
An Overview
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watersensitivecities.org.au

James Fogarty
Project Deputy Leader, IRP2
University of Western Australia

Integrated economic assessment and business case development

Email: James.Fogarty@uwa.edu.au
(or the project leader Sayed Iftekhar
Email: mdsayed.iftekhar@uwa.edu.au)
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?
IRP2
Researchers

Dr Sayed Iftekhar  
UWA

Dr James Fogarty  
UWA

Prof David Pannell  
UWA

Dr Maksym Polyakov  
UWA (from 2018)

Mrs Tammara Harold  
UWA

Dr Mark Siebentritt  
Seed Consulting

Prof Nigel Tapper  
Monash

Dr Kerry Nice / Stephanie Jacobs  
Monash

Mr Kym Whiteoak  
RMCG

Dr Sara Lloyd  
E2Design

Dr Asha Gunawardena  
UWA (2017)
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

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)

<table>
<thead>
<tr>
<th>Value</th>
<th>Melbourne</th>
<th>Sydney</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of flash flood by half</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Flood never</td>
<td>83</td>
<td>85</td>
</tr>
<tr>
<td>Stream health (medium)</td>
<td>84</td>
<td>117</td>
</tr>
<tr>
<td>Stream health (high)</td>
<td>234</td>
<td>229</td>
</tr>
<tr>
<td>Removal of level 3 &amp; 4 water restrictions</td>
<td>5</td>
<td>90</td>
</tr>
<tr>
<td>Removal of complete water restrictions</td>
<td>155</td>
<td>242</td>
</tr>
<tr>
<td>Reduction of temperature by 2 degree</td>
<td>45</td>
<td>54</td>
</tr>
</tbody>
</table>

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

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
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 Victoria?
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

Themes
- Non-point source pollution
- Flood hazard reduction
- Climate change mitigation
- Wastewater management
- Improved groundwater quality
- Ecological and environmental value
- Water supply and pricing
- Green infrastructure

Number of studies

Australia
Rest of the world
Distribution of studies by location
Distribution of studies by method used
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
**What does the NMV database look like**

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

- Water supply and pricing (largest segment)
- Ecological & environmental value
- Flood
- Green Space
- Stormwater
- Wastewater
- Other
- Cultural heritage
- Air pollution

CRC for Water Sensitive Cities
Distribution of values by value types
Distribution of values by systems/service/context
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
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

<table>
<thead>
<tr>
<th>Private</th>
<th>Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Amenity</td>
<td>• Amenity</td>
</tr>
<tr>
<td>• Recreation</td>
<td>• Recreation</td>
</tr>
<tr>
<td></td>
<td>• Connectivity (local access)</td>
</tr>
<tr>
<td></td>
<td>• Water quality (nutrient, heavy metal)</td>
</tr>
<tr>
<td></td>
<td>• Health (active living)</td>
</tr>
<tr>
<td></td>
<td>• Reduced heat</td>
</tr>
<tr>
<td></td>
<td>• Ecological/biodiversity/habitat</td>
</tr>
<tr>
<td></td>
<td>• Access to nature/mental health</td>
</tr>
<tr>
<td></td>
<td>• Industrial employment opportunities</td>
</tr>
<tr>
<td></td>
<td>• Indigenous heritage</td>
</tr>
</tbody>
</table>
# Urban design/practice and features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Wetlands</td>
<td>5</td>
</tr>
<tr>
<td>B. Living streams</td>
<td>1</td>
</tr>
</tbody>
</table>
## Closest matching studies

<table>
<thead>
<tr>
<th>Citation</th>
<th>Title</th>
<th>Value location</th>
<th>Sub-category of value</th>
<th>Definition of the marginal change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pandit et al. (2014)</td>
<td>Valuing public and private urban tree canopy cover</td>
<td>WA</td>
<td>Amenity</td>
<td>% increase of property price for having wetlands within 300 m</td>
</tr>
<tr>
<td>Polyakov et al. (2017)</td>
<td>The value of restoring urban drains to living streams</td>
<td>WA</td>
<td>Amenity</td>
<td>% increase of property value within 200 m of the restoration site</td>
</tr>
</tbody>
</table>
## Benefit transfer - amenity value of wetlands

<table>
<thead>
<tr>
<th>Context</th>
<th>Study site</th>
<th>Policy site</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Perth, Western Australia</td>
<td>Perth, Western Australia</td>
</tr>
<tr>
<td><strong>Setting</strong></td>
<td>Urban (established)</td>
<td>Urban (new)</td>
</tr>
<tr>
<td><strong>Nature of wetlands</strong></td>
<td>Mix of natural, man-made or extensively modified</td>
<td>Man-made or extensively modified</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>0.3-329 ha</td>
<td>15 ha</td>
</tr>
<tr>
<td><strong>Average house price</strong></td>
<td>$ 1,000,000 (2009)</td>
<td>$ 380,000 (2018)</td>
</tr>
<tr>
<td><strong>Average distance to wetlands</strong></td>
<td>943 m</td>
<td>300m</td>
</tr>
</tbody>
</table>
Wetlands – underlying details
# Wetlands benefit transfer

<table>
<thead>
<tr>
<th>Features</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage increase of property value (%)</td>
<td>0.92</td>
<td>1.87</td>
<td>2.81</td>
</tr>
<tr>
<td>Number of properties within 300m distance</td>
<td>348</td>
<td>348</td>
<td>348</td>
</tr>
<tr>
<td>Average property price ($)</td>
<td>380,000</td>
<td>380,000</td>
<td>380,000</td>
</tr>
<tr>
<td>Total amenity value ($) for residents due to wetlands</td>
<td>1,216,608</td>
<td>2,472,888</td>
<td>3,715,944</td>
</tr>
</tbody>
</table>
Benefit transfer - amenity value of living stream

