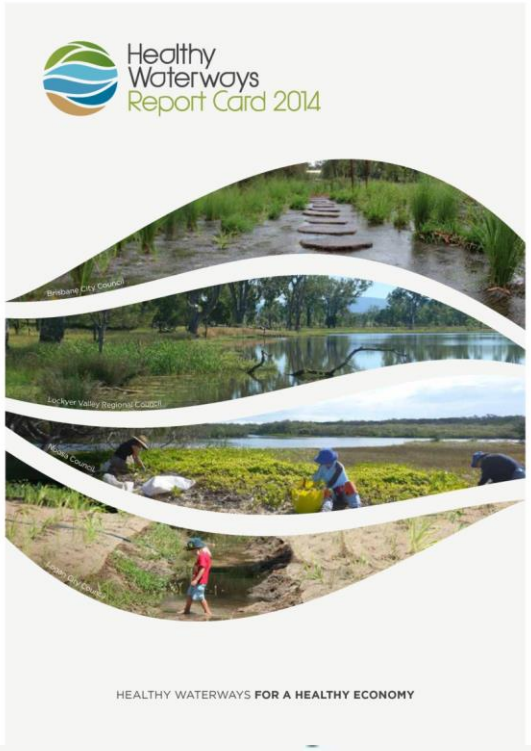
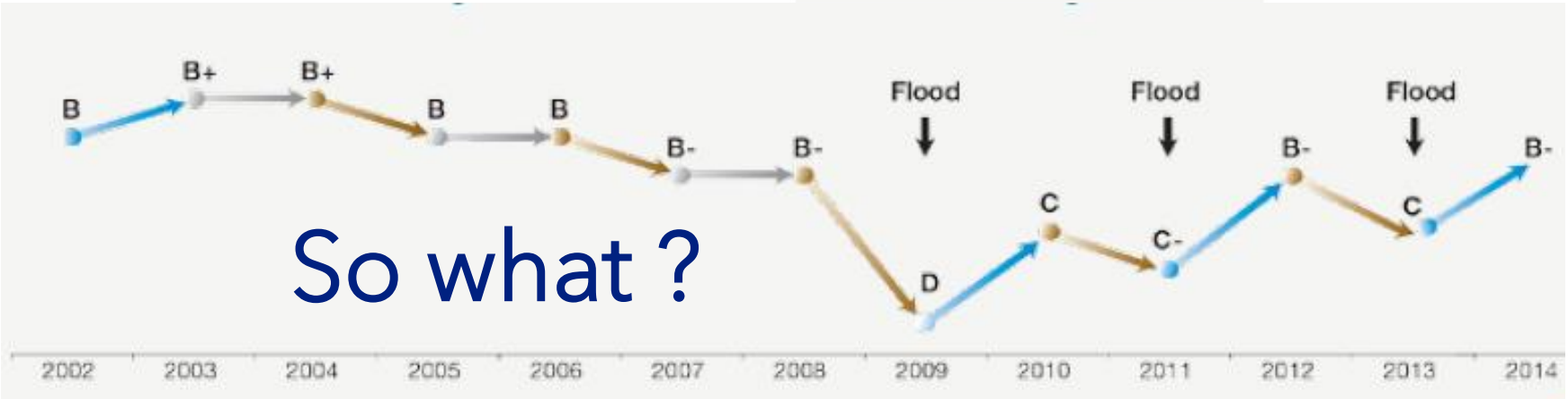
Source: https://www.planning.nsw.gov.au/research-and-demography/population-projections

Challenges – Ecosystem Health





So what ?

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What's at risk ? – Economic Values

	Value per annum	
Sector	Moreton Bay	Sydney Harbour
Tourism/ recreation	$3.5 billion	~$5.2 billion
Primary Industries	$1.39 billion	$0
Recreational Fishing	$210 million 200,000 anglers	$550 million 49,000 anglers
Total	**$5.11 billion**	**$5.75 billion**

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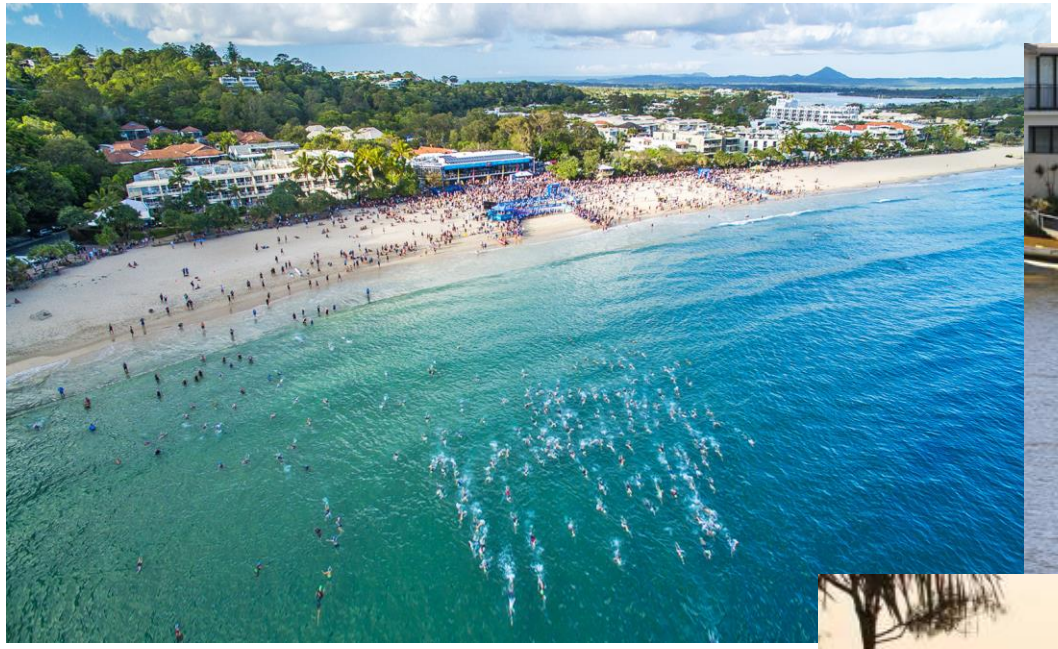
What's at risk ? – Social & Cultural Values



What's at risk ? – Ecological Values

Litter

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Nutrients

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Suspended Solids

A Change in mud in Moreton Bay over time. 2016 Healthy Waterways and University of Queensland study)

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With increasing population growth in Australia, what impacts are you most concerned about?

- Housing density
- Increased competition for jobs from foreign & interstate workers
- Increased traffic
- Insufficient waste management
- Lack of character in new housing
- Less green space
- Marine and waterway health
- Reduced air quality
- Reduced car parking availability
- Reduced house prices affecting the value of your property
- Reduced safety in local community
- Reduced water supply

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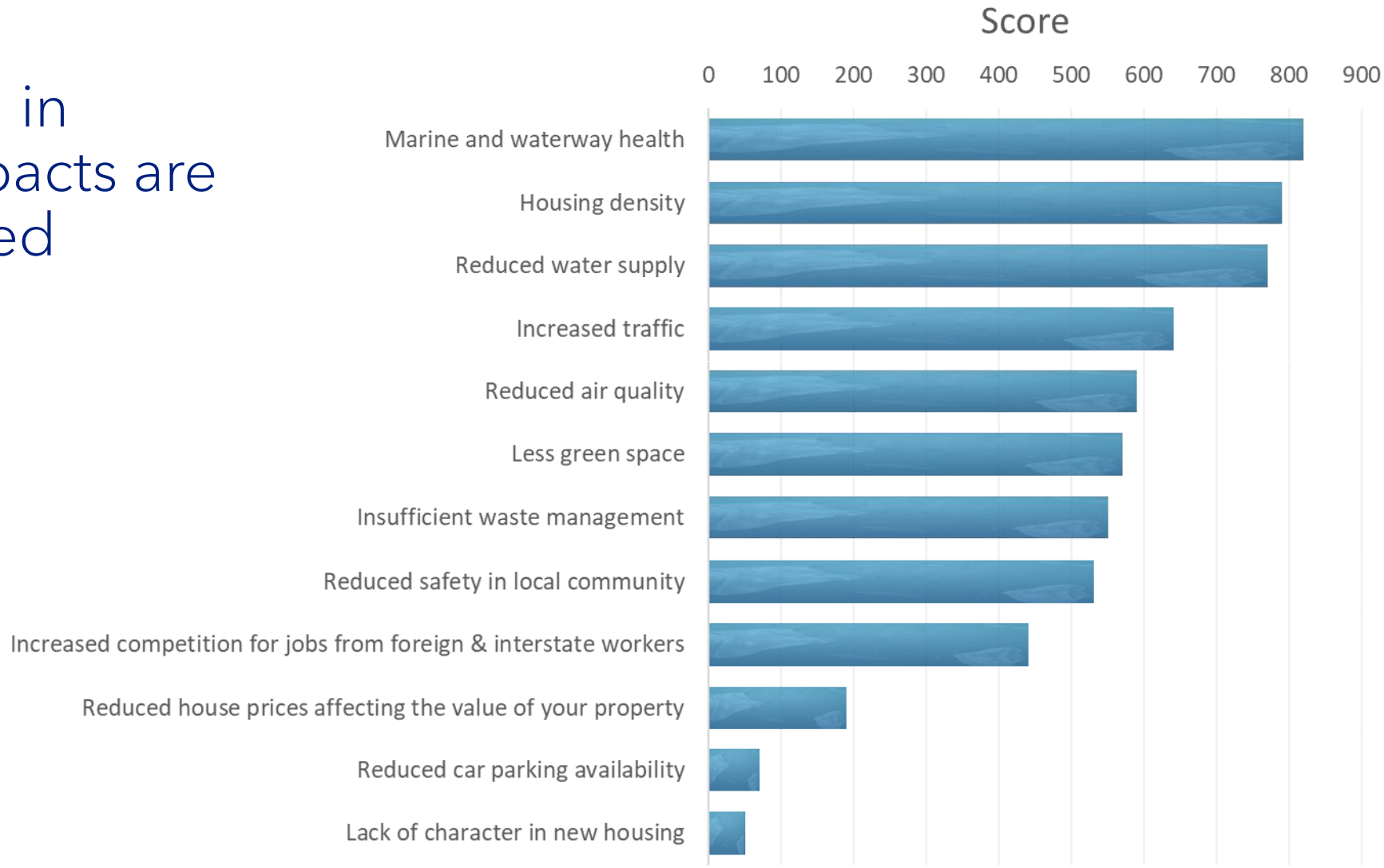
Survey results

