CRC for
Water Sensitive Cities

Australian Government
Department of Industry, Innovation and Science

Business
Cooperative Research
Centres Programme

IRP2 - Comprehensive Economic Evaluation Framework (2017 – 2019)

An Overview

30 April 2018

watersensitivecities.org.au

IRP2 - Comprehensive Economic Evaluation Framework (2017 – 2019)

James Fogarty

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University of Western Australia

Integrated economic assessment and business case development

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(or the project leader Sayed Iftekhar

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Indicative outline

- Session 1: What we agreed to do and what it would mean to successfully deliver these outputs in the Vic. context
- Session 2: Some of the things we have done in tranche 1: does it resonate with the Vic. context?
- Session 3: Some of the things we are doing: does it seem relevant for the Vic. context?

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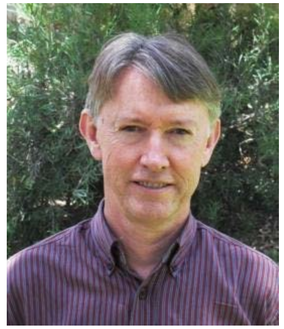
IRP2

Researchers

Dr Sayed Iftekhar
UWA

Dr James Fogarty
UWA



Prof David Pannell
UWA

Dr Maksym Polyakov
UWA (from 2018)

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UWA

Dr Mark Siebentritt
Seed Consulting

Prof Nigel Tapper
Monash

Dr Kerry Nice /
Stephanie Jacobs
Monash

Mr Kym Whiteoak
RMCG

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Project aim

The overall aim of this project is to develop, test and apply a broadly applicable framework for conducting integrated economic assessment to support business case development for investing in water sensitive, liveable and resilient cities.

Key deliverables (things in the contract!)

1. A Benefit Transfer tool and guideline for using existing non-market values in new context

2. A Benefit:Cost Analysis tool, framework, and use guidelines

3. Advice on financial regulation framework (especially, on benefit and cost sharing) for selected cases

4. Economic evaluation of Urban Heat Island (UHI) mitigation scenarios

5. Generate primary information for specific case studies

Tranche 1

Background: Project A.1 (2012 – 2016)

Provide tools and insights to industry partners and others, to assist with:

- decision making about investments in WSC
- design of policies to support WSC

Assist the CRC itself to:

- understand economic drivers
- make decisions about priorities for future research

The researchers

UWA and Monash

15 members;

- 7 academics
- 4 post-docs
- 4 research students

Themes

- Comparing and optimising water supply alternatives
- Optimal actions to reduce nutrient emissions
- Comparing potential projects and investments in water-sensitive cities
- Cost effective water provision to public open space (POS)

Themes…. continued

- Valuing unpriced social and environmental outcomes for various services Stormwater management options:
  - Rain water tank
  - Urban drainage restoration (Living stream)
  - Land uses of buffer zones of wastewater treatment plants
  - Rain gardens
  - Constructed wetlands

Use of non-market valuation estimates

FOCUS: completed studies on non-market values

- Perspective on how the values match to the Vic. context where one study is local and one is another Aust. jurisdiction

- Choice experiment / Conjoint Analysis / Type 3 BWS

- STUDY 1: Local stormwater management

- STUDY 2: Buffer zone management

Study 1: Valuing environmental services associated with local stormwater management

Brent, D. A., et al. (2017). "Valuing environmental services provided by local stormwater management." Water Resources Research(53): 4907-4921.

Stormwater

- Stormwater management provides multiple benefits. Few of the secondary benefits associated with local stormwater management have been quantified in dollar-equivalent terms.
- Conducted choice experiments with nearly one thousand households from four metropolitan councils in Melbourne and Sydney.
- Respondents were asked to choose among different options for improving local stormwater management.

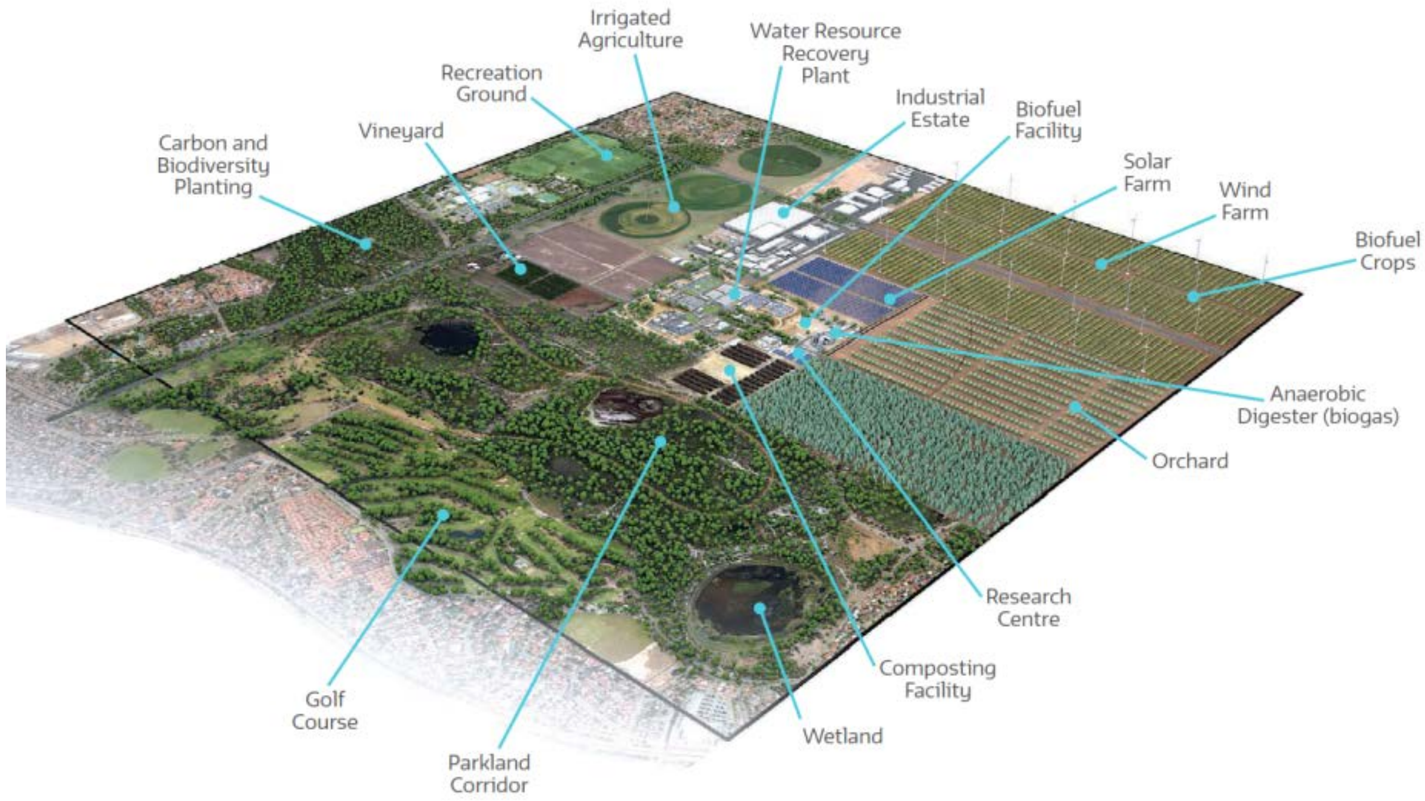
Stormwater

- There is significant economic support for stormwater projects. Marginal willingness to pay ($) per household per year (median)

Value	Melbourne	Sydney
Reduction of flash flood by half	22	22
Flood never	83	85
Stream health (medium)	84	117
Stream health (high)	234	229
Removal of level 3 & 4 water restrictions	5	90
Removal of complete water restrictions	155	242
Reduction of temperature by 2 degree	45	54

The values are estimated in comparison to the status Quo (or the current scenario).

Study 2: Non-market valuation of buffer zone management of wastewater treatment plants



Iftekhar, M., et al. (2018). "Understanding social preferences for land use in wastewater treatment plant buffer zones." Under Review

Buffer

- Buffer zones are common around wastewater treatment plants and pumping stations. The ‘best’ use of the buffer zone land depends, in part, on community values

- The study involved a survey (n=709) to understand community preferences for different land uses within buffer zones in Perth and regional Western Australia

Buffer zones and the experimental design

- 4 land use attributes: nature conservation, agriculture, sports & recreation, and industry

- Two information conditions:

  With visual aids
  Without visual aids

Ground View

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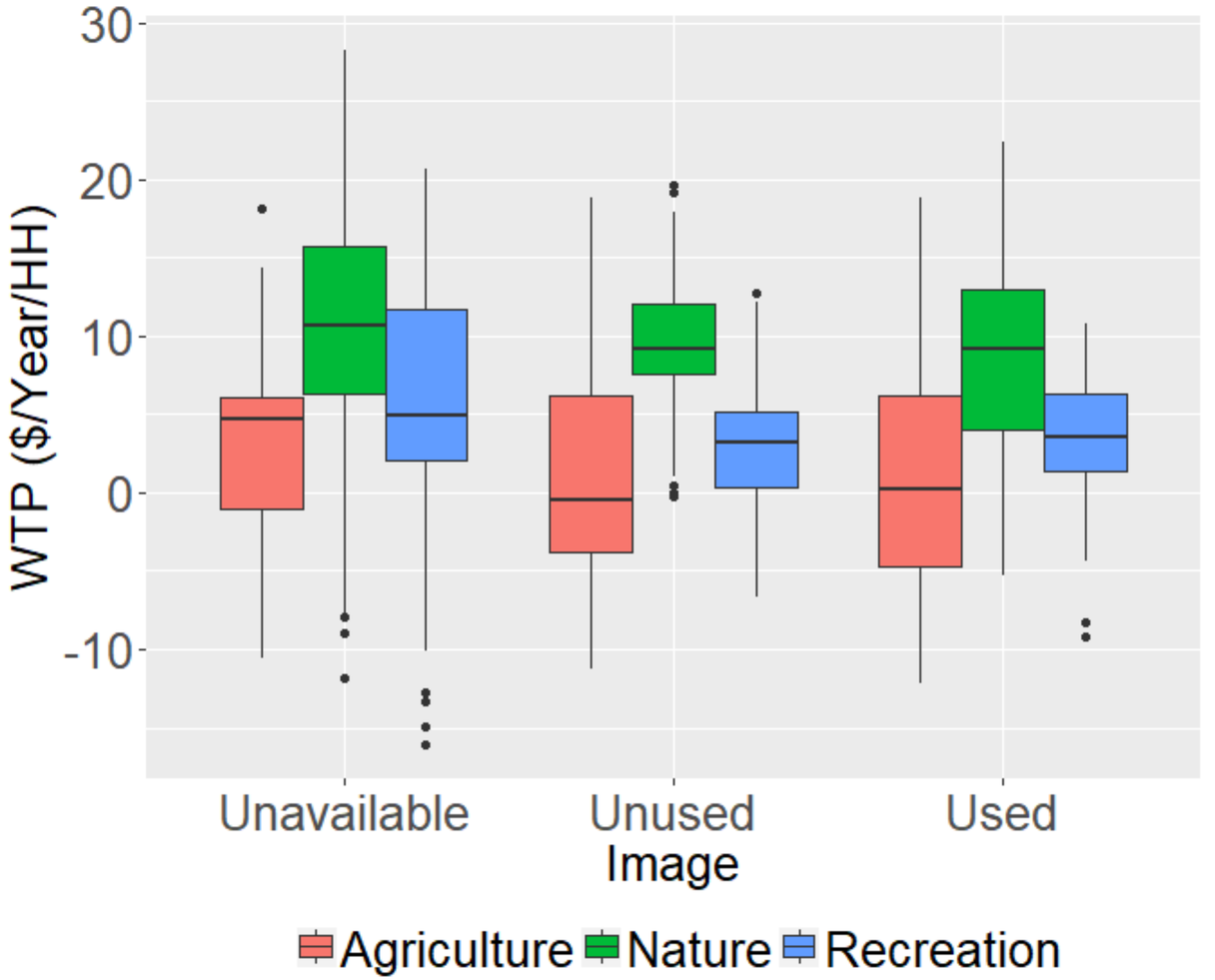
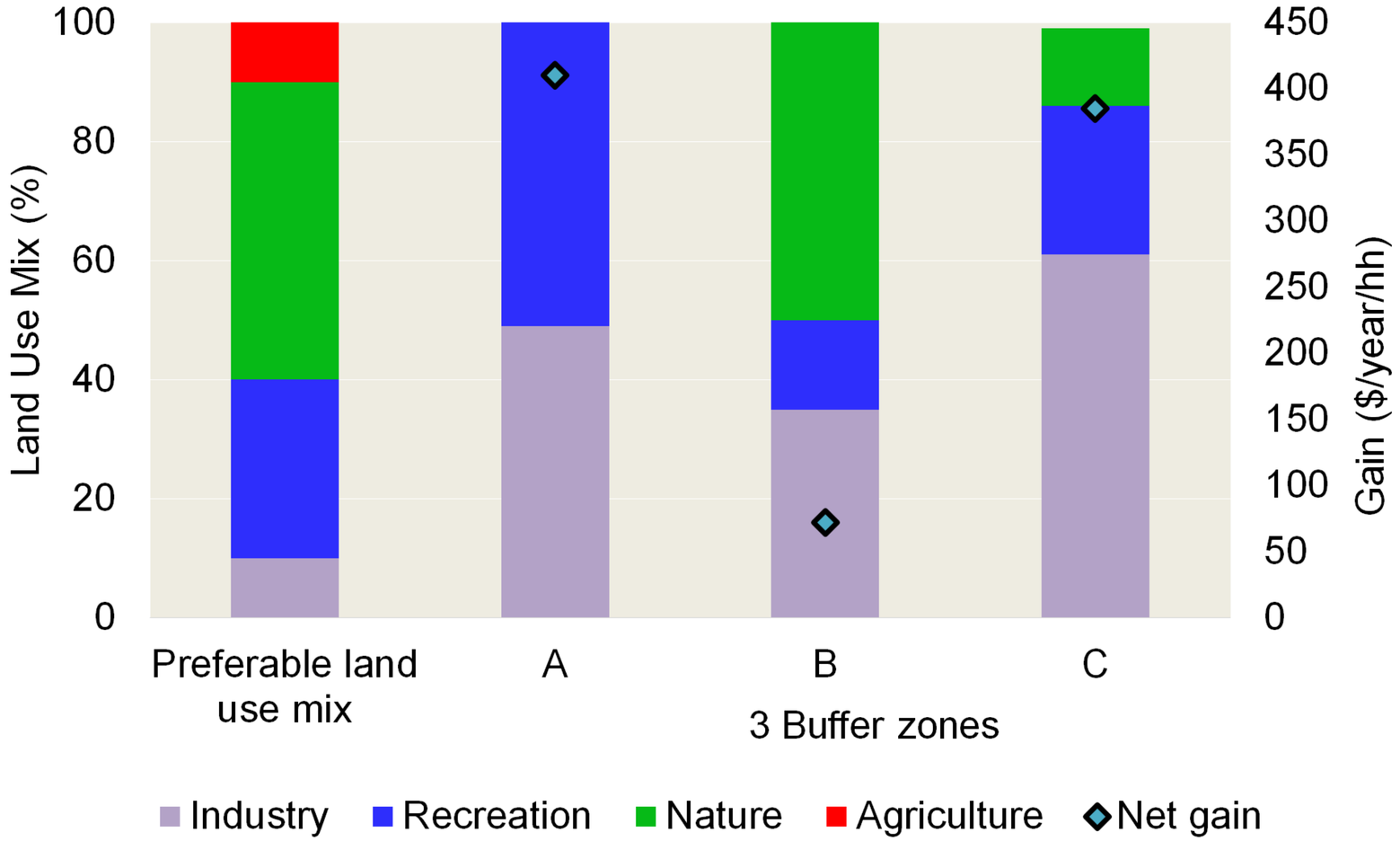
Buffer zone land use preferences

