



# MARCHMENT HILL

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## Stormwater - Curse or Virtue?

The Senate Inquiry<sup>1</sup> into Stormwater Resources in Australia, due to report on 19 August 2015, is a reminder of the complex set of challenges faced when we plan and manage stormwater systems.

### Challenge #1 - Floods are costly and dangerous



*Photo courtesy of Steven Riddle*

The Insurance Council of Australia estimates the insured costs of the 2011 floods in Queensland and Victoria exceeded \$2.5bn. The annual total economic cost<sup>2</sup> of natural disasters in Australia is predicted to increase from \$6.3bn in 2011 to \$23.0bn in 2050. The National Disaster Insurance Review (NDR)<sup>3</sup> suggests that between 5% and 10% of Australian households are susceptible to flooding. In 2012, this review recommended a national update and portal for flood information to be delivered by the National Flood Risk Information Program<sup>4</sup> incorporating a comprehensive review and update of the Australian Rainfall and Runoff<sup>5</sup> guideline published by Engineers Australia. The NDR made further recommendations about insurance coverage, including a temporary

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<sup>1</sup> [www.aph.gov.au/Parliamentary\\_Business/Committees/Senate/Environment\\_and\\_Communications/Stormwater](http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Stormwater)

<sup>2</sup> <http://australianbusinessroundtable.com.au/white-paper>

<sup>3</sup> <http://www.ndir.gov.au/content/Content.aspx?doc=home.htm>

<sup>4</sup> <https://www.em.gov.au/Publications/Program%20publications/Pages/National-Guidelines-for-the-National-Flood-Risk-Information-Program.aspx>

<sup>5</sup> <http://www.arr.org.au/>

discount on premiums for high-risk areas and an indemnity regime for providers of flood information.

Getting the numbers right and sharing information and risk are not the only challenges. Flood protection and drainage systems are designed to fail. That is, there is a level of risk (typically, beyond the 1-in-100-year rainfall event) at which the community is prepared to accept the consequences of flooding. A trade-off is made between the costs of prevention and the costs of coping with floods. However, some consequences of flooding are deemed 'intolerable'.

\*\*\* "A reasonable person would agree that, almost regardless of cost, the consequence of the flood should be virtually eliminated or significantly reduced.

Factors which may make flood risks intolerable include:

- Significant threat to life health or safety
- Potential impacts to large numbers of people
- Significant environmental impacts
- Significant disruption to economic activity or public infrastructure"

Melbourne Water (2007) Port Phillip and Westernport Region Flood Management and Drainage Strategy\*\*\*

## Challenge #2 - Climate change will bring more floods

Perversely, while climate change is predicted to exacerbate problems of water scarcity, recent Australian research<sup>6</sup> published in Nature Geoscience predicts climate change will also increase the intensity of rain storms causing more flooding. Investigating the temporal rainfall patterns within storms, the study predicts increased flood peaks and flash floods for all of Australia's major cities.

\*\*\* "Our results were consistent across all the climate zones in Australia, regardless of season or storm type, without exception. This was an unexpected finding, and it supports our hypothesis that increasing temperatures are changing rainfall patterns. It means that most people in Australia can expect to see intensification in the magnitude of flash flooding in smaller catchments, particularly in urban or residential areas."

Co-author Professor Ashish Sharma, UNSW \*\*\*

Lead author, UNSW PhD candidate Conrad Wasko, raises the prospect that updating our current understanding of flood potential may not be enough. "That's the big caveat," he

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<sup>6</sup> <https://newsroom.unsw.edu.au/news/science-tech/study-shows-flash-flooding-risks-increase-peak-downpours-intensify>

says. “Is our present-day climate indicative of potential changes to future climates? Or will we begin to see entirely new weather systems emerging as climates change?”