- With increasing population growth in Australia, what impacts are you most concerned about?



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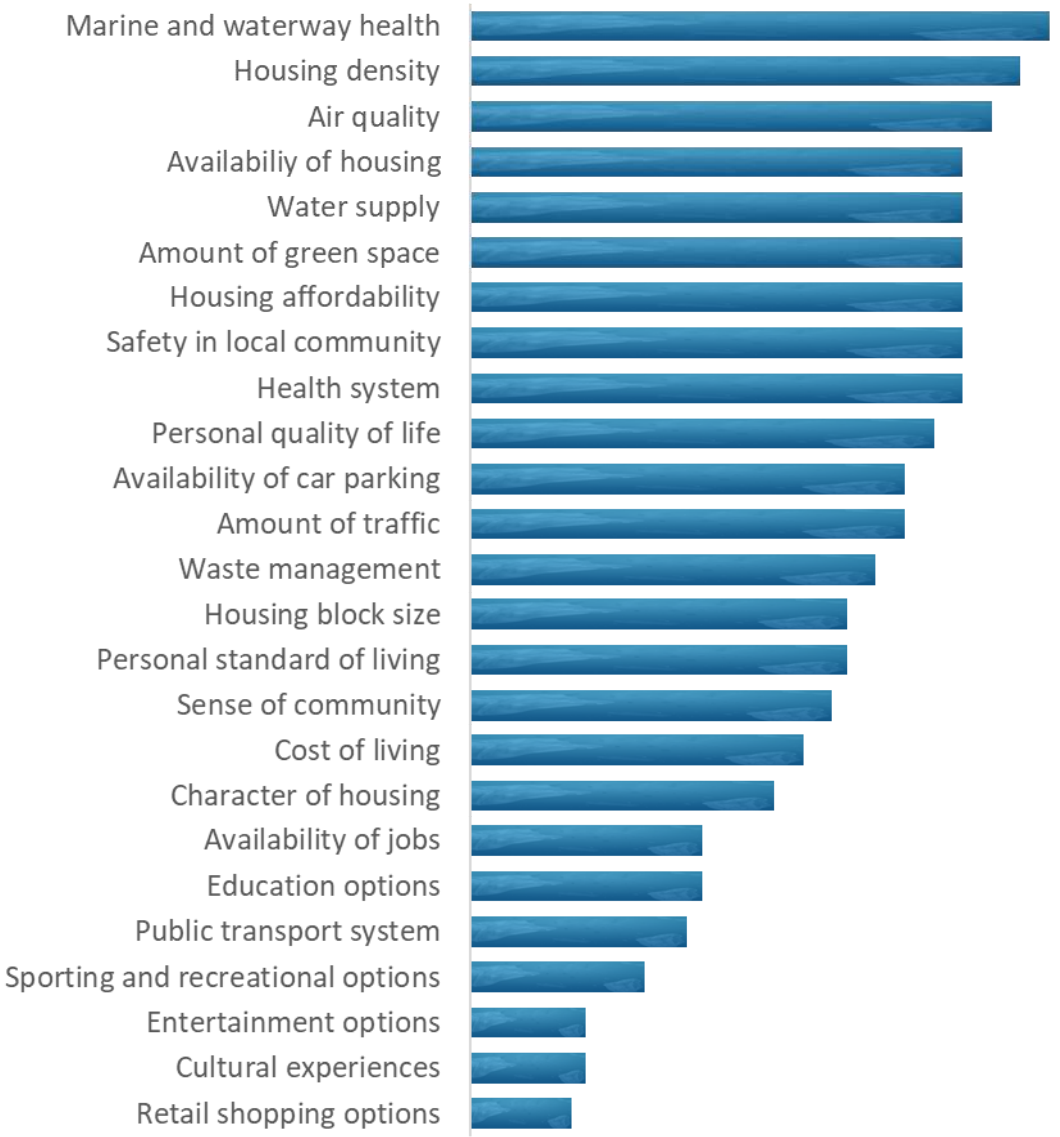
Queensland Growth Management Summit 2010

Social Research on Population Growth and Liveability in South East Queensland

March 2010

- Prepared for: Department of the Premier and Cabinet
- Client contact: Julie Northage
- TNS consultants: Debra Haszard, Robyn Rutley
- 81195 : March 2010

tns social research



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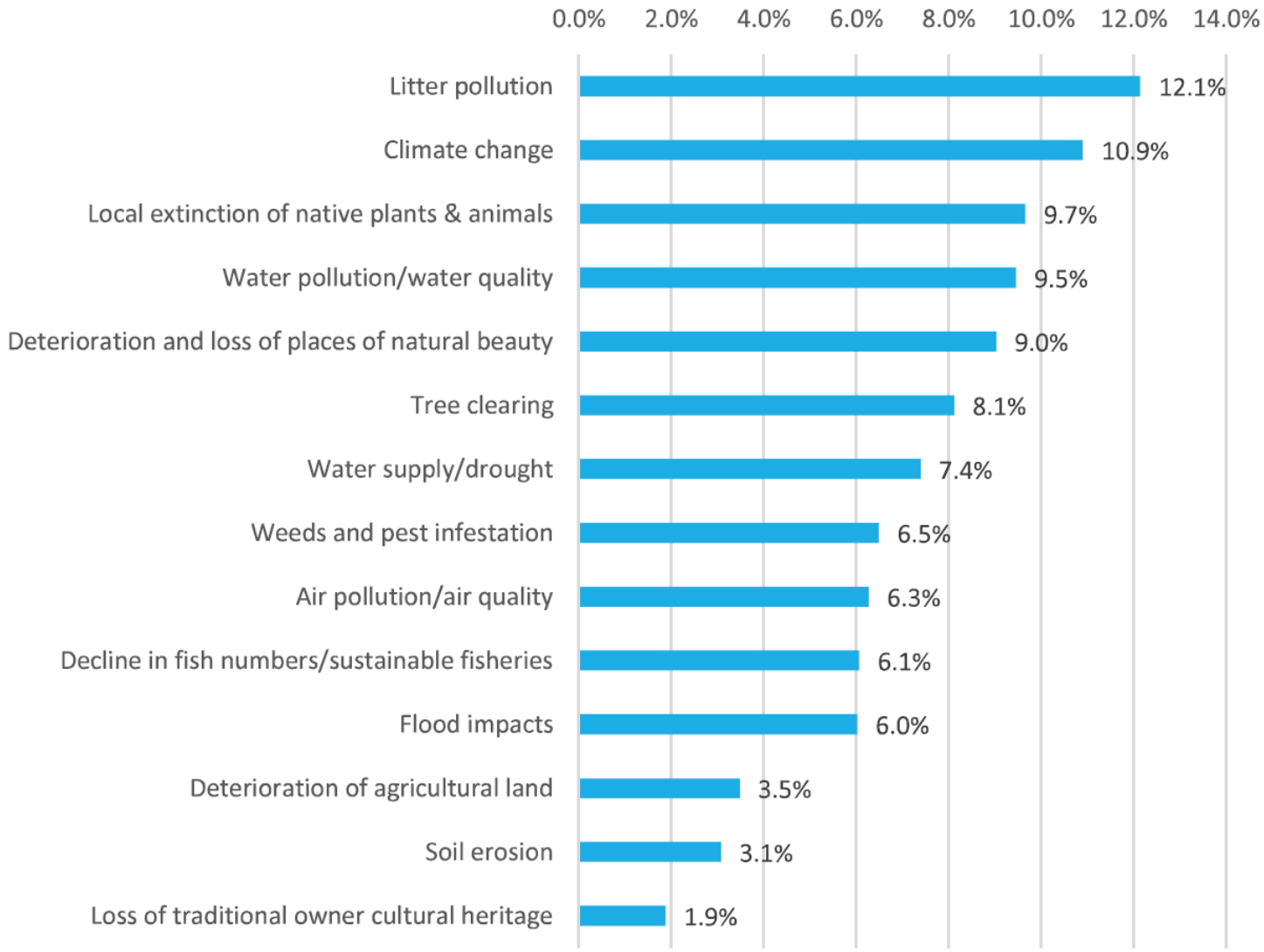
- Summary of results of community research (by Healthy Land and Water & QUT, 2018) asking respondents to rank their top three environmental concerns