- There was a clear, consistent preference ordering for land use within buffer zones
- The most preferred land use was nature conservation
- What experience is there in there in Vic.?



Buffer zones estimates of different land use mixes

- Consider the gains relative to the actual use mix at three existing sites shows large increases in community welfare, although costs of provision are not considered



Reference questions

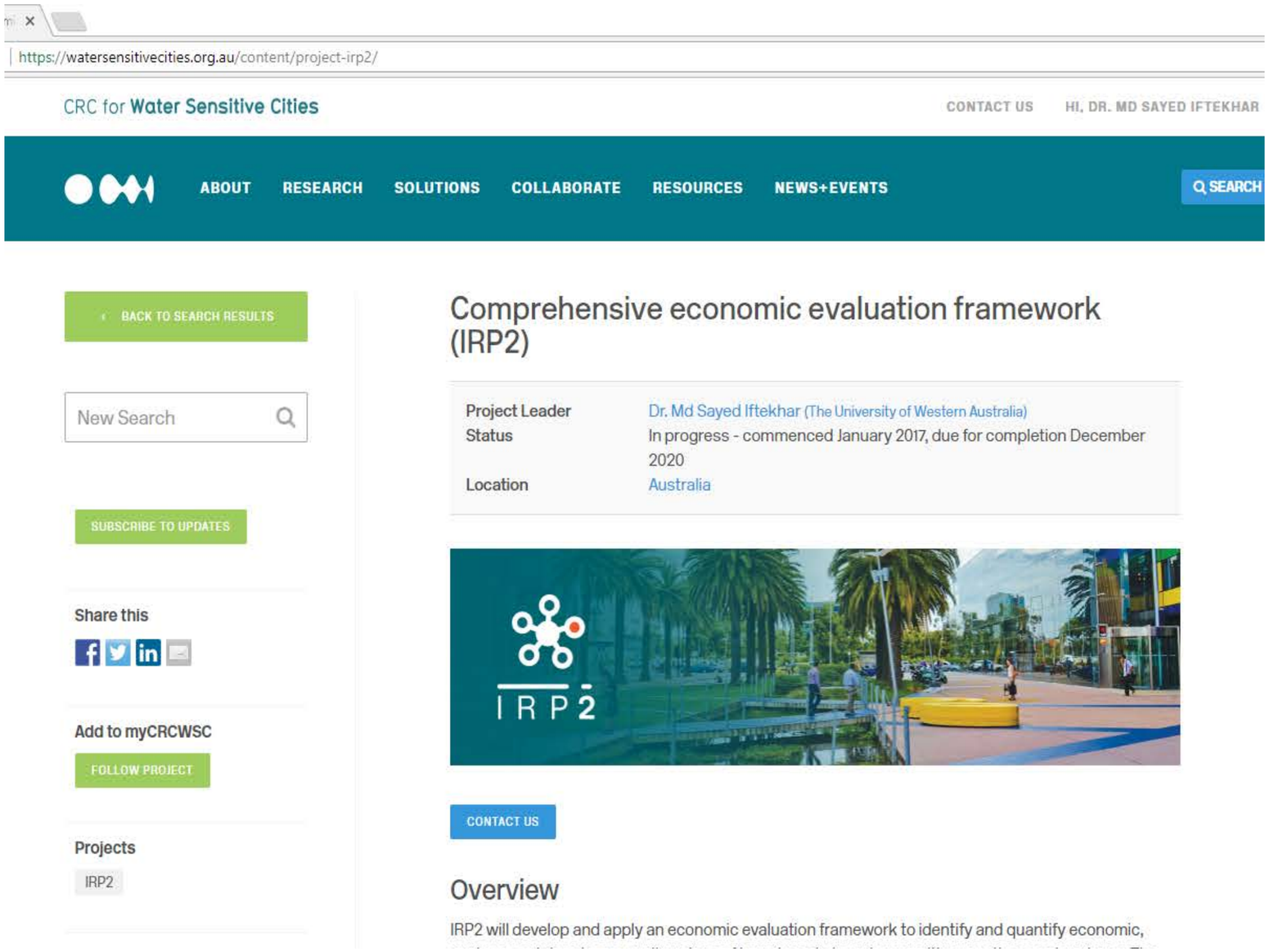
- Is there a specific format that is most effective in terms of evidence?
- What format is most effective in terms of the PREMO assessment?
- Is it valuable to lower the cost of primary studies?
- Should we be thinking in terms of the median or a higher standard?

IRP2: Current work and future plan

WP1: Stakeholder engagement

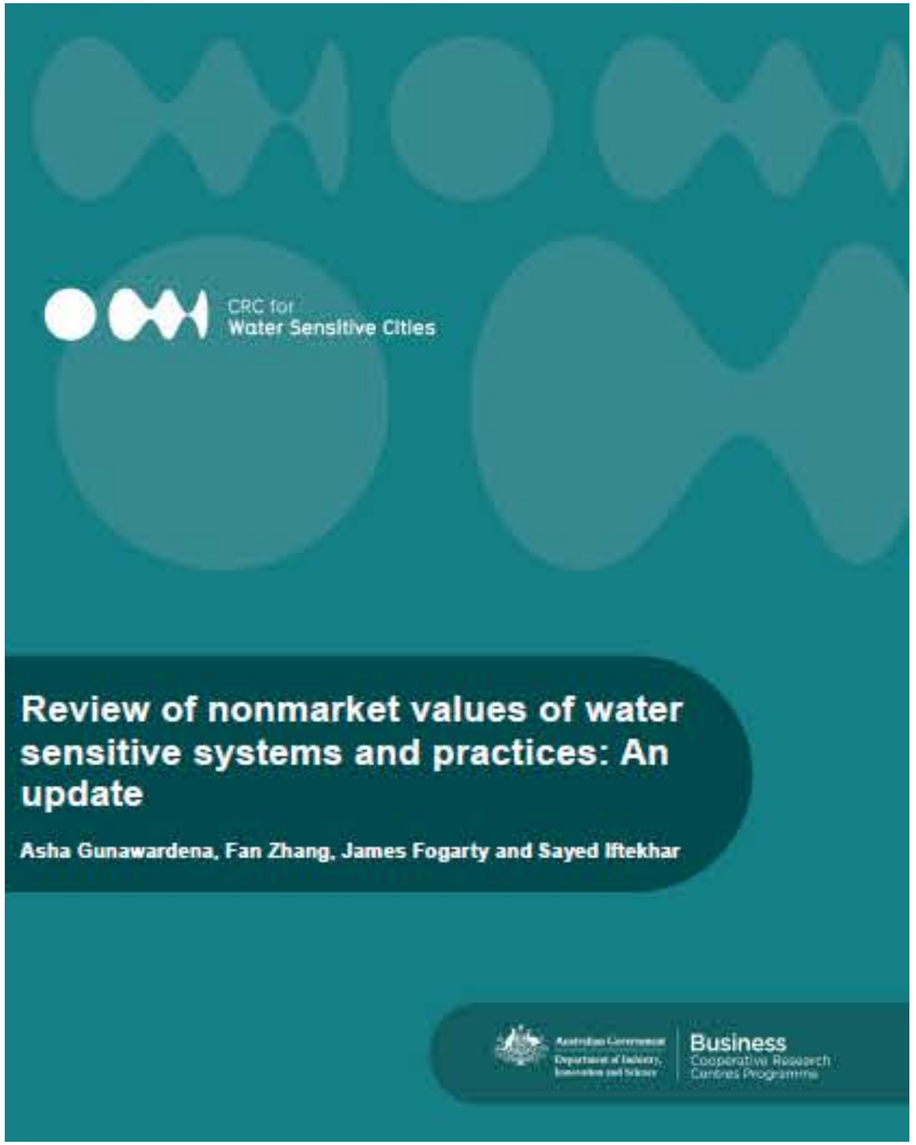
- Stakeholder Engagement Strategy (SES) and Stakeholder Needs Assessment Reports have been developed

- Regular updating of the website with outputs, events and progress reports.

