Water alternatives for Adelaide (and SA)

Dr John Tibby
Senior Lecturer
Geographical and Environmental Studies
john.tibby@adelaide.edu.au
Twitter: @john_tibby
Structure

- Key issues
- History of water use in Adelaide
- Constraints on water use and adaptation in Adelaide
- Alternatives
- A framework for future decisions
Brad Udall, Director, Western Water Assessment, University of Colorado & NOAA, (recent visitor to SA Department for Water) said...

“Climate change is about water”
Before we “start”

- What is the capacity of Mount Bold Reservoir?
- 45 gigalitres (GL)

Image source: www.wikipedia.org
Summary: Adelaide water

- 2013 water use: 214 GL
- Groundwater (bores): 6%
- Rainwater tanks: <1%
- Desalination plant: 100 GL/year
- Average (pre-desalination plant): 60% from Adelaide Hills catchments, 10% in drought years
(A brief) history of water use

- Adelaide’s water supply has been supplemented by transfers from the River Murray since 1955
  - In that year, water use rose by 20%
  - Adelaide was the only mainland city not to have water restrictions.
- Entitlement to water from the MDB derives from previous Murray Darling Basin agreements
  - Included SA funding of Dartmouth Dam in Victoria
- 2005 “Water Proofing Adelaide...” released from a widespread consultative process. Ideas included:
  - 37 GL demand reduction
  - 11 GL stormwater
  - 16 GL recycled water
  - 4 GL rainwater tanks
Adelaide: a comparison 1

- “Adelaide annual water use”

Data source: Water for Good (2009)
Adelaide: a comparison

per capita water usage Kl/hd/yr 2002-2003

Melbourne  84
Sydney      92
Perth       101
Brisbane    106
Adelaide    124*

* Measured during a high use year

Where is water used?

**Opportunity:** considerable potential for use of non-potable water in the city

**Constraint:** Retrofitting is expensive

Information source: Water Proofing Adelaide (2005)
There is a fine (obvious) irony...

- Gardens need more water when it is hot!
- Graph: Annual water use vs. reservoir level (April of each year)

Source media release by Paul Caica “Water restrictions eased again” 11/4/2010
Challenges for future water use

- Population growth and distribution
- Climate change
- Change in the Murray Darling Basin
- Environmental water allocations
- “Redundancy”
  - Retro-fitting a city

Constraints interact and are both human and environmental.
Challenges 1: population growth

- Population policies have succeeded in increasing Adelaide’s growth

Data source: Water for Good (2009)
Population growth: effects...

- Expanding population, expanding water use...

Data source: Water for Good (2009)

Question...How to “fill” the circles?
Challenges 2: Climate change

- Most of the last 20 years have been warmer than average...

Source: www.climatechangeinaustralia.gov.au
Climate change...

- Drying trend for last ~ 50 years

Source: www.climatechangeinaustralia.gov.au
Predicted to get worse...

- 50% chance of 5% rainfall decline by 2030
- Perhaps a 25% reduction in stream flow

Source: www.climatechangeinaustralia.gov.au
Climate change: summary

- Water for Good strategy plans for a 41% reduction in next 40 years from Mount Lofty Ranges

Data source: Water for Good (2009)
Challenges 3: The (changing) Murray

- Murray-Darling Basin is Australia’s largest river basin, accounting for about 70% of irrigated crops and pastures (MDBC, 2006).
- Average natural discharge to the sea: 14,000 GL
- Average irrigation extraction: 11,000 GL

Open channel cotton irrigation near St George, southern Queensland
South Australian use of Murray

- Have a “guaranteed” allocation of 1850 GL
  - 570 GL: irrigation
  - 170 GL: domestic water (mainly Adelaide)
  - 1110 GL: “environment” (complex)

- **Total storage volume in Basin: 9885 GL (44% full)**
  6th Aug, 2015

• Discharge likely to fall 10-25% by 2050 (A1 scenario)
• From the Garnaut Review (quoted in Govt’s green paper):
  ○ By 2100 a 92% decline in irrigated agricultural production in the Murray-Darling Basin
• Conclusion: reduced reliance on MDB needed in Adelaide.
Water “users” in MDB in 2020

- Canberra bushfire regrowth: 130 GL/yr
- Climate change: 1100 GL/yr
- Living Murray Initiative: 500 GL/year?
  - 327 GL delivered in 2013-2014 (from Commonwealth);
    >1000 GL in total

source: adapted from Lawrie and Williams (2004)
Murray vs. Torrens water quality

Suspended solids (mean)

Source: Greg Ingleton, SA Water
Murray vs. Torrens water quality 2

![Graph showing water quality trends between Murray and Torrens with specific years and phosphorus levels.](image-url)
Over to you...

- What are the options?

• **Positives:**
  - Currently there is excess stormwater discharge from Adelaide
  - Builds on success: Adelaide has highest amount of stormwater harvest of any state
  - Approximately 6 GL/yr

• **Negatives:**
  - Volume of water is not particularly large:
    - 20 GL/yr by 2013
    - 60 GL/yr by 2050

*Source: Water for Good (2009)*

*Stormwater outflow near Brighton, Adelaide*
Groundwater

- **Positives:**
  - (perceived) ability to draw on limitless supply
  - In 2007 there were 500 applications for the drilling of domestic water bores in Adelaide...
    - Increased from 85 in 2005

- **Negatives**
  - Also vulnerable to climate change

Re-use

- **Positives:**
  - A large resource available
  - Reduced pollution to marine environment

- **Negatives:**
  - Retrofitting is a challenge
  - There are unknowns associated with long-term usage
Desalination

• Positives:
  o “Limitless” supply
  o Delivers a large amount of water

• Negatives:
  o Massive cost
    ▪ Construction: $1.83 Billion
    ▪ Ongoing increased water cost
  o Environmental impact
    ▪ Greenhouse emissions
“Water for Good” vision

- Water supply in a dry year...

“Water for Good” vision

Greater Adelaide’s water supply from all sources for both drinking and non-drinking purposes

2010

2014

2025

2050

Conclusion (almost)

- There has been a “stepping away” from demand management and a focus on desalination
  - Are there different more radical ways to re-configure a city?
- Federal Government contribution means lower demand on River Murray
- Being able to “flick a switch” and supply 1/3 our water needs could reduce innovation in other areas...
How to assess?

**Adaptation**

Actions taken in response to climate change which “...*moderate harm or exploit beneficial opportunities.*” (Klein *et al.*, 2007)

**Maladaptation**

“...*an adaptation that does not succeed in reducing vulnerability but increases it instead.*” (IPCC, 2001)
Maladaptation “indicators”

1. Increase greenhouse gas emissions
2. Disproportionately burden the most vulnerable
3. Produce high opportunity costs
   Compared to alternate options
4. Reduce other incentives to adapt
   By undermining alternative adaptation actions
5. Create “path dependency”
   Scale of investment creates “locked-in” commitment to a specific adaptation pathway

(Barnett and O’Neill, 2010)
Challenges experienced by Adelaide (and SA more broadly) reflect those experienced in other parts of the world.

There may be more than one precautionary principle which needs to be applied.

Maladaptation framework MAY help you to assess the desirability of future adaptation strategies.
Information sources

- Water Proofing Adelaide: Water Proofing Adelaide A thirst for change 2005 – 2025
Unused but potential useful slides follow
Adelaide consumption

- Dry vs. wet years...

Information source: Waterproofing Adelaide (2005)