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The values of waterways

3.2 Socio-economic benefits of waterways

Waterways underpin the lifestyle, culture and wellbeing of residents of South East Queensland

Fundamental to the South East Queensland lifestyle are the recreational, health, cultural, and economic benefits provided by the region's extensive, diverse, and scenic waterways (creeks, rivers, lakes, beaches). A heathy catchment also protects our drinking water supply, maintains biodiversity, and supports productive fisheries and agricultural productivity. Among the highly valued waterways is Moreton Bay, a place of remarkable natural beauty and social and cultural value. The Bay and associated estuaries provide substantial economic benefit to the residents of the region, and support some of Queensland's most productive fisheries, which includes indigenous, commercial, and recreational sectors.

It's not surprising that the majority of South East Queensland residents have a deep connection with nature and waterways, reporting that it is an important part of their lives.

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World Cloud of Survey Respondents' Answers to

"What are you concerned about in the [redacted] River catchment?"

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World Cloud of Survey Respondents' Answers to

"What major changes or issues have you seen with [redacted] River?"

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Water Strategy

2012-2031

www.moretonbay.qld.gov.au | Phone 3205 0555

Moreton Bay Regional Council

Our vision

A Water Sensitive Region

'We seek to protect and improve the health and resilience of our natural and built environments by managing water in an integrated and cost-effective manner.'

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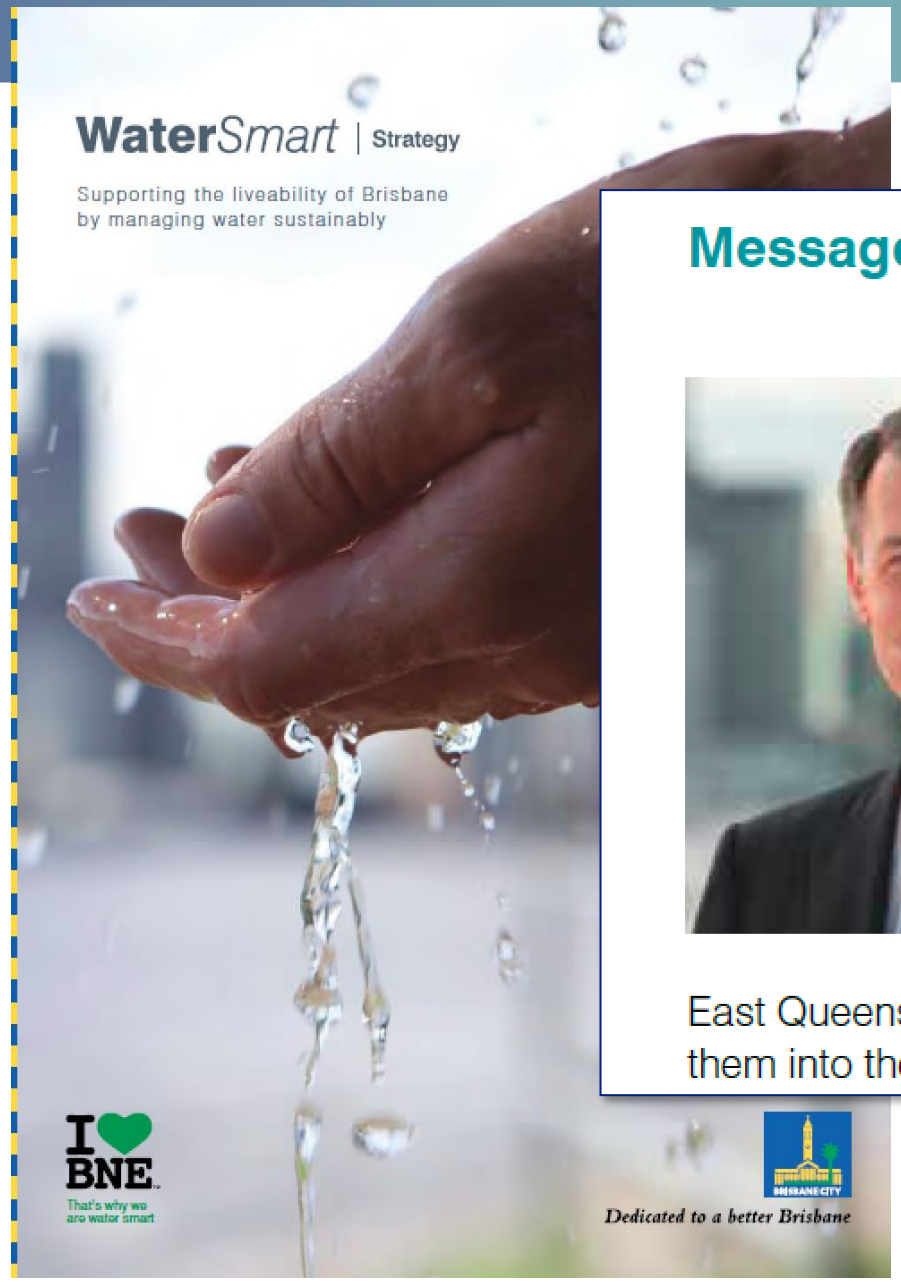

Message from the Lord Mayor

Water is our most precious resource. Our bay, river and environmental waterways are not only important to our unique lifestyle, they are integral to the economic wellbeing of Brisbane and South East Queensland.

It is critical we protect and manage these resources in partnership across South East Queensland to ensure we continue to use and enjoy them into the future.

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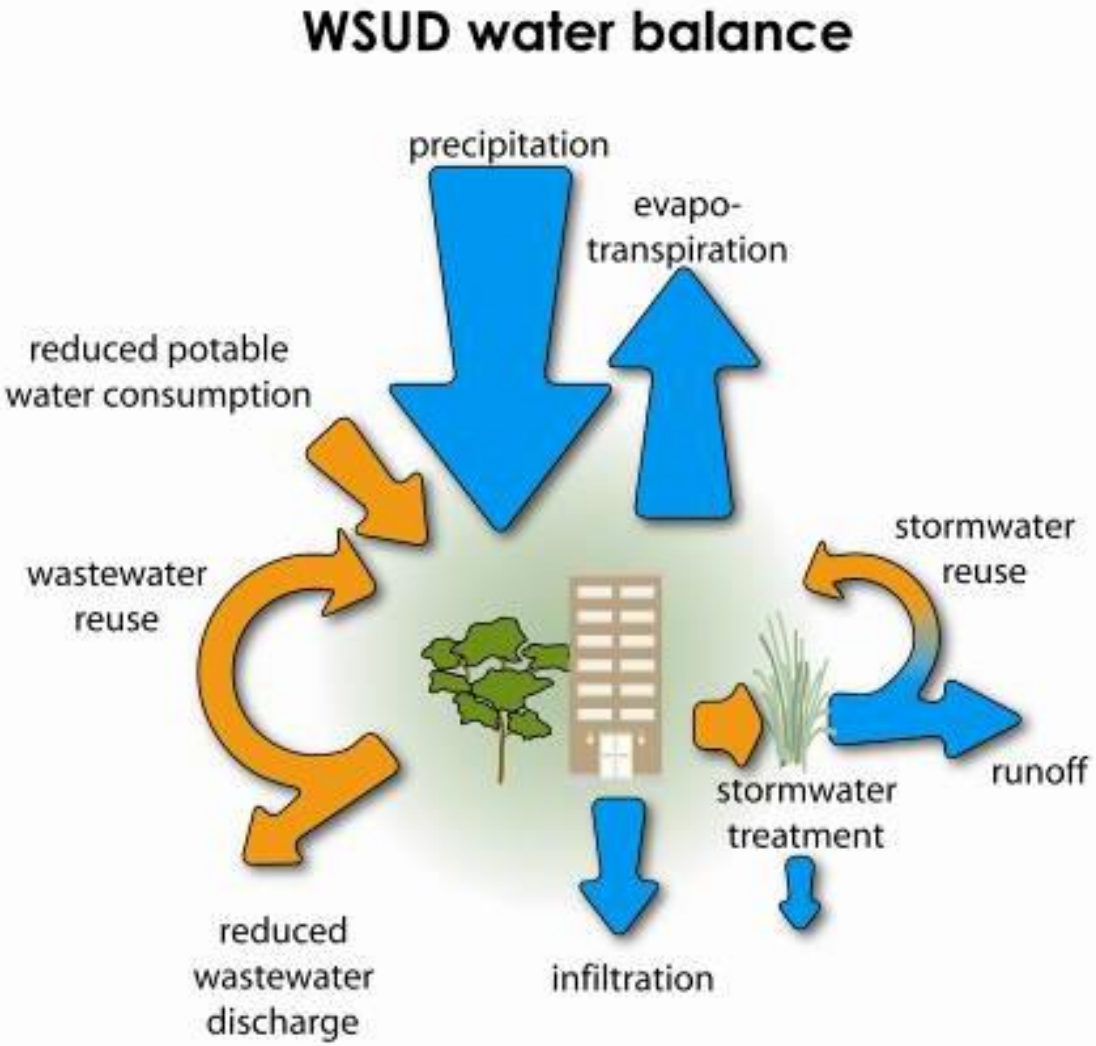
- *Water Sensitive Urban Design (WSUD) is the preferred approach for mitigating the impacts of urbanisation on the natural water cycle and to reconnect communities to the landscape and the management of local water*