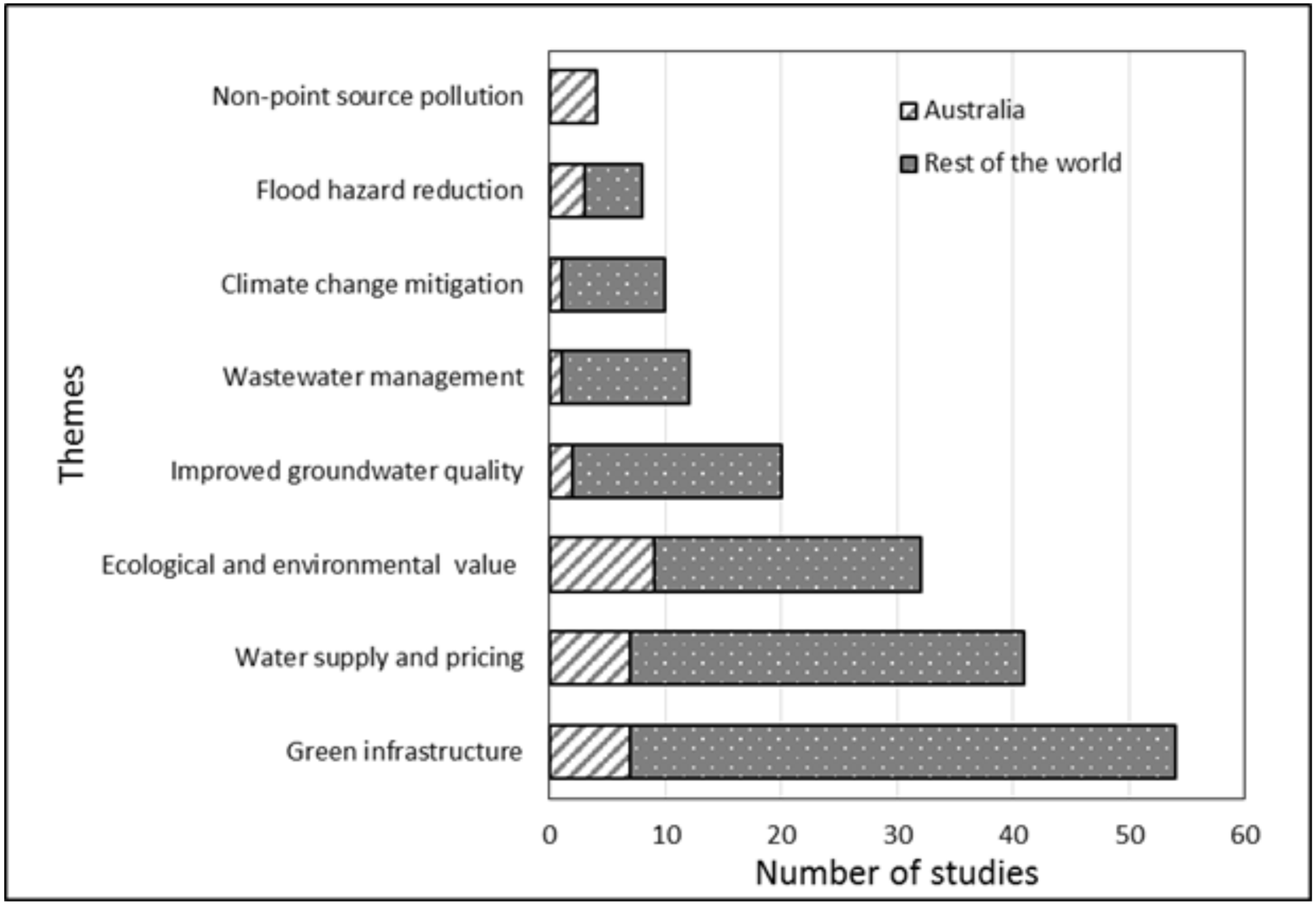


WP2: Benefit Transfer Tool

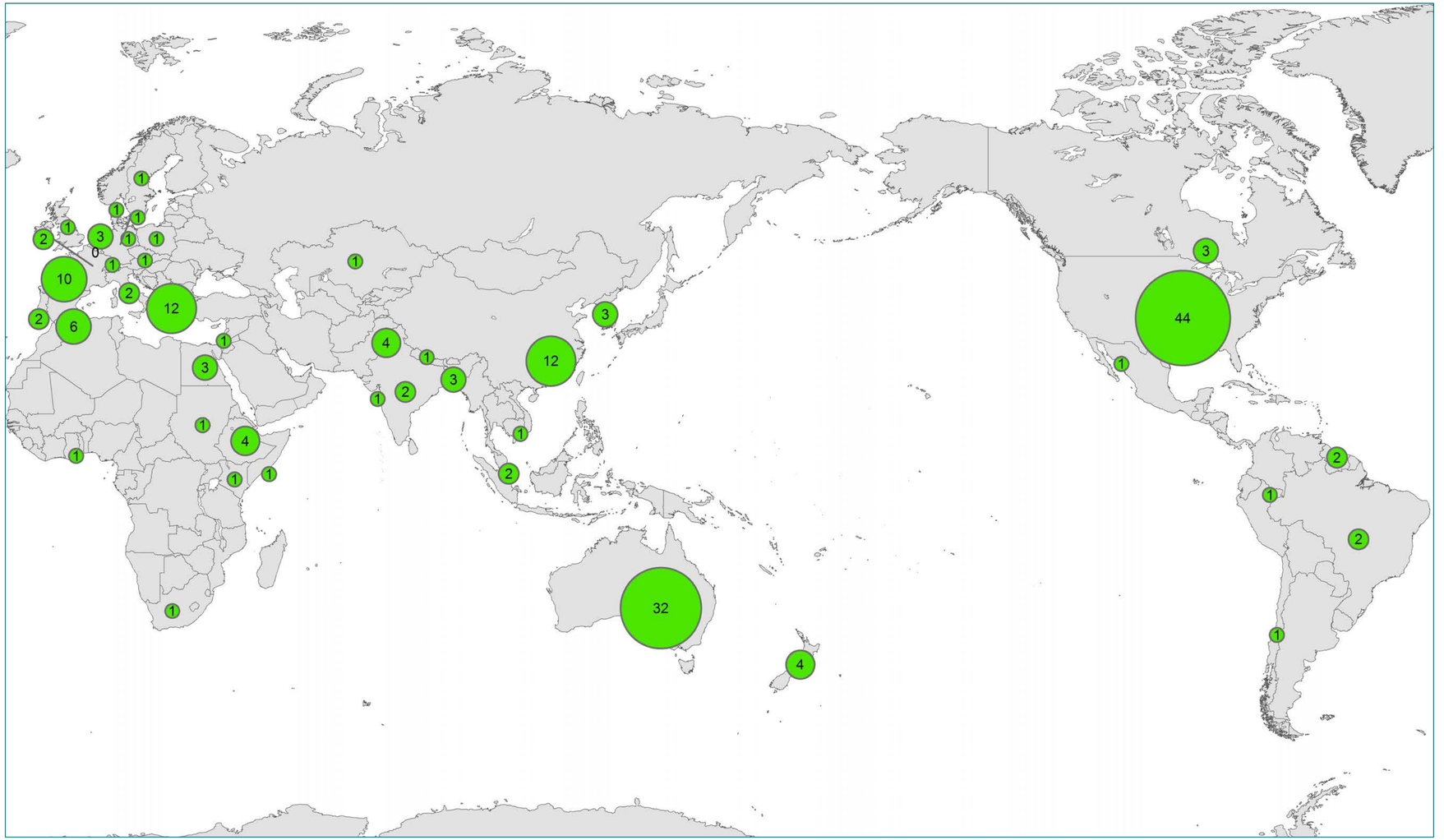
- An extensive review of non-market values of water sensitive systems and practices
- 181 studies; approximately 20% of them are Australian
- Major themes are – green infrastructure, ecological and environmental values of water and water supply and pricing
- Main methods: Survey and house price analysis
- Is benefit transfer relevant in the Vic. Context?



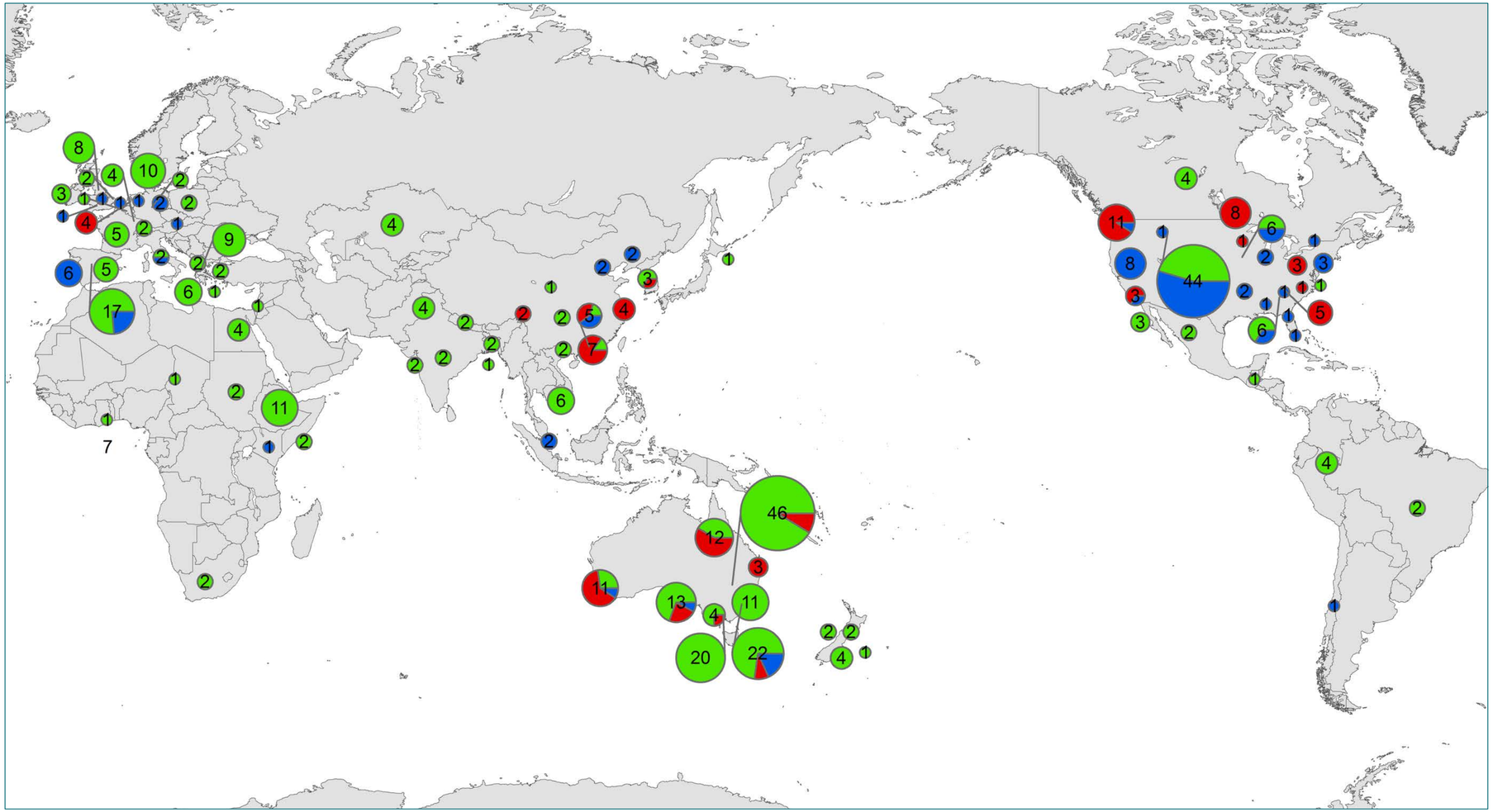
Distribution of studies by themes



Distribution of studies by location



Distribution of studies by method used



Stated Preference

Revealed Preference

Other

NMV database as an output

- Started with the Australian studies
- Information from 52 studies (250 non-market values) have been included so far
- Information organized in an excel spreadsheet-based database

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THE UNIVERSITY OF WESTERN AUSTRALIA

Database of non-market values of water sensitive systems and practices

Asha Gunawardena, Sayed Iftekhar and James Fogarty
Centre for Environmental Economics and Policy, University of Western Australia
Date 1/02/2018

