
An Overview
8 March 2018

watersensitivocities.org.au

Sayed Iftekhar

Project Leader, IRP2

CRC WSC IRP2 Integrated economic assessment and business case development
The University of Western Australia (UWA)
Email: mdsayed.iftekhar@uwa.edu.au
Structure of the talk

- A background of Tranche 1 research
- A snap-shot of NMV studies
- An overview of IRP2
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 valuations

- 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 commonly applied to wastewater treatment plants to identify the area impacted by odour. How that land is best used depends, in part, on community values.

This study conducted a survey (n=709) to understand community preferences for different land uses within buffer zones in Perth and regional Western Australia.
4 land use attributes: nature conservation, agriculture, sports & recreation and industry.

The choice experiment involved two information conditions, one using text and tables only, the other had the option for respondent to view land use maps.
Buffer....

- There was a clear, consistent, preference ordering for land use within buffer zones.

- The most preferred land use was nature conservation.
Changing current land zoning at 3 treatment plants shows large increases in community welfare, although costs of provision are not considered here.
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

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

2. A Benefit-Cost Analysis tool, framework and guideline

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
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
Distribution of studies by themes

- 1 = Green infrastructure
- 2 = Water supply and pricing
- 3 = Ecological and envt. value of water
- 4 = Improved groundwater quality
- 5 = Wastewater management
- 6 = Climate change mitigation
- 7 = Flood hazard reduction
- 8 = Non-point source pollution

Australian studies - bubbles with patterns; International studies - bubbles with solid fill.
Size of each bubble shows the percentage of studies under each theme.
Distribution of studies by location
Distribution of studies by method used
NMV database

- Started with the Australian studies
- Information from 52 studies (233 non-market values) have been included so far
- Information organized in an excel spreadsheet-based database
<table>
<thead>
<tr>
<th>Obs. ID</th>
<th>Paper ID</th>
<th>Citation</th>
<th>Title</th>
<th>WTP measure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Value location</td>
<td>Theme</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Value Type</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>System</td>
</tr>
<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>
</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>
</tr>
</tbody>
</table>
Distribution of values by themes

- Pollution
- Flood
- Climate change
- Cultural heritage
- Recycled water
- Dam
- Stormwater
- Wastewater
- Green Space
- Water supply and pricing
- Ecological & environmental value

[Bar chart showing the distribution of values by themes, with water supply and pricing having the highest percentage.]
## Distribution of values by themes and methods used

<table>
<thead>
<tr>
<th>Theme</th>
<th>Method (% of total)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RP (house price)</td>
<td>SP (survey)</td>
<td>Other</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Climate change</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Cultural heritage</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Dam</td>
<td>50</td>
<td>50</td>
<td>0</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Ecological &amp; environmental value</td>
<td>23</td>
<td>77</td>
<td>0</td>
<td>133</td>
<td></td>
</tr>
<tr>
<td>Flood</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Green Space</td>
<td>70</td>
<td>20</td>
<td>10</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Pollution</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Recycled water</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Stormwater</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Wastewater</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Water supply and pricing</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td><strong>All themes</strong></td>
<td><strong>21</strong></td>
<td><strong>77</strong></td>
<td><strong>2</strong></td>
<td><strong>233</strong></td>
<td></td>
</tr>
</tbody>
</table>

CRC for Water Sensitive Cities

watersensitivecities.org.au
## Distribution (%) of values by themes and states

<table>
<thead>
<tr>
<th>Theme</th>
<th>ACT</th>
<th>NSW</th>
<th>NT</th>
<th>QLD</th>
<th>SA</th>
<th>TAS</th>
<th>VIC</th>
<th>WA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cultural heritage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dam</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ecological &amp; environmental value</td>
<td>2</td>
<td>14</td>
<td>1</td>
<td>15</td>
<td>7</td>
<td>1</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Flood</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Green Space</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Pollution</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Recycled water</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stormwater</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Wastewater</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Water supply and pricing</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>All themes</strong></td>
<td>13</td>
<td>18</td>
<td>2</td>
<td>26</td>
<td>15</td>
<td>2</td>
<td>14</td>
<td>10</td>
</tr>
</tbody>
</table>
Use of the spreadsheet database