Healthy Waterways (2010)



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‘Best practice’ targets

(& why they aren’t really ‘best practice’)

Regulatory drivers

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July 2017

State Planning Policy

Queensland Government

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Table A: Construction phase – stormwater management design objectives

Application:

- Applies to all climatic regions.

Part 1 Construction phase – stormwater management design objectives[12]

Issue	Desired outcomes
Drainage control	1. Manage stormwater flows around or through areas of exposed soil to avoid contamination. 2. Manage sheet flows in order to avoid or minimise the generation of rill or gully erosion. 3. Provide stable concentrated flow paths to achieve the construction phase stormwater management design objectives for temporary drainage works (part 2). 4. Provide emergency spillways for sediment basins to achieve the construction phase stormwater management design objectives for emergency spillways on temporary sediment basins (part 3).
Erosion control	1. Stage clearing and construction works to minimise the area of exposed soil at any one time. 2. Effectively cover or stabilise exposed soils prior to predicted rainfall. 3. Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces must be effectively stabilised[13] using methods which will achieve effective short-term stabilisation.
Sediment control	1. Direct runoff from exposed site soils to sediment controls that are appropriate to the extent of disturbance and level of erosion risk. 2. All exposed areas greater than 2500 metres^2 must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5–8.5).
Litter, hydrocarbons and other contaminants	1. Remove gross pollutants and litter. 2. Avoid the release of oil or visible sheen to released waters. 3. Dispose of waste containing contaminants at authorised facilities.
Waterway stability and flood flow management	1. Where measures are required to meet post-construction waterway stability objectives (specified in table B), these are either installed prior to land disturbance and are integrated with erosion and sediment controls, or equivalent alternative measures are implemented during construction. 2. Earthworks and the implementation of erosion and sediment controls are undertaken in ways which ensure flooding characteristics (including stormwater quantity characteristics) external to the development site are not worsened during construction for all events up to and including the 1 in 100 year ARI (1% AEP).

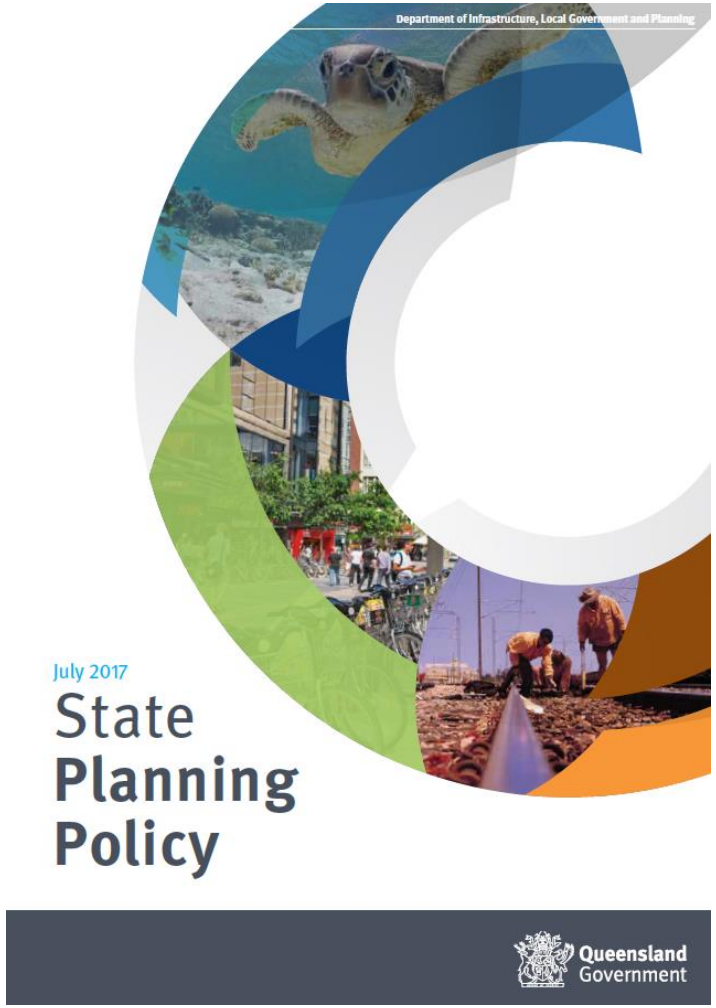

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Table B: Post construction phase – stormwater management design objectives

Application:

(1) A material change of use for an urban purpose that involves premises 2500 metres² or greater in size and:

(a) will result in six or more dwellings; or

(b) an impervious area greater than 25 per cent of the net developable area.

(2) Reconfiguring a lot for urban purposes that involves premises 2500 metres² or greater in size and will result in six or more lots.

Climatic region	Design objectives Reductions in mean annual load from unmitigated development (%)				
	Total suspended solids (TSS)	Total phosphorus (TP)	Total nitrogen (TN)	Gross pollutants >5mm	Waterway stability management
South East Queensland	80	60	45	90	Limit the peak 1-year ARI event discharge within the receiving waterway to the pre-development peak 1-year ARI discharge
Central Queensland (south)	85	60	45	90	
Central Queensland (north)	75	60	40[15]	90	
Cape York[14], wet tropics and dry tropics	80	60[16]	40	90	
Western Queensland[14]	85	60	45	90	