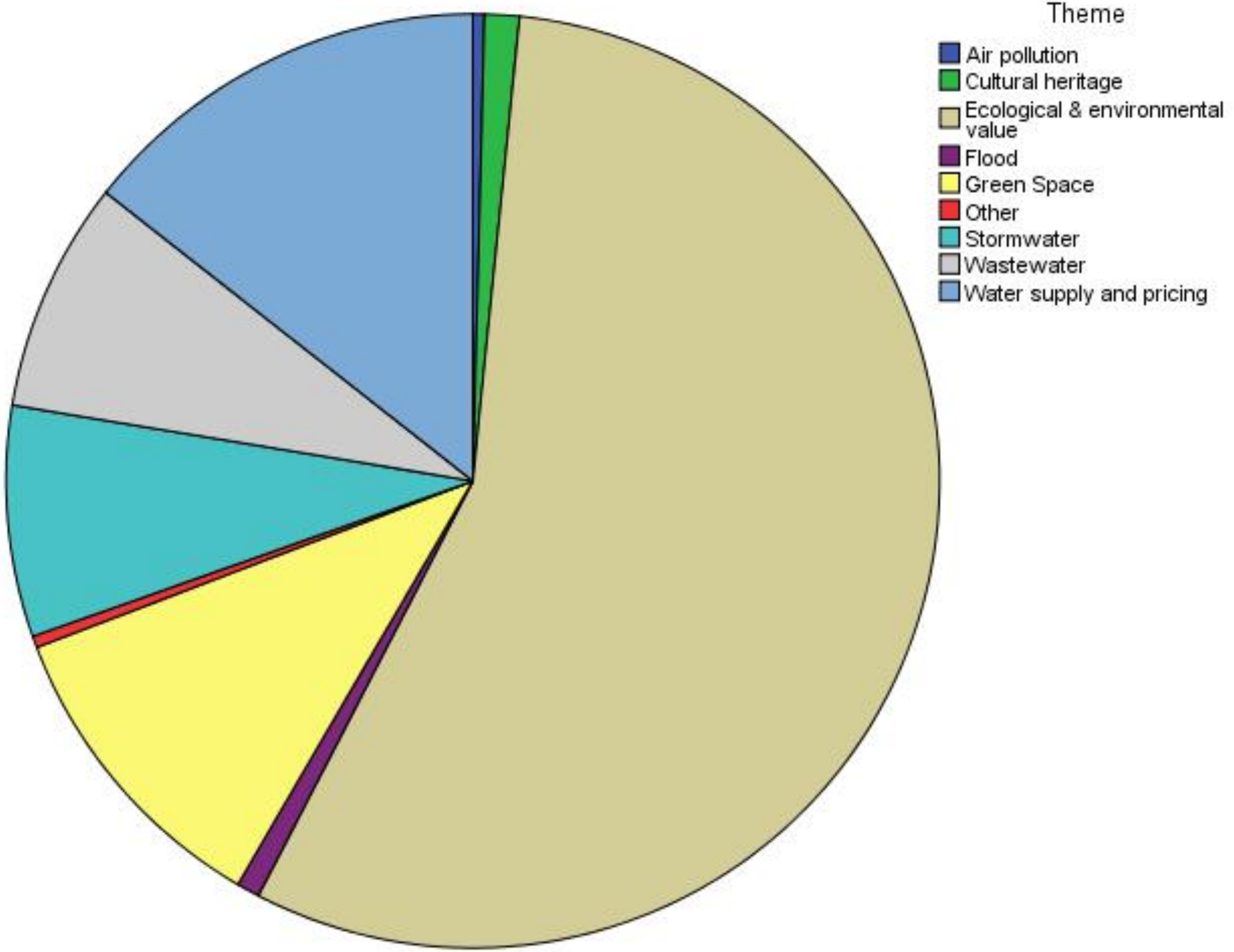
Introduction

This database was developed as part of CRC for Water Sensitive Cities IRP2 prject
It is supported by a set of guidelines: Gunawardena, A., Iftekhar, M. S., Fogarty, J., (2018). Non-market value database on water sensitive systems and practices: User Guideline. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities
Contact: mdsayed.iftekhar@uwa.edu.au
This database is a collection of non-maket values of water sensitive systems and practices from primary studies from Australia from 2000 to December 2017.

What does the NMV database look like

Study identification				WTP measure				
Obs. ID	Paper ID	Citation	Title	Value location	Theme	Value Type	System / Service / Context	Definition of marginal change
1	1	Ambrey and Fleming (2014)	Public Greenspace and Life Satisfaction in Urban Australia	Entire Australia	Green Space	Amenity	PoS	WTP per household for a 1 per cent (143 square metres) increase in public green space
2	1	Ambrey and Fleming (2014)	Public Greenspace and Life Satisfaction in Urban Australia	Entire Australia	Green Space	Amenity	PoS	Household income a household would sacrifice for one standard deviation (12.49 per cent) increase in public green space
3	2	Bennett et al (2008)	The economic value of improved environmental health in Victorian rivers.	Moorabool river (large pre-urban regulated river)	Ecological & environmental value	Native Fish	River	WTP per household for a 1% increase of native fish (percentage of pre-settlement species and population levels)
4	2	Bennett et al (2008)	The economic value of improved environmental health in Victorian rivers	Moorabool river (large pre-urban regulated river)	Ecological & environmental value	Native vegetation	River	WTP per household for a 1% increase of native vegetation (percentage of river's length with healthy vegetation on both banks)

Distribution of values by themes



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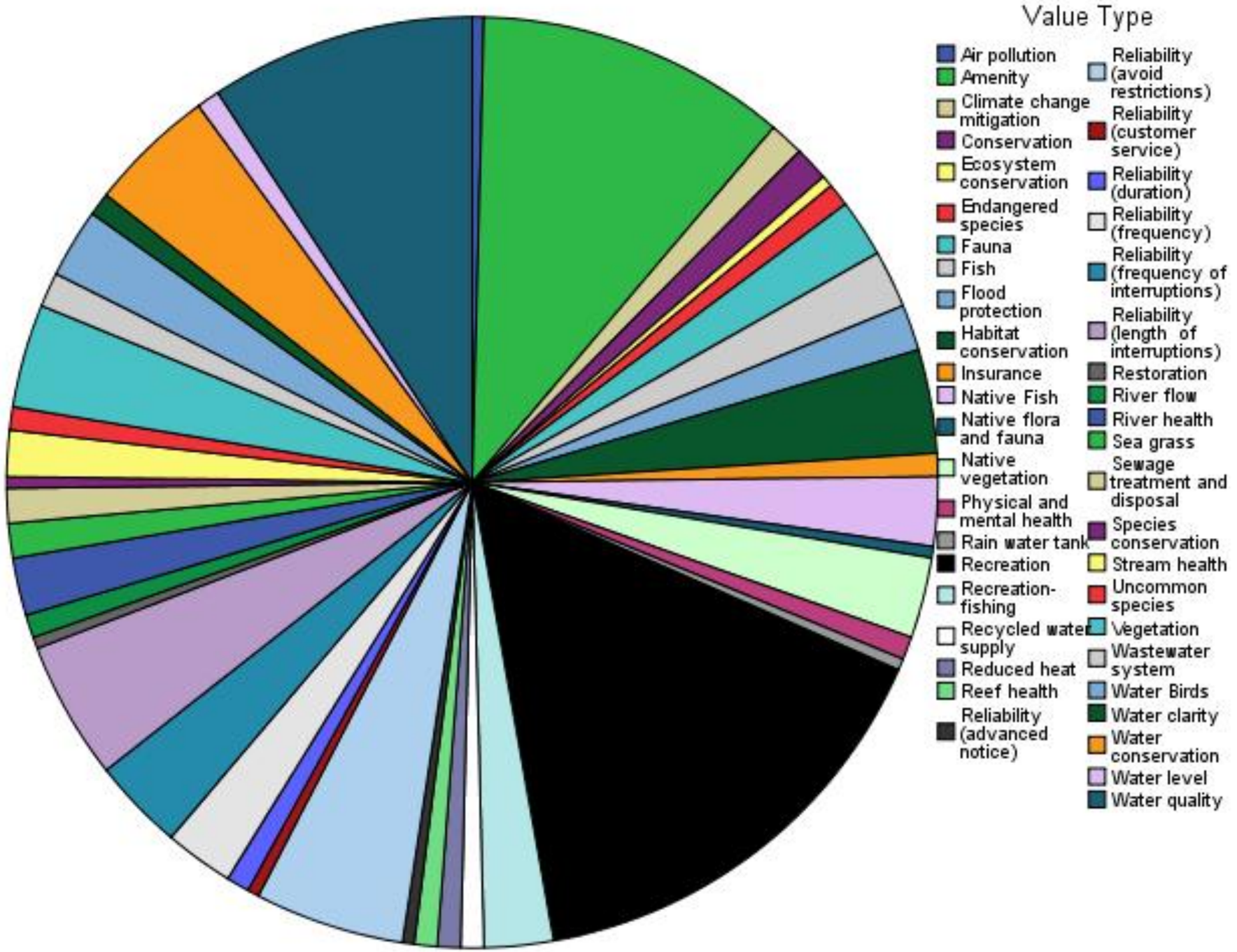
Distribution of values by value types



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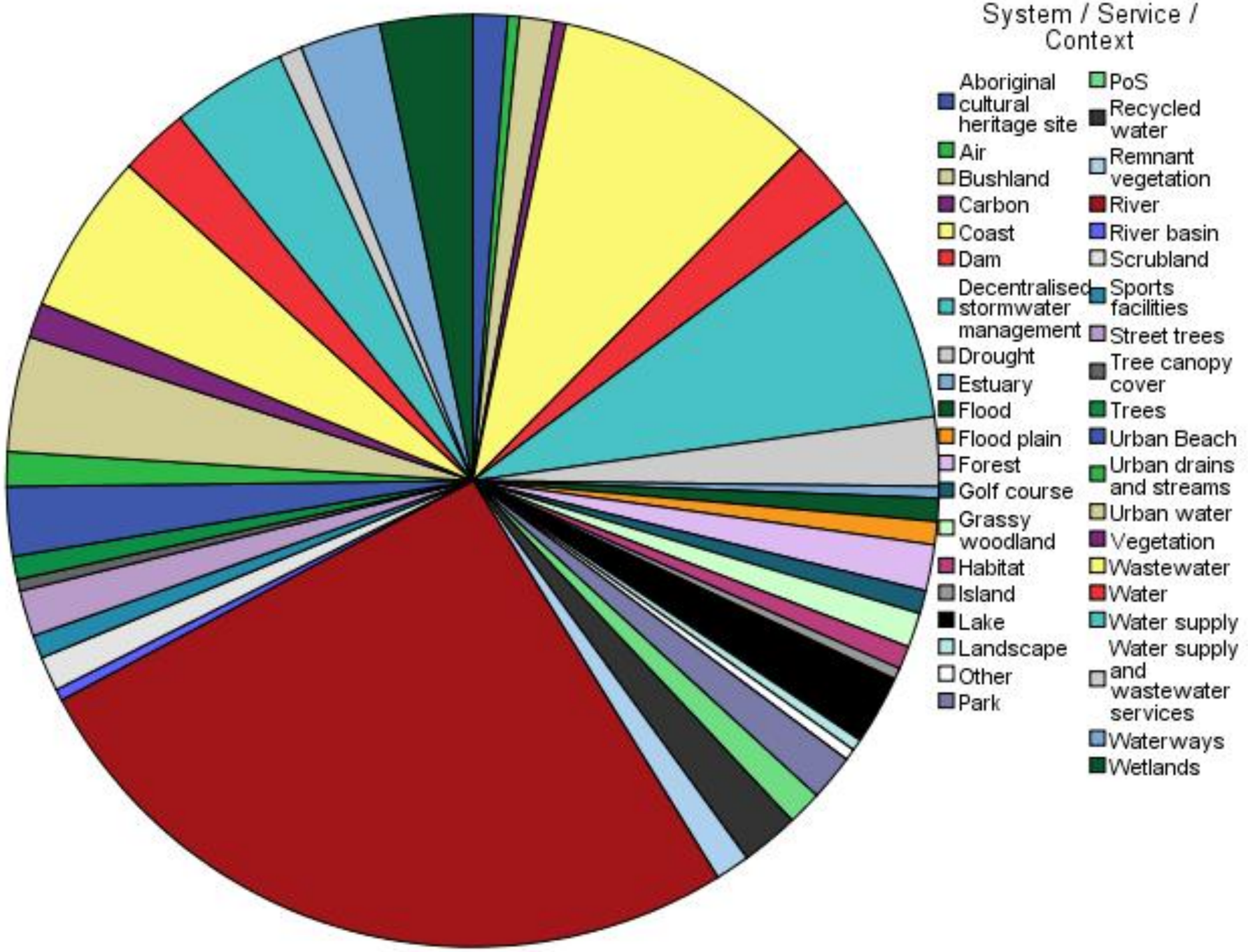
Distribution of values by systems/service/context