1. Decide the type of benefits/services you are interested in.

   - Check the theme categories and sub-categories. Is there any entry related to the benefits?
     - No
       - Think about alternative methods (conduct primary studies or use adjusted values from international studies)
     - Yes
       - Check the details of individual studies. Identify the entries closest to the policy site and more recent. Are there multiple entries?
         - No
           - Decide the study is reliable or not
             - No
               - No
             - Yes
               - Yes
                 - Select the entries with better quality. Decide whether the studies are reliable or not.
                   - Yes
                     - Entries matches with policy site?
                       - Yes
                         - Check the adjusted WTP estimates (2016)
                       - No
                         - Calibrate the adjusted WTP estimates (2016) for policy site
Use of the spreadsheet 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)

● Affected population
  ▪ Potential increase of residential population – 800 people
  ▪ Dwelling target – 348

● Socio-economic characteristics (Bellevue 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></th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Wetlands</td>
<td>7</td>
</tr>
<tr>
<td>B. Living streams</td>
<td>1</td>
</tr>
</tbody>
</table>
## Closest matching studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Study Description</th>
<th>Location</th>
<th>Habitat Type</th>
<th>Benefit Type</th>
<th>Property Value Increase</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>Wetlands</td>
<td>Amenity</td>
<td>% increase of property price 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>Living stream</td>
<td>Amenity</td>
<td>% increase of property value within 200m of the restoration site</td>
</tr>
</tbody>
</table>
## Benefit transfer - amenity value of wetlands

<table>
<thead>
<tr>
<th></th>
<th>Study site</th>
<th>Policy site</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Context</strong></td>
<td>Urban (established)</td>
<td>Urban(new)</td>
</tr>
<tr>
<td><strong>Nature of wetland</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 distance to wetlands from properties</strong></td>
<td>943 m</td>
<td>300m</td>
</tr>
</tbody>
</table>
Amenity value of wetlands

Percentage increase of property value = 0.9 - 2.8 %
Number of properties = 348
Average property price = $380,000

Total amenity value for residents due to wetlands = $3,041,520
( $1,190,160 - $3,702,720)
Amenity values of living streams

Property price premium

Within 200m = 2.8 - 6.6 %
Number of properties with in 200m = 170
Average property price = $380,000

Amenity value of living stream = $3,940,600
($2,454,800 - 4,263,600 )
Amenity values

- Wetland
- Living stream
IRP2: Current work and future plan
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

Process

• Collate information about existing BCA tools

• One-to-one interviews; discussions with tool developers and economists

• All of the lessons encapsulated into a detailed spec for BCA tool (over 30 pages)
WP3: Benefit-Cost Analysis

Process

• The draft framework (specs) has been prepared and shared with the PSC and Case study partners
WP4: Financial models

Process

• Early stage
• Organized two sessions with WSAA
• Multiple meetings with Economic Regulation Authority (ERA), WA
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
WP5.1: Greening the Pipeline (GTP), Melbourne

- The Greening the Pipeline initiative aims to convert 27-km of the heritage listed Main Outfall Sewer pipeline into a parkland.

- A 100m section at Williams Landing has been transformed into a parkland for community use.
WP5.1: GTP, Melbourne

Information on the cost effectiveness of creating linear parklands in urban areas:

- **Amenity (specifically facilities)** – e.g. seats vs picnic tables vs bbqs and toilets; public art; educational signage?
- **Recreation** (i.e. playground equipment, gym equipment, dog park, etc.)
- **Stormwater** (i.e. bioretention system like the one at the Pilot Park)
- **Vegetation** – vegetation for people (i.e. large areas of grass) vs for habitat; manicured vegetation vs bushlike/wild vegetation
- **Connectivity** – connectivity across the pipeline
- **Active transport** - Federation Trail enhancement. Current poor condition vs upgrade to a high standard.
WP5.1: Greening the Pipeline, Melbourne

- The house price data procurement arrangement has been finalized with a commercial company. This data will be used to conduct hedonic analysis.

- The draft questionnaire for the Choice experiment has been prepared and shared with the case study partners.


MW GTP video

[Greening the Pipeline](http://greeningthepipeline.com.au/)
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).

- Scenarios 1-3 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.