HEALTHY WATERWAYS
Because we're all in the same boat

Water Sensitive Urban Design

Technical Design Guidelines for South East Queensland

Version 1 June 2006

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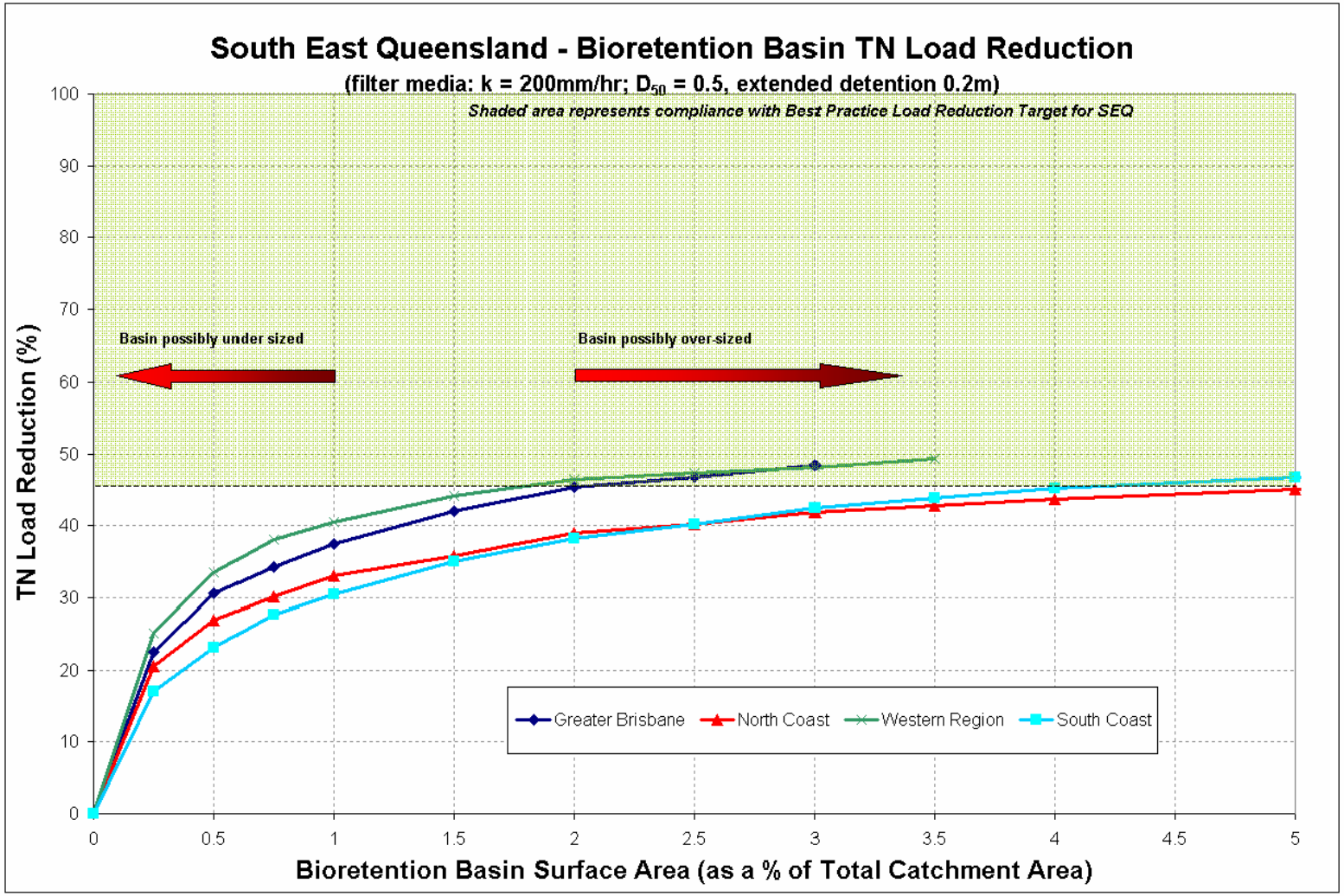

Figure 5-5: Bioretention Basin TN Removal Performance

Healthy Waterways
ONE CLEAR VISION

- (SPP) targets are based on how well bioretention systems can improve the quality of urban stormwater runoff, without the treatment systems becoming excessively large
- The targets do not necessarily achieve a no-worsening of pollutant loads compared to current or natural catchment conditions

Healthy Waterways (2014)

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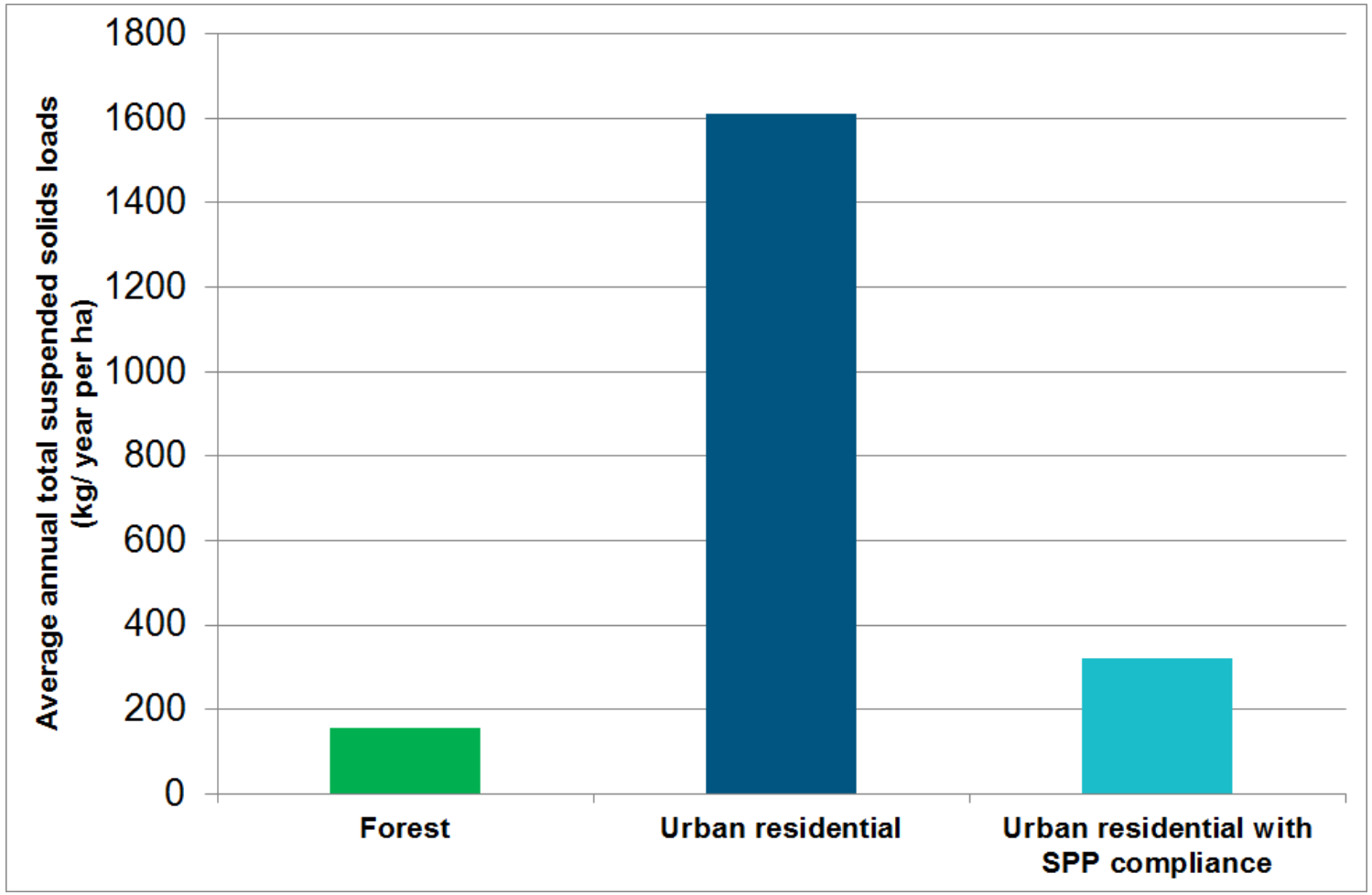

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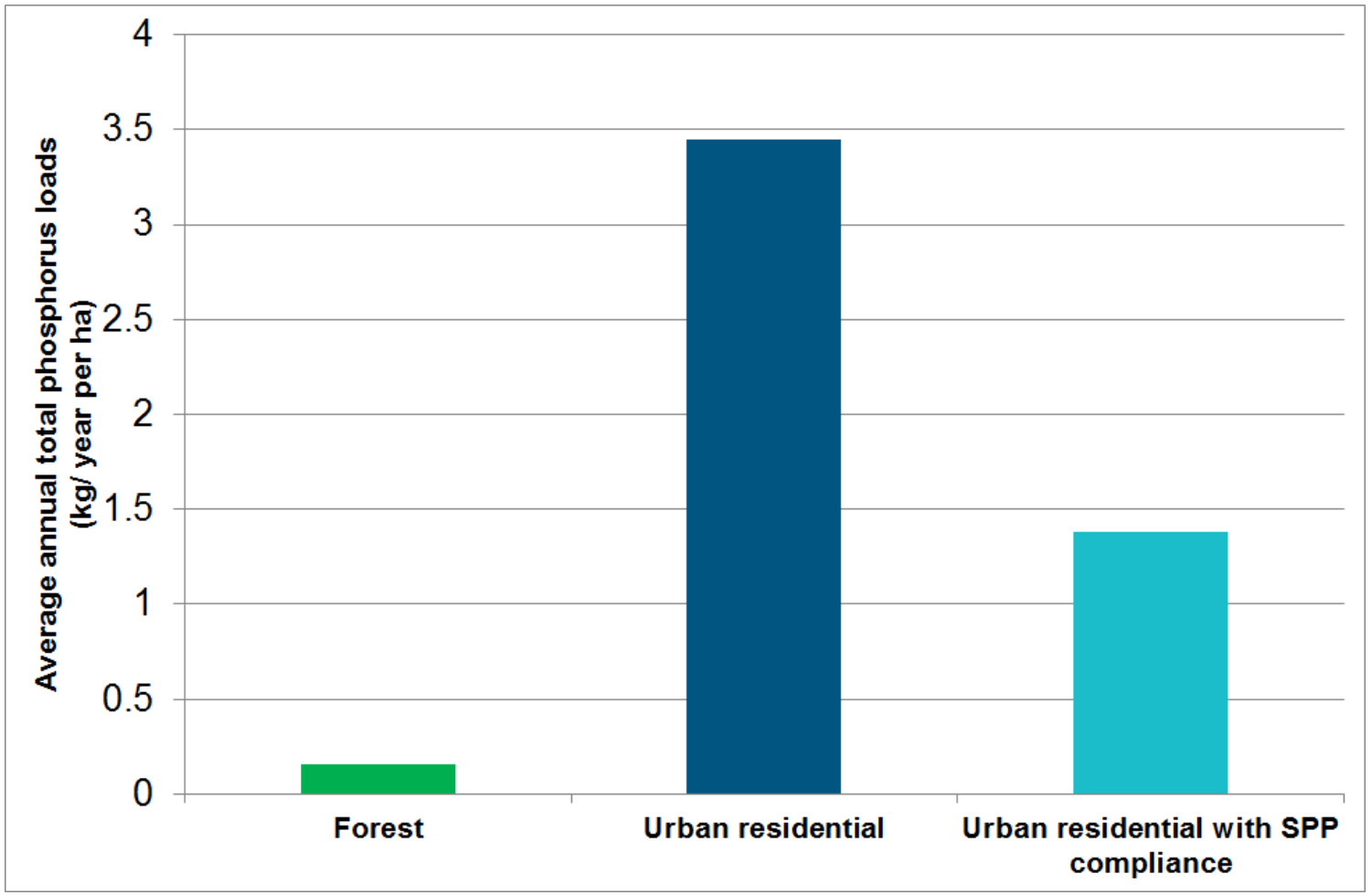