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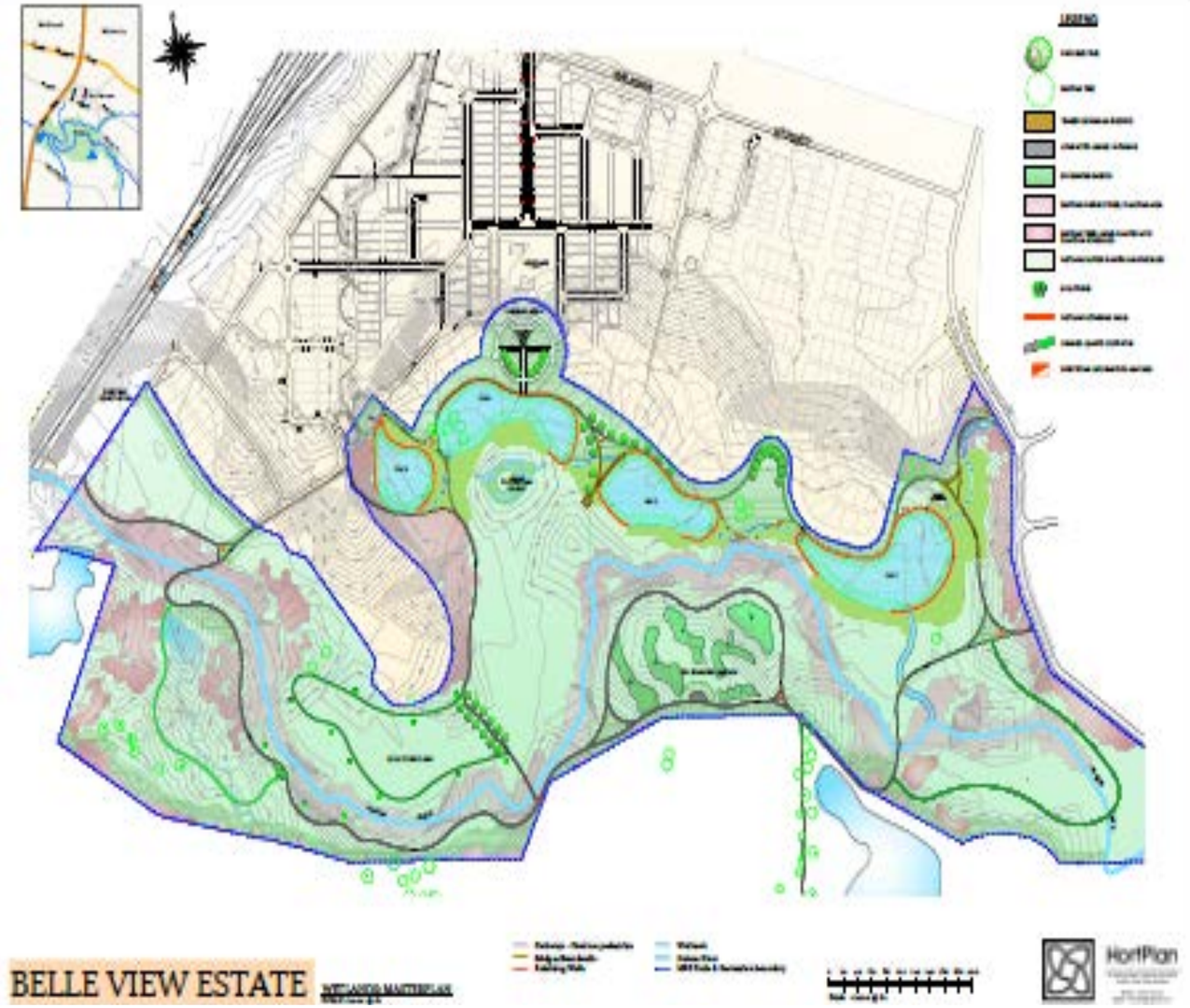
Distribution (%) of values by states

Use of the NMV database – an example

- Residential development with WSUD in Perth
- Working with a private property developer
- 25 ha of residential area
- 15 ha of public open space
    - **4 Constructed wetlands**
    - **A living stream**



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Case study : Bellevue Estate (WP5.3)

- Population in the policy site
  - Potential increase of residential population – 800 people
  - Dwelling target – 348

- Socio-economic characteristics (Belllevue suburb)
  - Median age – 26, Average household size -2.3

- Information on substitutes
  - Neighbourhood parks (.5ha) and local park (0.25 ha)

Identifying relevant valuation studies

- Main features of the urban design
  - Wetlands
  - Living stream

- Different types of non-market values available

Case study : Bellevue Estate

Values identified in the stakeholder consultations

Private	Local
• Amenity • Recreation	• Amenity • Recreation • Connectivity (local access) • Water quality (nutrient, heavy metal) • Health (active living) • Reduced heat • Ecological/biodiversity/habitat • Access to nature/mental health • Industrial employment opportunities • Indigenous heritage

Urban design/practice and features

	Studies
A. Wetlands	5
B. Living streams	1

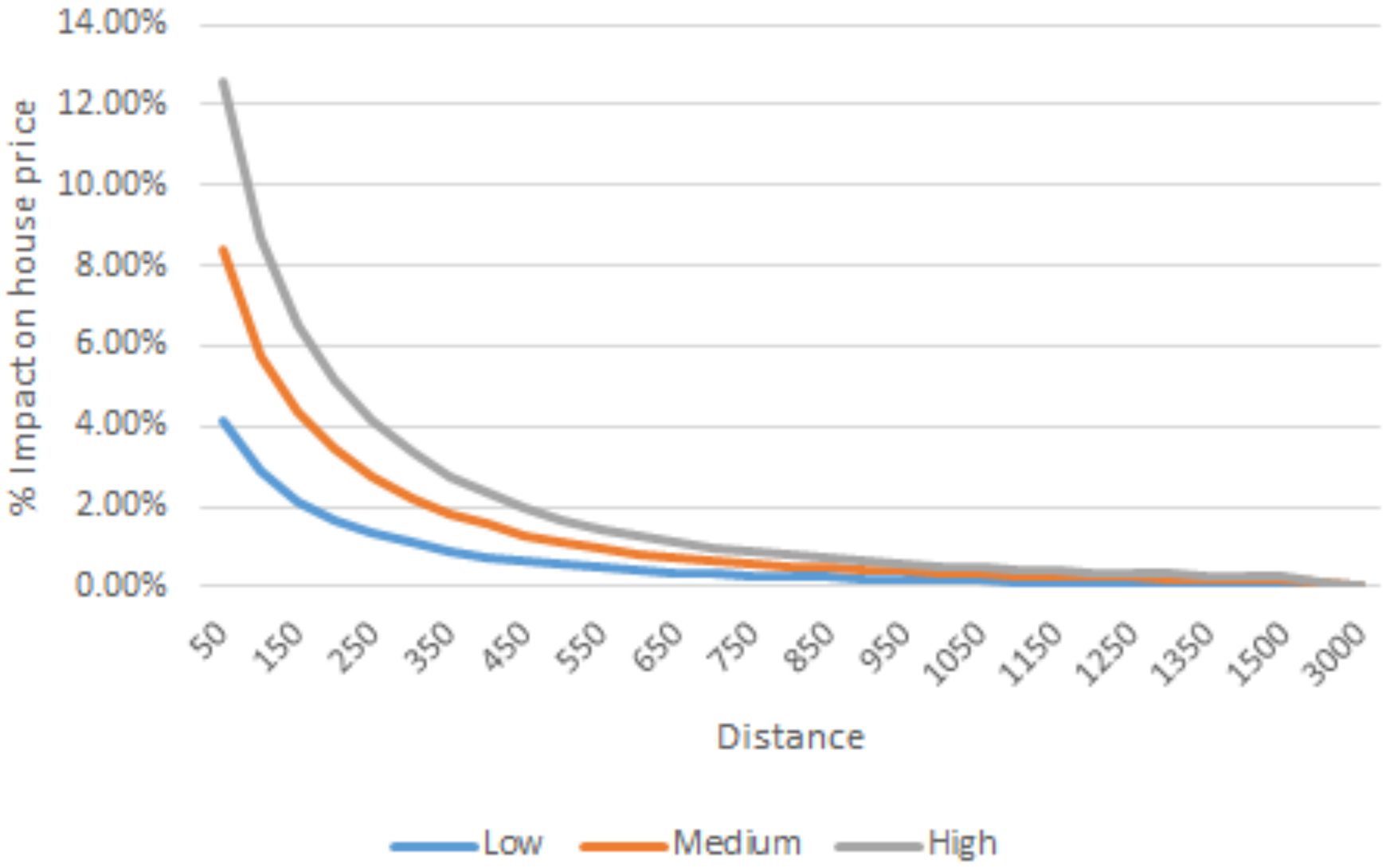
Closest matching studies

Citation	Title	Value location	Sub-category of value	Definition of the marginal change
Pandit et al. (2014)	Valuing public and private urban tree canopy cover	WA	Amenity	% increase of property price for having wetlands within 300 m
Polyakov et al. (2017)	The value of restoring urban drains to living streams	WA	Amenity	% increase of property value within 200 m of the restoration site

Benefit transfer- amenity value of wetlands

Context	Study site	Policy site
Location	Perth, Western Australia	Perth, Western Australia
Setting	Urban (established)	Urban (new)
Nature of wetlands	Mix of natural, man-made or extensively modified	Man-made or extensively modified
Size	0.3-329 ha	15 ha
Average house price	$ 1,000,000 (2009)	$ 380,000 (2018)
Average distance to wetlands from properties	943 m	300m

Wetlands – underlying details



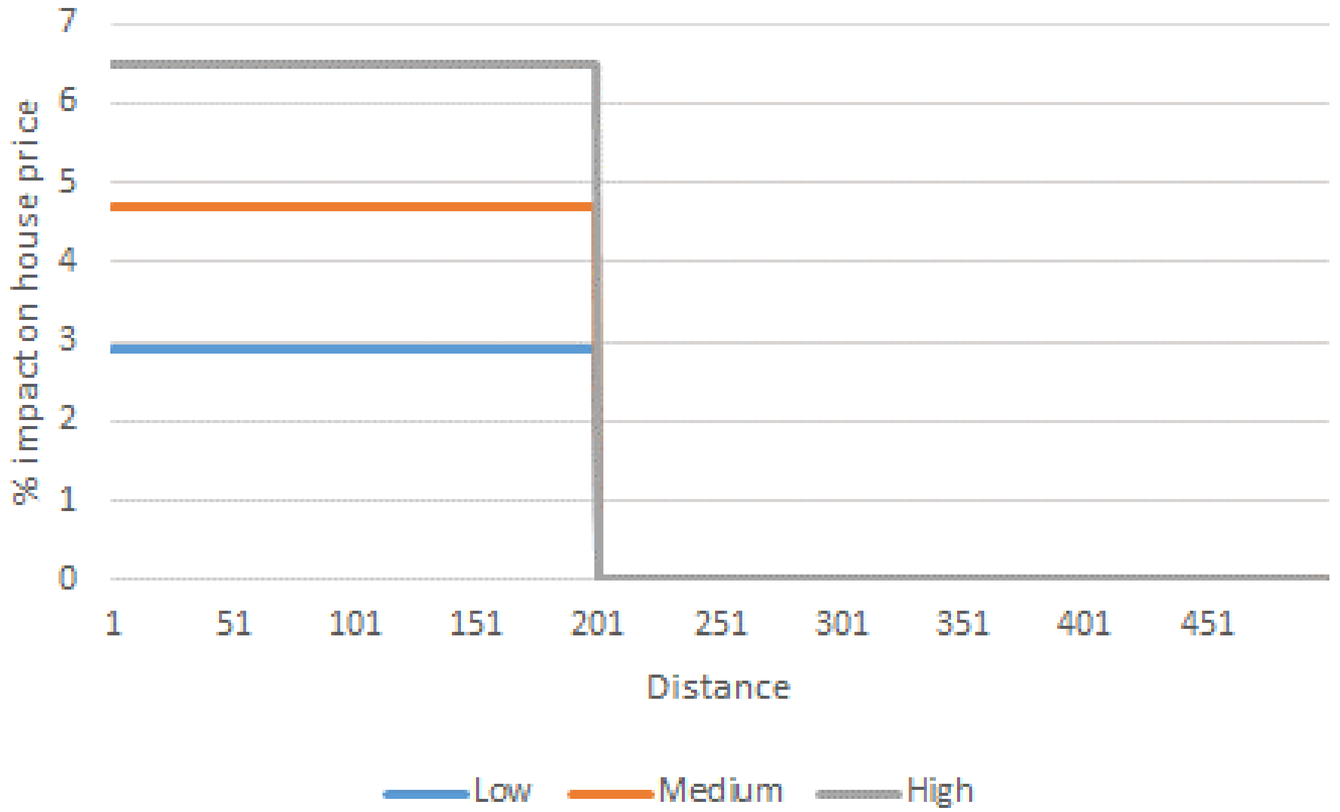
Wetlands benefit transfer

Features	Impact		
	Low	Medium	High
Percentage increase of property value (%)	0.92	1.87	2.81
Number of properties within 300m distance	348	348	348
Average property price ($)	380,000	380,000	380,000
Total amenity value ($) for residents due to wetlands	1,216,608	2,472,888	3,715,944

Benefit transfer- amenity value of living stream

Context	Study site	Policy site
Location	Perth, Western Australia	Perth, Western Australia
Setting	Urban (established)	Urban (new)
Nature of living stream	Restoration site	Restoration site
Average house price	$ 238,749 (2013)	$ 380,000 (2018)