<table>
<thead>
<tr>
<th>Context</th>
<th>Study site</th>
<th>Policy site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Perth, Western Australia</td>
<td>Perth, Western Australia</td>
</tr>
<tr>
<td>Setting</td>
<td>Urban (established)</td>
<td>Urban (new)</td>
</tr>
<tr>
<td>Nature of living stream</td>
<td>Restoration site</td>
<td>Restoration site</td>
</tr>
<tr>
<td>Average house price</td>
<td>$ 238,749 (2013)</td>
<td>$ 380,000 (2018)</td>
</tr>
</tbody>
</table>
Living stream – underlying assumptions
Living stream – benefit transfer

<table>
<thead>
<tr>
<th>Features</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage increase of property value (%)</td>
<td>Low: 2.9</td>
</tr>
<tr>
<td>Number of properties within 200m distance</td>
<td>Low: 170</td>
</tr>
<tr>
<td>Average property price ($)</td>
<td>Low: 380,000</td>
</tr>
<tr>
<td>Total amenity value ($) for residents due to living stream</td>
<td>Low: 1,873,400</td>
</tr>
</tbody>
</table>
Amenity values

- Wetland
- Living stream

Amenity Values

- 0
- 500,000
- 1,000,000
- 1,500,000
- 2,000,000
- 2,500,000
- 3,000,000
- 3,500,000
- 4,000,000
- 4,500,000
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)
Components of BCA Tool

- “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**

1. Where, what, how?
   - Project activities 1.4, 1.5, 1.6
   - Location and scale 1.1
   - General goal 1.2

2. Benefits
   - Works and actions 1.3
   - With vs without scenarios 2.2
   - Potential benefit levels by benefit type 2.3, 2.4

3. Participation, costs, risks
   - Participation and compliance 3.1
   - Project costs 3.2, 3.3, 3.4
   - Project risks 3.5
   - Negative spinoffs 3.6

Net Present Value Benefit: Cost Ratio Summary report
What’s next

- 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

(1) Need Assessment
- Understand the issue / problem
- Regulatory framework
- Review and collect relevant information

(2) Information collection
- Conduct primary studies (if required)
- Assess the potential of benefit transfer tool

(3) Economic evaluation
- BCA of alternatives
- Distribution of benefits & costs

(4) Feasibility analysis & recommendation
- Engage with regulators
- Recommendation for implementing agencies and regulators
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.
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.
<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 (current)</td>
<td>No facilities</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 2</td>
<td>Minimum facilities: - Seats</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 3</td>
<td>Basic level of facilities: - Seats - Drink fountains</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 4</td>
<td>Moderate level of facilities: - Seats - Drink fountains - BBQ</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 5</td>
<td>High level of facilities: - Seats - Drink fountains - BBQ - Toilet</td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
<tr>
<td>Level</td>
<td>Description</td>
<td>Image</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Level 1</td>
<td>No exercise facilities</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 2</td>
<td>Basic level of facilities: - Exercise equipment</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 3</td>
<td>Basic level of facilities: - Exercise equipment - Playground</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 4</td>
<td>Moderate level of facilities: - Exercise equipment - Playground</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 5</td>
<td>High level of facilities: - Exercise equipment - Playground - Skate facilities</td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
<tr>
<td>Level</td>
<td>Description</td>
<td>Image</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Level 1</td>
<td>No removal of pollutants from rainwater</td>
<td>![Image]( Level 1.jpg)</td>
</tr>
<tr>
<td>Level 2</td>
<td>Clean rainwater to remove pollutants before they enter the river/creek</td>
<td>![Image]( Level 2.jpg)</td>
</tr>
<tr>
<td>Level 3</td>
<td>Clean rainwater to remove pollutants before they enter the river/creek and reuse the rainwater for irrigation</td>
<td>![Image]( Level 3.jpg)</td>
</tr>
<tr>
<td>Level</td>
<td>Description</td>
<td>Image</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>Level 1 (current)</td>
<td>Bare soil and non-maintained grass</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 2</td>
<td>Well-maintained grass</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 3</td>
<td>Well-maintained grass with sparse trees and shrubs to provide some shading</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 4</td>
<td>Well-maintained grass with many trees and shrubs for extensive shading, and is irrigated</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Level</td>
<td>Description</td>
<td>Image</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Level 1 (current)</td>
<td>Fenced reserve with open concrete channel (MOS)</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 2</td>
<td>Fenced reserve with pedestrian foot bridges to cross the open concrete channel every few hundred metres.</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 3</td>
<td>Fences removed and channel filled in for a 100 m section at every 1 km length of the reserve.</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 4</td>
<td>Fences removed and channel filled in for sections up to 1 km long.</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Level</td>
<td>Description</td>
<td>Image</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Level 1</td>
<td>Old asphalt path shared by pedestrians and cyclists</td>
<td><img src="https://example.com/path1.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 2</td>
<td>Renovated concrete paths separate for pedestrians and cyclists</td>
<td><img src="https://example.com/path2.png" alt="Image" /></td>
</tr>
<tr>
<td>Level 3</td>
<td>Renovated concrete path shared by pedestrians and cyclists</td>
<td><img src="https://example.com/path3.png" alt="Image" /></td>
</tr>
</tbody>
</table>
Choice experiment:
Example of a choice set
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.
Thank you.