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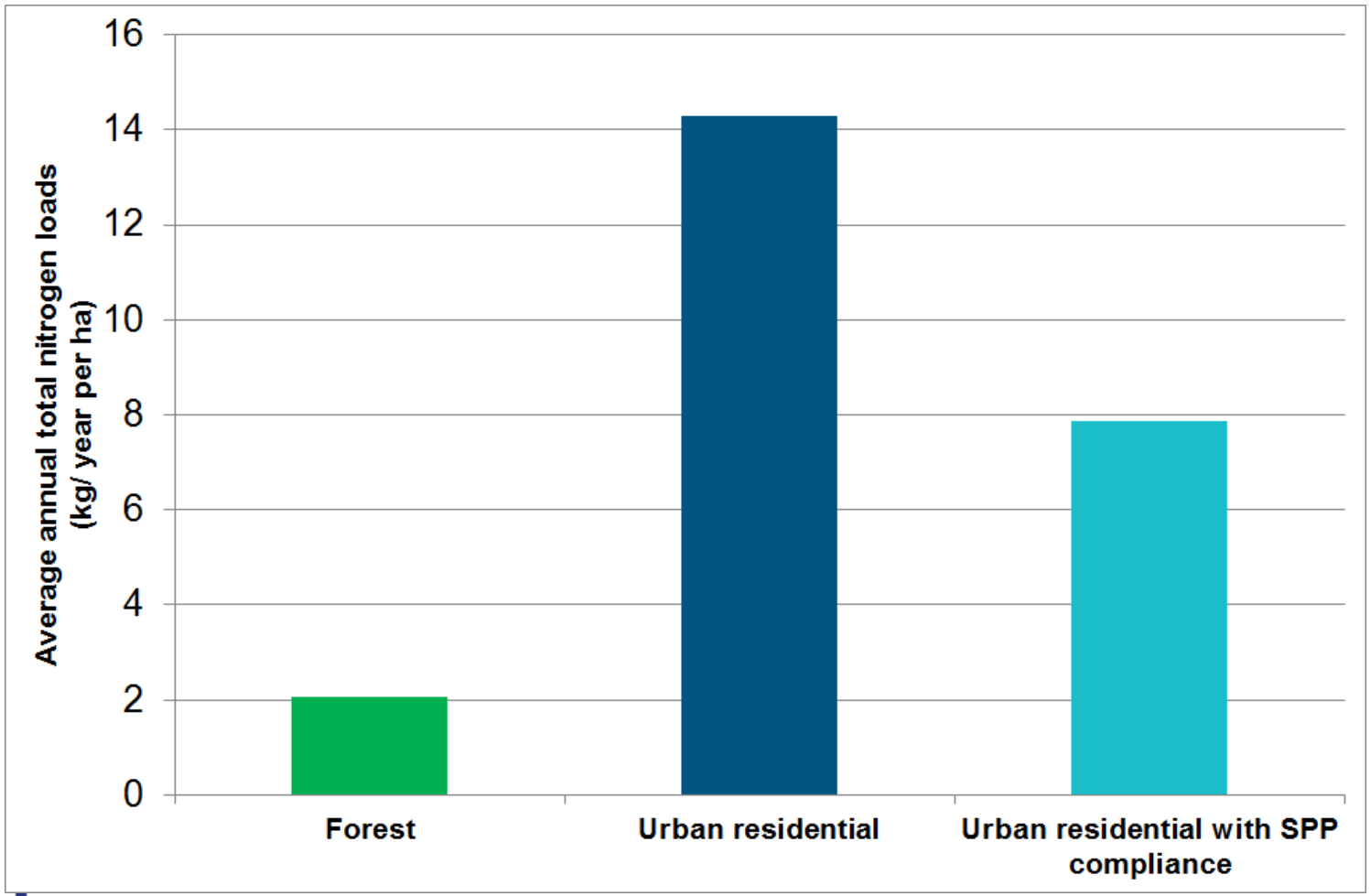

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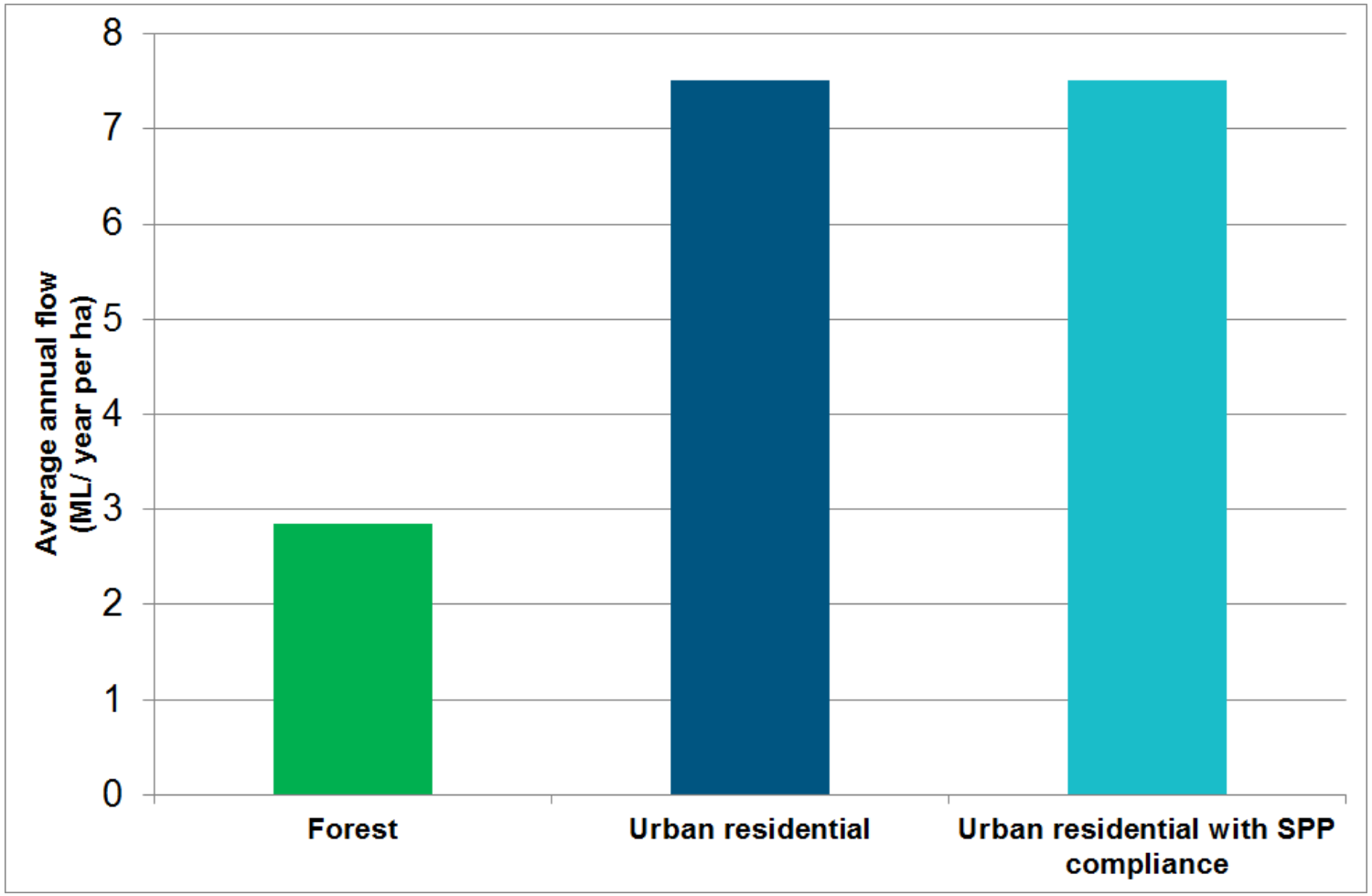