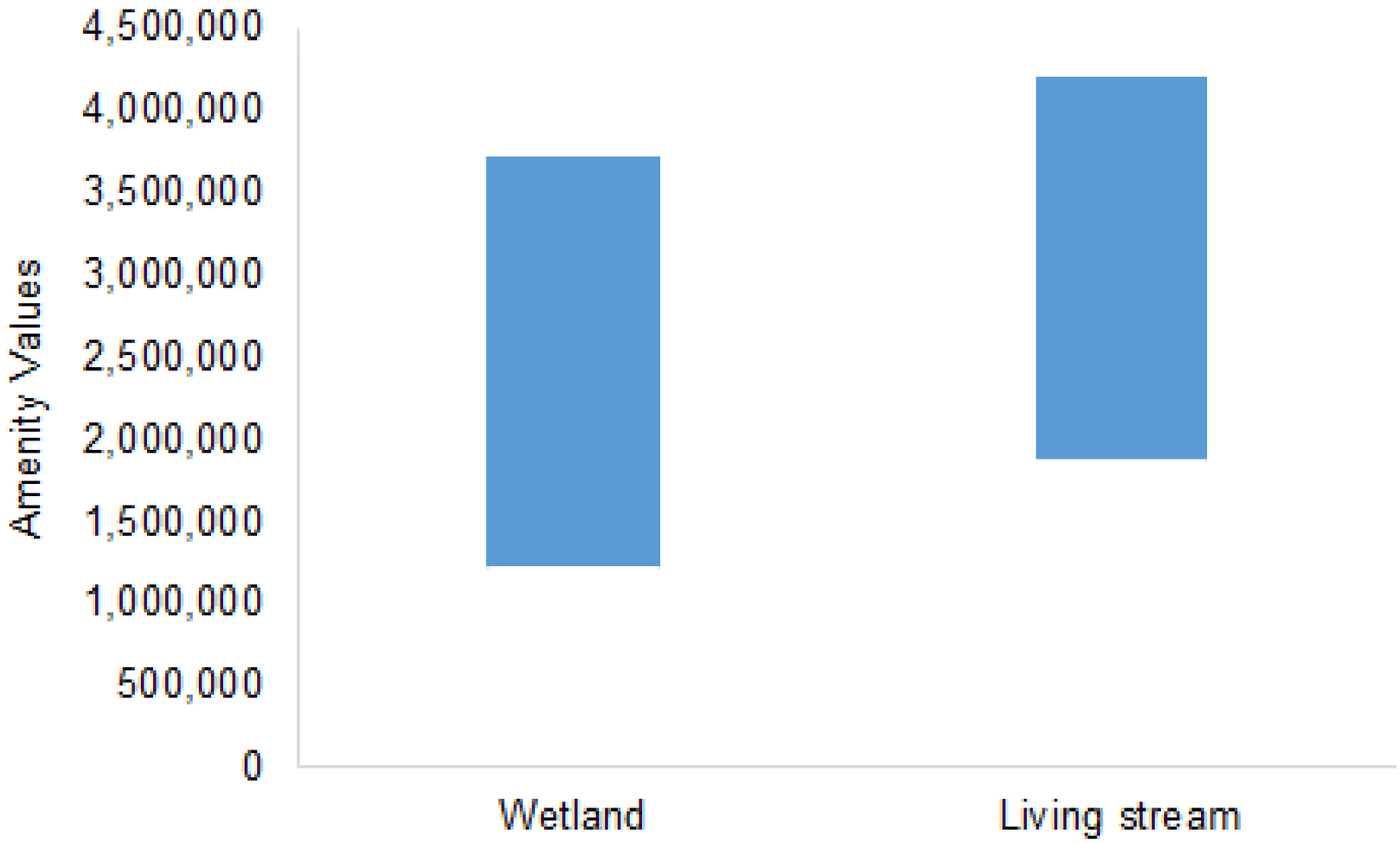
Living stream – underlying assumptions



Living stream – benefit transfer

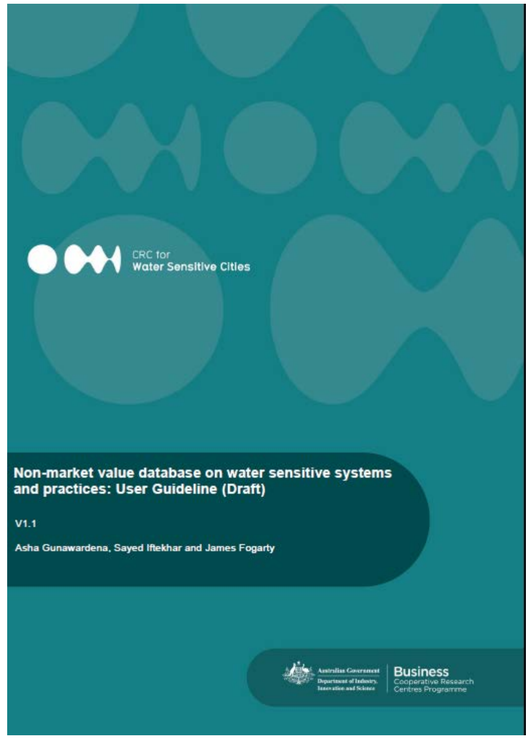
Features	Impact		
	Low	Medium	High
Percentage increase of property value (%)	2.9	4.7	6.5
Number of properties within 200m distance	170	170	170
Average property price ($)	380,000	380,000	380,000
Total amenity value ($) for residents due to living stream	1,873,400	3,036,200	4,199,000

Amenity values



NMV database – work in progress

- Finalize the user guideline in collaboration with the Steering Committee members and case study partners
- Working on benefit transfer examples for selected case studies
- Add new information in the database as required



WP3: Benefit-Cost Analysis

- Need to prioritise investments in water-sensitive cities
- Present convincing business cases to decision makers
- Strong interest from partners in CRC for WSC in tools to help with this

The tools

1. A tool to provide defensible estimates of the monetary-equivalent values of non-market benefits (social and environmental)

2. A standardised tool to conduct Benefit: Cost Analysis (BCA)

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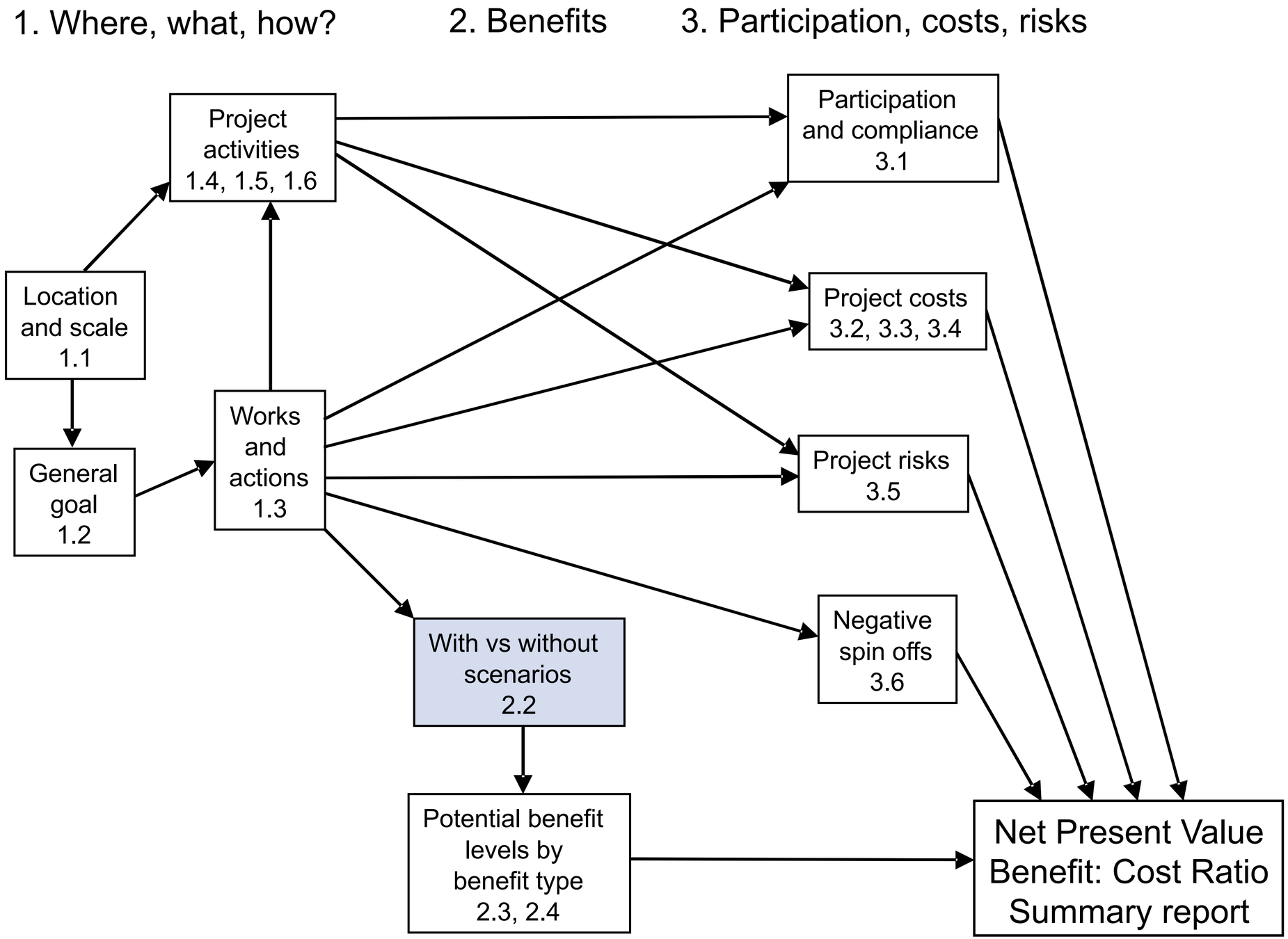
Components of BCA Tool

inffews
Investment Framework For Economics of Water Sensitive Cities

- "BCA and Strategic Decision Making"
  High-level of advice on role of economics in strategic decisions
- "Rough" BCA Tool
  Conduct a simple BCA as a first step, or as the only step for a small project
- BCA Tool Guidelines
  Detailed guidance on the more challenging aspects of conducting a BCA
- BCA Tool Template
  Captures qualitative info about a project, needed to complete a full BCA
- BCA Tool Spreadsheet
  Collects required info, calculates BCA results, conducts sensitivity analysis
- Training resources – various types for various audiences

BCA tool



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What's next

inffews
Investment Framework For Economics of Water Sensitive Cities

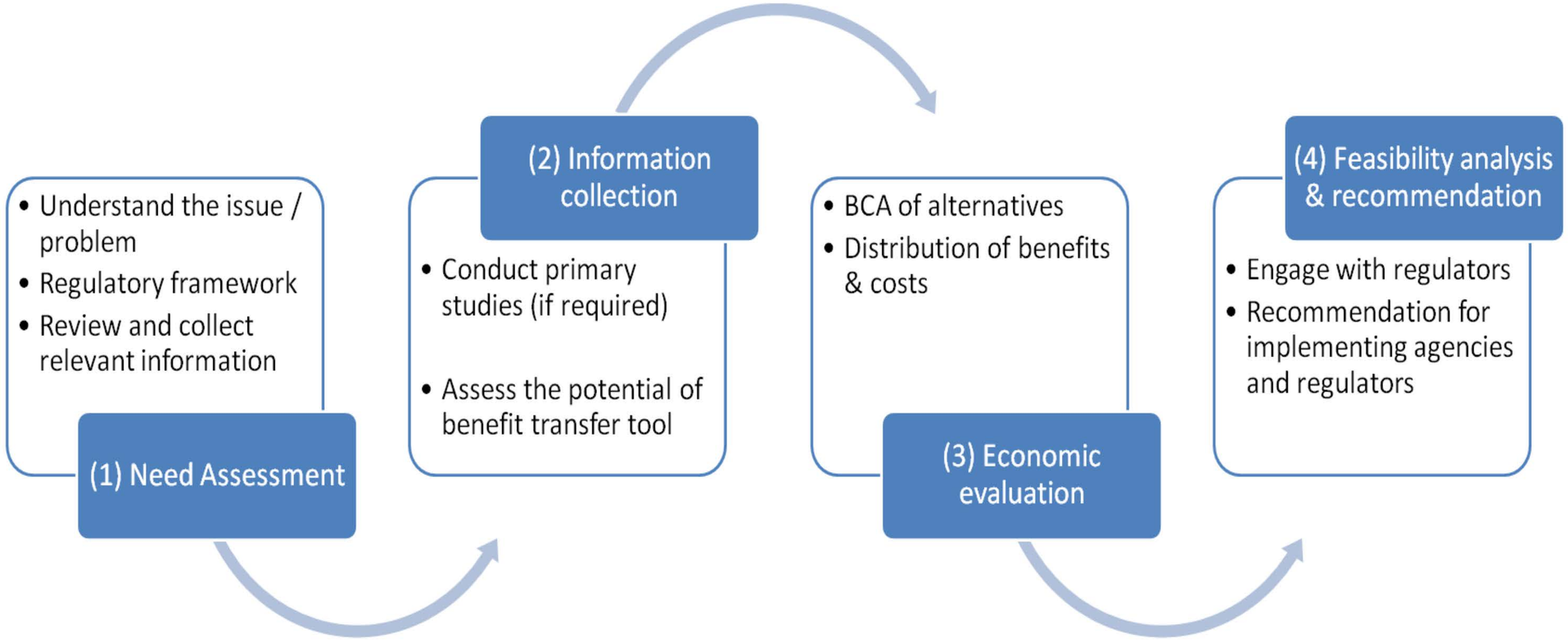
- Initial version completed March 31
- Testing internally
- Initial (detailed) feedback from steering committee
- Beta version released soon