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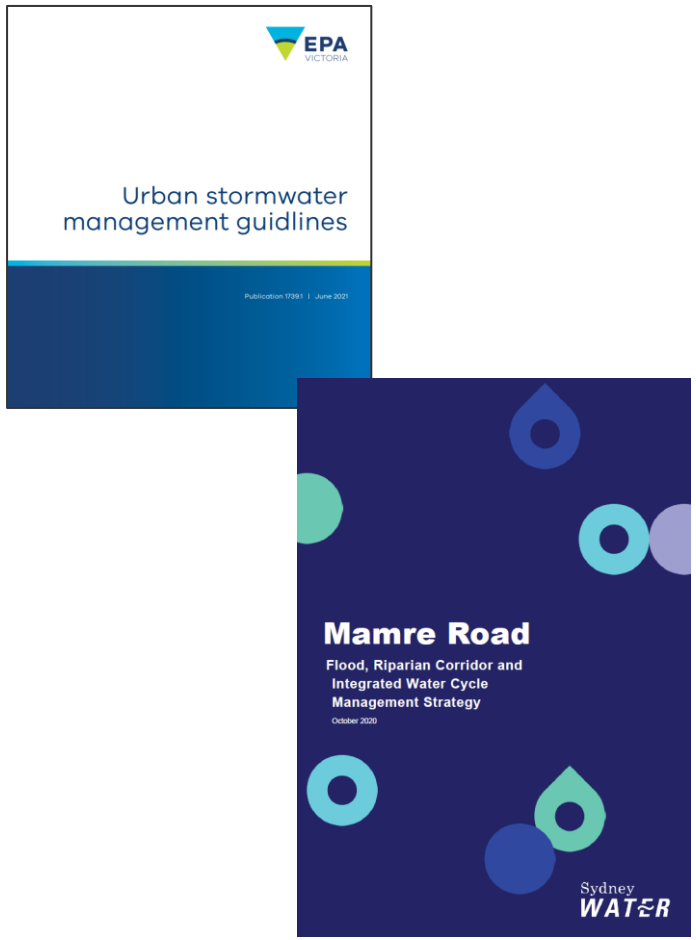
Flow reduction targets ?



- Average annual flow limit or reduction rate ?

Key Questions:

- What is scientific basis for targets ?
- Are modelling methods appropriate ?
- Are assumed water 'losses' realistic, sustainable ?
- Are targets practical ?
- Will targets exacerbate urban 'sprawl'?

- Refer to https://oceanprotect.com.au/advocacy/
  - Draft urban stormwater management guidance
  - Feedback on draft Mamre Road DCP

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‘Best Practice’ targets ?

- Targets are:
  - very ‘generic’
  - typically based solely on what MUSIC predicts bioretention can achieve, using:
    - Historical climate data
    - Potentially out-dated/ incorrect pollutant export properties
    - MUSIC algorithms (for bioretention) based solely on lab-scale studies
  - Key reason for ‘overly simplified’/ generalized outcomes
    - i.e. stand-alone ‘bioretention’ with high rates of operational problems
- Minimal (typically zero) appreciation for downstream waterway values
- Flow & load reduction targets provide zero incentive to reduce flow & pollution generation
- Just one (essential) part of Total Water Cycle Management for a catchment/ region

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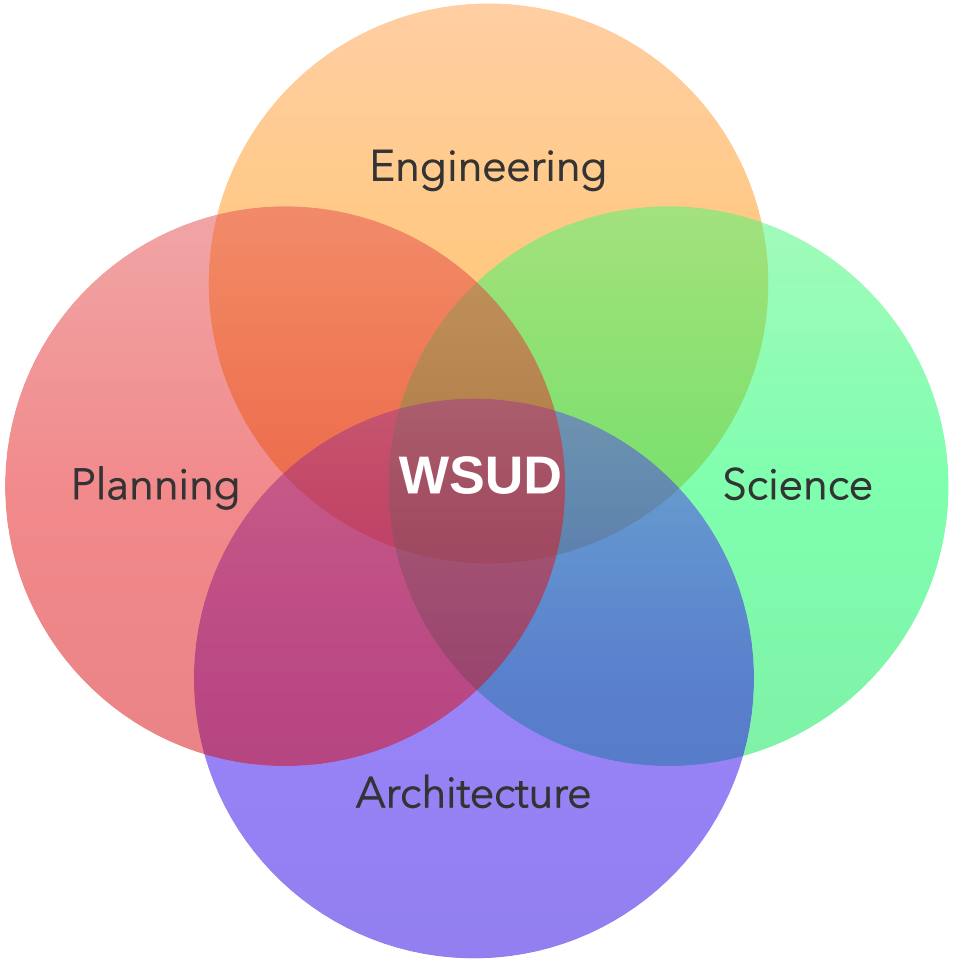
WSUD – A Multidisciplinary Endeavour



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Examples of stormwater treatment assets to help achieve WSUD

Examples

- Pretreatment
- Swales (& buffer strips)
- Sediment basins
- Wetlands
- ‘Rain gardens’/ bioretention
- Proprietary assets

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Pretreatment


CARTON PICK HEADER LABEL
Coca-Cola
NO SUGAR

Swales & Buffer Strips


Noosa, QLD


Springfield Lakes, QLD


Brisbane, QLD


Coomera Waters, QLD


Coomera Waters, QLD


Kuraby, Brisbane, QLD


Kuraby, Brisbane, QLD


Kuraby, Brisbane, QLD

Sedimentation Basins

Coorparoo, Brisbane, QLD


Coorparoo, Brisbane, QLD
Trash rack upstream of sedimentation basin


Coorparoo, Brisbane, QLD


Coorparoo, Brisbane, QLD
Low flow outlet of sedimentation basin


Coorparoo, Brisbane, QLD
Excavator access track into sedimentation basin

Sunnybank Hills, Brisbane, QLD
Before

Source: David Simpson (BCC: 2011:Pers.comm)

Sunnybank Hills, Brisbane, QLD
After

Source: David Simpson (BCC: 2011:Pers.comm)


Waterford, QLD

Wetlands


Glenmay Wetland, Morayfield, QLD

Glenmay Wetland, Morayfield, QLD

Glenmay Wetland, Morayfield, QLD

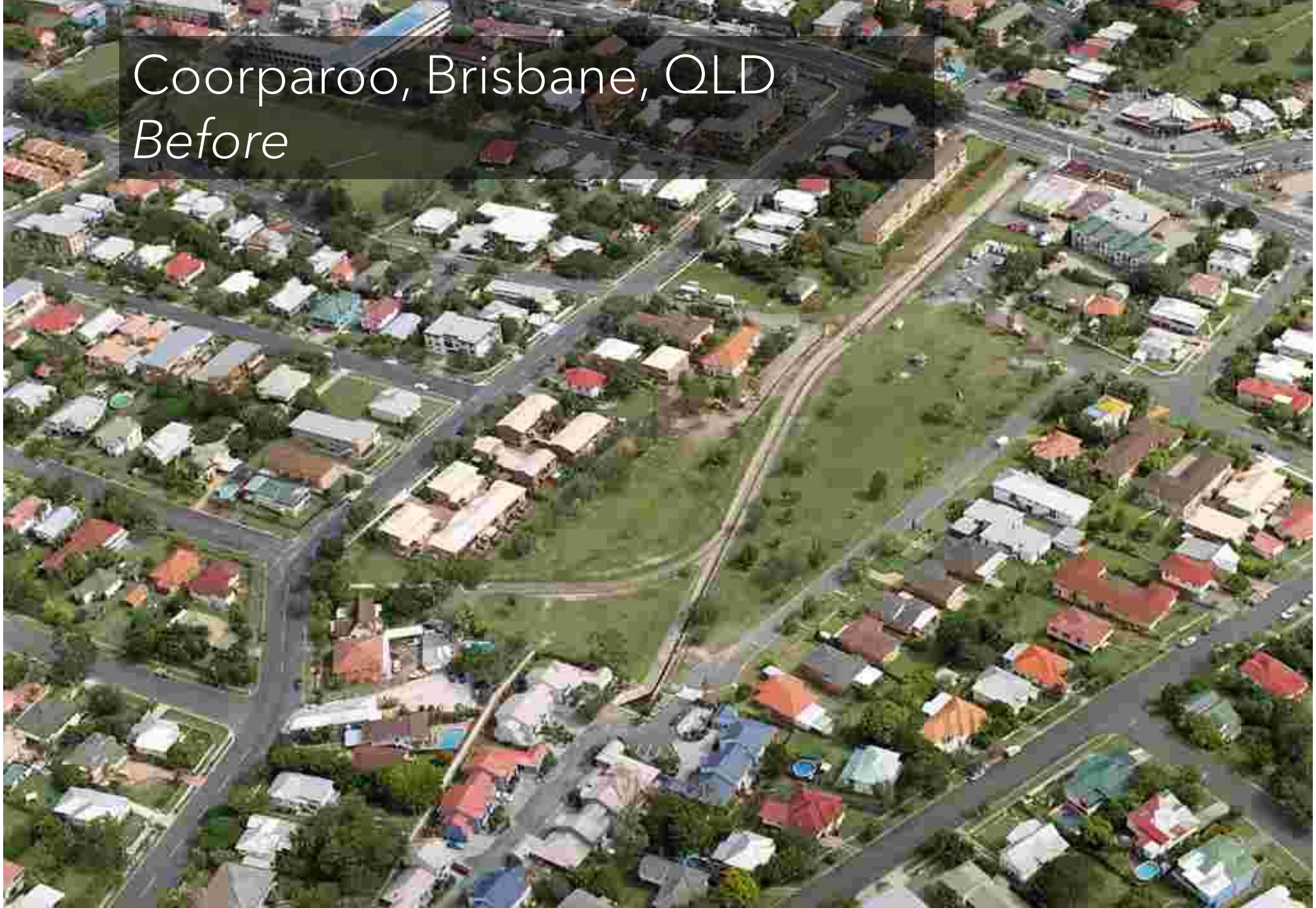

Coomera Waters, QLD


Coomera Waters, QLD


Varsity Lakes, QLD


Manly West, Brisbane, QLD

North Lakes, QLD


Coorparoo, Brisbane, QLD
Before


Coorparoo, Brisbane, QLD
After

Bioretention ('Rain Gardens')

Bracken Ridge, QLD


Springfield Lakes, QLD


Springfield Lakes, QLD


Springfield Lakes, QLD


Redbank Plains, QLD

Helensvale, Gold Coast, QLD

Council Retrofit Project


Brisbane, QLD
Council Retrofit Project

Brisbane, QLD

Council Retrofit Project

Bray Park, QLD

Melbourne, VIC


Melbourne, VIC

Melbourne, VIC


Melbourne, VIC

Melbourne, VIC

Canberra, ACT


Caloundra, QLD


Caloundra, QLD

Caloundra, QLD


Birtinya Island, QLD


Forest Glen, QLD


Forest Glen, QLD


Noosa, QLD

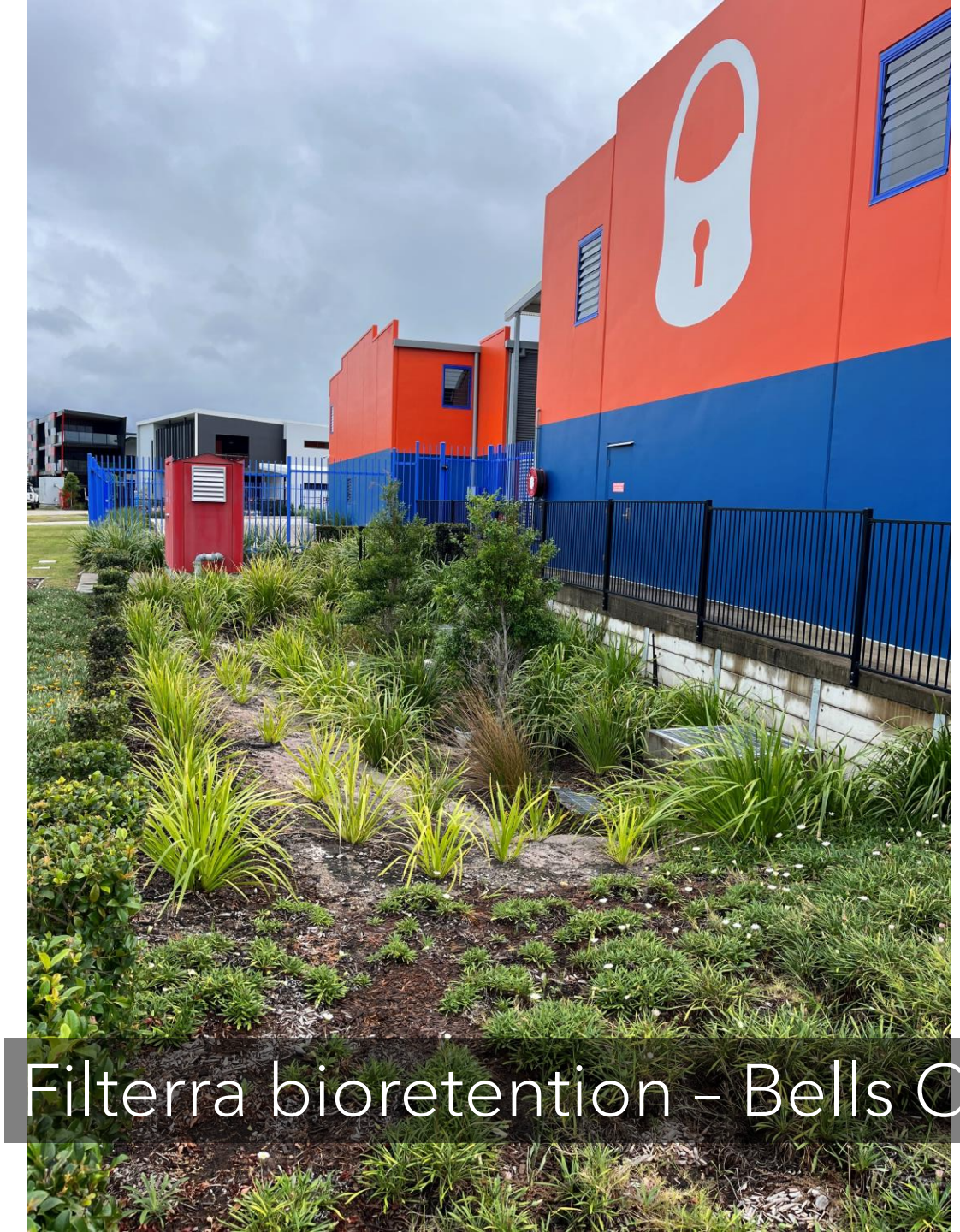
Filterra bioretention - Warwick Farm, NSW

Filterra bioretention – Kingswood, NSW

Filterra bioretention – Silverdale, NSW

Filterra bioretention – Silverdale, NSW

Filterra bioretention – Ingleburn, NSW



Filterra bioretention – Bells Creek, QLD

Filterra bioretention – Bells Creek QLD

“Proprietary” assets


Before
After




7

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THANK YOU

Brad Dalrymple
Principal Environmental Engineer
bradd@oceanprotect.com.au