WP4: Financial models

Process

- At the planning stage. 1st of July starting date
- Organized several sessions with WSAA. Multiple meetings with Economic Regulation Authority (ERA), WA
- Focus on PREMO and what this means for liveability type projects

WP5: Case studies

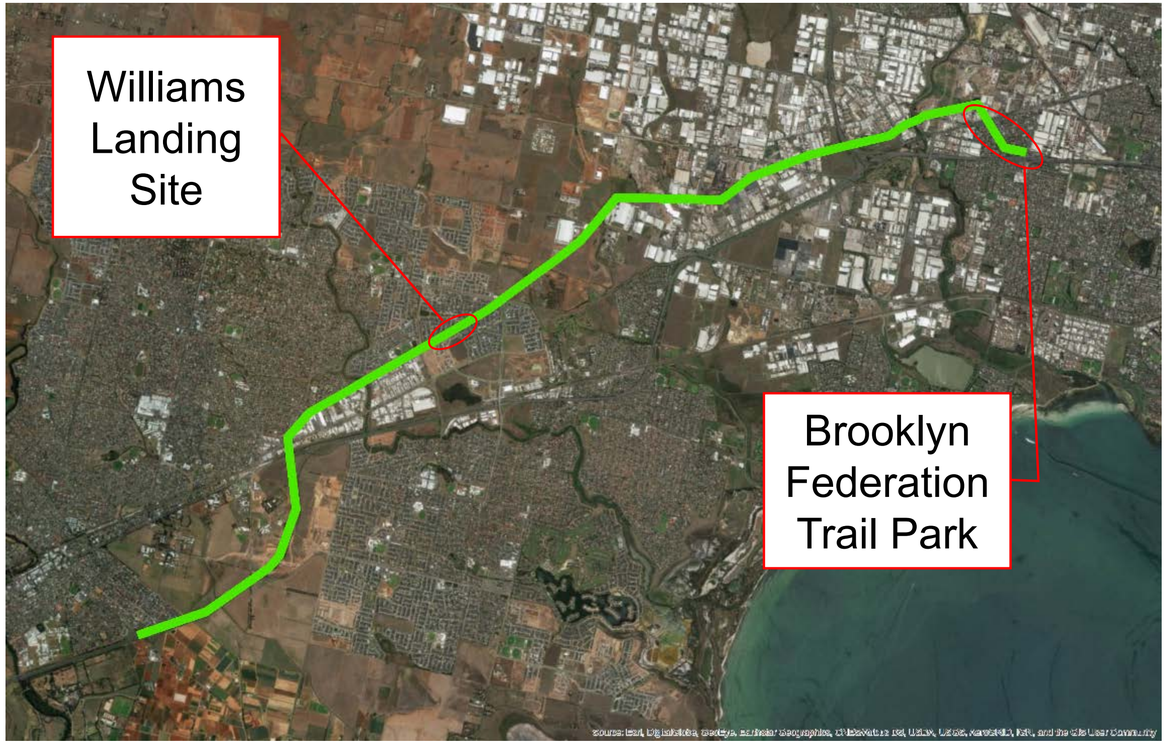


WP5: Case studies

- WP5.1: Greening the Pipeline, Melbourne
- WP5.2: Subiaco Wastewater Precinct, Perth
- WP5.3: Residential development with WSUD, Perth
- WP5.4: Urban renewal with flood management context, Melbourne
- WP5.5: Urban redevelopment (City of Salisbury) case study, Adelaide

Greening the Pipeline, Melbourne

- The Greening the Pipeline initiative aims to convert 27-km of the heritage listed Main Outfall Sewer pipeline into a parkland
- Implemented projects:
  - Brooklyn Federation Trail Park – a four hectare public open space created in 2012
  - A 100 m section at Williams Landing has been transformed into a parkland in 2017



GTP primary valuation studies

- Hedonic valuation of Brooklyn Federation Trail Park

- Choice experiment to estimate community values of attributes of potential improvement projects along Main Outfall Sewer (MOS) reserve.

Brooklyn Federation Trail Park

Brooklyn Federation Trail Park

- The house sales price data has been obtained from a commercial company.
- Near 3,000 observations from 2003 to 2017
- This data will be used to conduct hedonic analysis.

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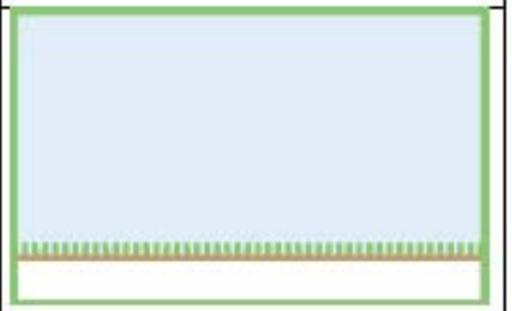
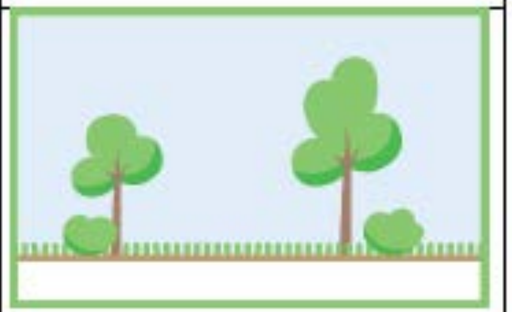
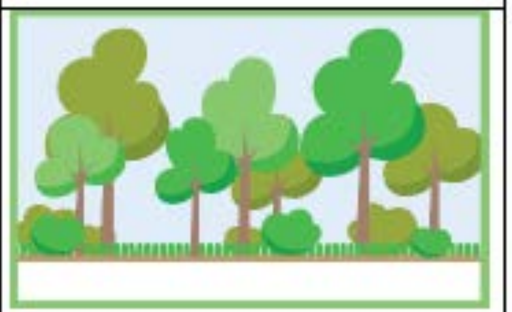
Choice experiment: valuing benefits of linear parkland

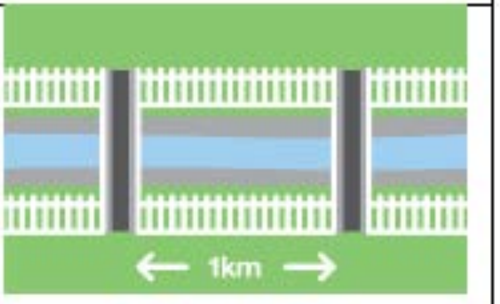
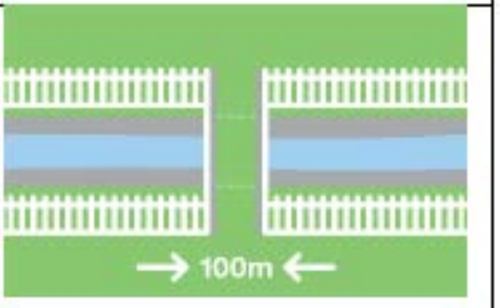
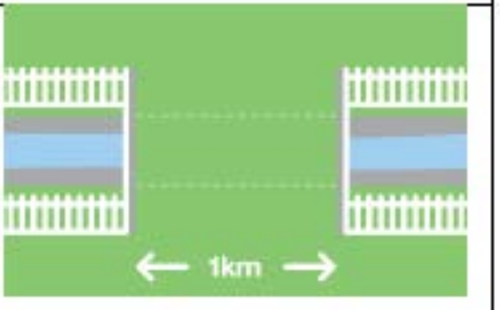
- Passive recreation facilities – e.g. seats vs picnic tables vs bbqs and toilets; public art; educational signage?
- Active recreation facilities: (e.g. playground equipment, gym equipment, dog park, etc.)
- Stormwater (i.e. bioretention system like the one at the Pilot Park)
- Vegetation – vegetation for people (ie large areas of grass) vs for habitat; manicured vegetation vs bush-like/wild vegetation
- Connectivity – connectivity across the pipeline
- Active transport - Federation Trail enhancement. Current poor condition vs upgrade to a high standard.

General park facilities		
Level	Description	Image
Level 1 (current)	No facilities	
Level 2	Minimum facilities: - Seats	
Level 3	Basic level of facilities: - Seats - Drink fountains	
Level 4	Moderate level of facilities: - Seats - Drink fountains - BBQ	
Level 5	High level of facilities: - Seats - Drink fountains - BBQ - Toilet	

Exercise facilities		
Level	Description	Image
Level 1 (current)	No exercise facilities	
Level 2	Basic level of facilities: - Exercise equipment	
Level 3	Basic level of facilities: - Exercise equipment - Playground	
Level 4	Moderate level of facilities: - Exercise equipment - Playground	
Level 5	High level of facilities: - Exercise equipment - Playground - Skate facilities	

Rainwater management		
Level	Description	Image
Level 1 (current)	No removal of pollutants from rainwater	
Level 2	Clean rainwater to remove pollutants before they enter the river/creek	
Level 3	Clean rainwater to remove pollutants before they enter the river/creek and reuse the rainwater for irrigation	

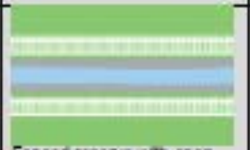
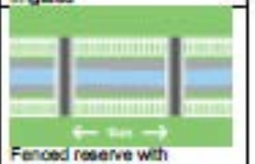
Vegetation		
Level	Description	Image
Level 1 (current)	Bare soil and non-maintained grass	
Level 2	Well-maintained grass	
Level 3	Well-maintained grass with sparse trees and shrubs to provide some shading	
Level 4	Well-maintained grass with many trees and shrubs for extensive shading, and is irrigated	

Local crossings		
Level	Description	Image
Level 1 (current)	Fenced reserve with open concrete channel (MOS)	
Level 2	Fenced reserve with pedestrian foot bridges to cross the open concrete channel every few hundred metres.	
Level 3	Fences removed and channel filled in for a 100 m section at every 1 km length of the reserve.	
Level 4	Fences removed and channel filled in for sections up to 1 km long.	

Path		
Level	Description	Image
Level 1 (current)	Old asphalt path shared by pedestrians and cyclists	
Level 2	Renovated concrete paths separate for pedestrians and cyclists	
Level 3	Renovated concrete path shared by pedestrians and cyclists	

Choice experiment: Example of a choice set

Design scenario 1 1

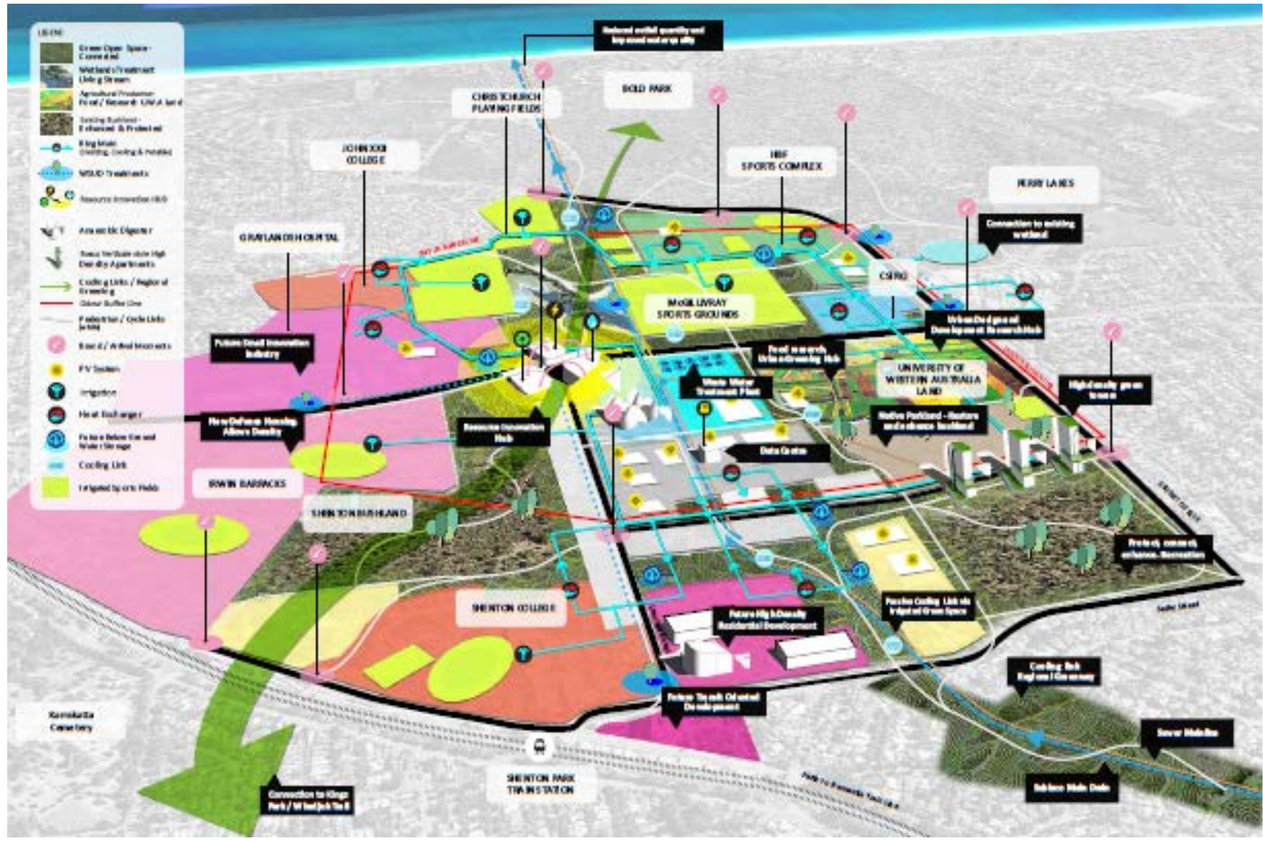
	Option 1 (Current)	Option 2	Option 3
General park facilities	 No General park facilities	 Basic level of facilities: - Seats - Drink fountains	 Moderate level of facilities: - Seats - Drink fountains - BBQ
Exercise facilities	 No Exercise facilities	 High level of facilities: - Exercise equipment - Playground - Skate facilities	 High level of facilities: - Exercise equipment - Playground - Skate facilities
Rainwater management	 No removal of pollutants from rainwater	 Clean rainwater to remove pollutants before they enter the river/creek and reuse the rainwater for irrigation	 Clean rainwater to remove pollutants before they enter the river/creek and reuse the rainwater for irrigation
Vegetation	 Bare soil and non-maintained grass	 Well-maintained grass with many trees and shrubs for extensive shading, and is irrigated	 Well-maintained grass with many trees and shrubs for extensive shading, and is irrigated
Connectivity	 Fenced reserve with open concrete channel	 Fences removed and channel filled in for sections up to 1 km long	 Fenced reserve with pedestrian foot bridges to cross the open concrete channel every few hundred metres
Active transport	 Old asphalt path shared by pedestrians and cyclists	 Renovated concrete path shared by pedestrians and cyclists	 Renovated concrete path shared by pedestrians and cyclists
Additional one-time charge	$0	10	25
Which option would you choose?	□	□	□
Which is your least preferred option?	□	□	□

CRC for Water Sensitive Cities

WP5.2: Subiaco Wastewater Precinct, Perth

- The Subiaco plant is one of three that treat around 85% of the total sewage produced in the Perth-Peel region

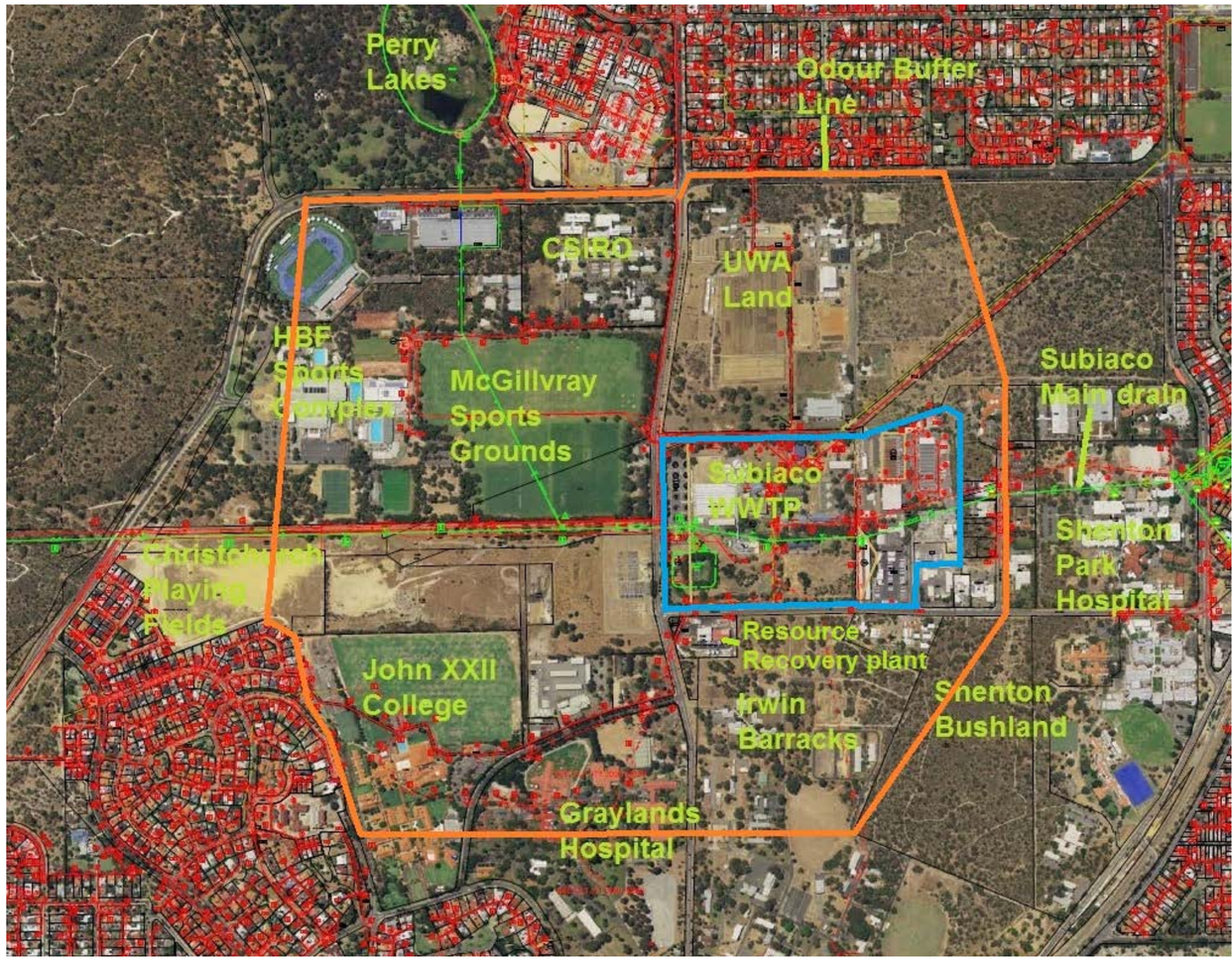
- Currently servicing 240K population => 290K (in 2030)



WP5.2: Subiaco Wastewater Precinct, Perth

- Economic evaluation of optimal use of the resource precinct with due consideration of intangible benefits and costs.

- Workshop on Ideas for Subiaco

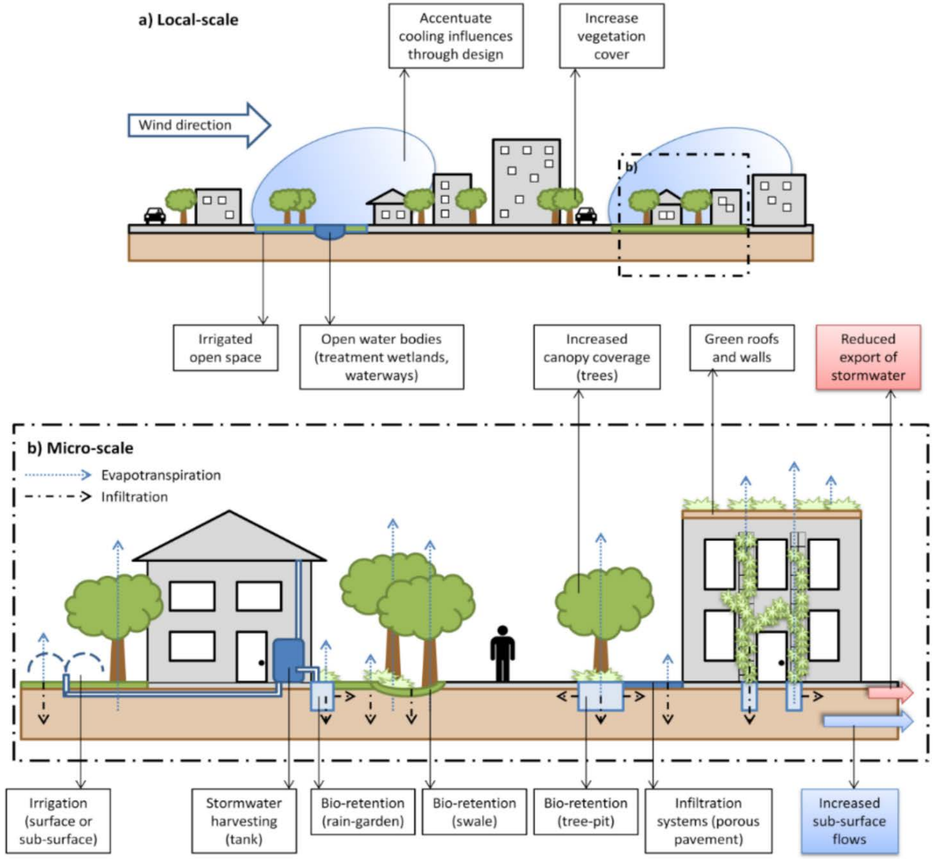


WP6: Urban Heat Island mitigation

Process/Progress

- Purpose - economic valuation of cooling from WSUD

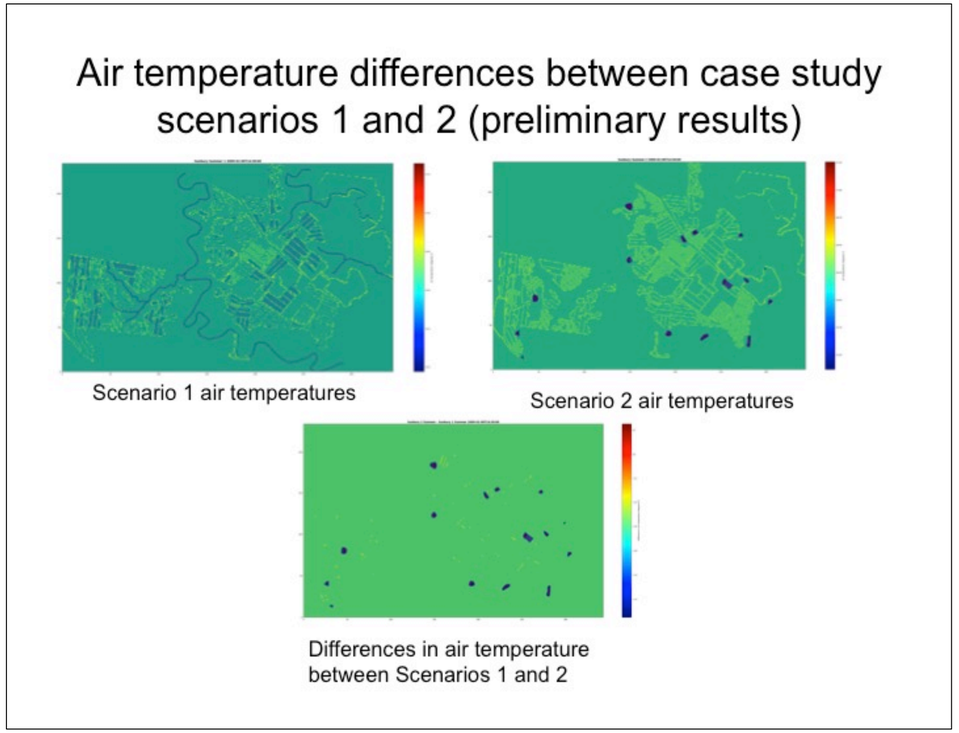
- Case study area is ~ 3,770 ha new growth area adjacent to an existing urban area in outer Melbourne



WP6: Urban Heat Island mitigation

Process/Progress

- 4 scenarios –
  - *Scenario 1 = no WSUD or whole of water cycle management*
  - *Scenario 2 = current regulatory settings for WSUD*
  - *Scenario 3 = proposed changes for WSUD*
  - *Scenario 4 = a targeted UHI mitigation scenario to achieve a desired cooling (e.g. 2 degrees on extreme heat days).*



- All scenarios (1-4) are complete and modelling has been successfully undertaken on the heat mitigation provided by those scenarios using the SURFEX and (our CRCWSC) TARGET climate models.

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Thank you.