### Challenge #3 - As cities grow, urban development increases stormwater runoff

Australia’s Infrastructure Audit<sup>7</sup> predicts substantial population increases for our cities over the next 20 years - with Melbourne, for example, predicted to add another 1.8 million people between 2011 and 2031.

Urban development is accompanied by increased area of paved and other impervious surfaces so that a greater proportion of rain ends up as surface runoff and that rain-runoff response is also faster and more concentrated in time. Not only is there a greater volume of stormwater flowing in a shorter period of time, but it carries with it significant pollution loads. During floods, stormwater pollution is exacerbated by the depth and speed of the stormwater flows - mobilising contaminants from industrial sites and storage areas, and picking up overflows from sewerage systems.

However, in lower flow periods, stormwater pollution continues to present environmental problems, even for relatively minor urban catchment contributions<sup>8</sup>. A major body of research has developed on methods for improving the quality and flow characteristics of urban stormwater. This work addresses not only the impact of stormwater pollutants but also the impact of the altered hydrology resulting from stormwater contributions to urban streams. Beginning several decades ago, urban stormwater management has advanced from simple, and often poorly-maintained retention basins, to complex landscape solutions<sup>9</sup>.

### Challenge #4 - Urban water supply scarcity will return

Australia’s population is expected to grow by 36.5% between 2011 and 2031, or an additional 8.2 million people. 72% of this increase is expected to be absorbed by the four largest cities - Sydney, Melbourne, Brisbane and Perth - a collective growth of 5.9 million people, or 46%<sup>10</sup>. This growth, coupled with climate change, will place increasing pressure on urban water supplies over time.

Australia’s response to the millennium drought (1997-2010) has softened the urgency around urban water supply scarcity. The drought led each major city to build new desalination facilities to supplement supplies should rainfall-dependent sources become over-stretched. Consumer awareness through the drought, and the introduction of tiered

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<sup>7</sup> <http://infrastructureaustralia.gov.au/policy-publications/publications/Australian-Infrastructure-Audit.aspx>

<sup>8</sup> <http://www.sciencedirect.com/science/article/pii/S016920461100363X>

<sup>9</sup> <http://watersensitivecities.org.au/gum-scrub-creek-wins-2014-australian-institute-of-landscape-architects-award/>

<sup>10</sup> <http://infrastructureaustralia.gov.au/policy-publications/publications/files/Australian-Infrastructure-Audit-Key-Findings.pdf>

usage charges, led to substantial demand reductions, of the order of 30%<sup>11</sup> in some areas. Water savings derived from a range of conservation measures, such as rainwater and greywater systems and recycled urban wastewater (third pipe) supplies. The converse side of water savings is a reduction in usage-based revenues so that while stresses on supplies are relieved in the short to medium term, it is more difficult to provide for future system renewal and augmentation.

Cities face another water-related challenge from climate change, in the form of ‘liveability’<sup>12</sup>. For example, as temperatures and carbon dioxide levels increase and rainfall becomes more uncertain, it may become more difficult to maintain green spaces and street trees which directly support activities such as sports and recreation, and indirectly provide local cooling effects.

The current Senate Inquiry into Stormwater Resources in Australia follows a motion by Nick Xenophon to explore the greater use of stormwater<sup>13</sup> to supplement urban water supplies.

## Challenge #5 - Integrated stormwater management is the complex task of resolving these challenges together

Putting the first and second challenges together, if climate change increases the potential for urban flooding, then at what point will the infrastructure and investment required - even if only for ‘intolerable’ flooding - exceed the community’s capacity to deliver and pay? Work on warning systems and emergency response already attends to this possibility<sup>14</sup>.

Current industry approaches have started to address the distinct challenges of stormwater in combination. For example, Melbourne Water’s Stormwater Strategy<sup>15</sup> responds to its Flood Management and Drainage Strategy<sup>16</sup> by placing priority on critical flooding locations for stormwater calming measures.

Stormwater presents different challenges depending on time, place and perspective. These challenges may morph from one to the next as conditions develop. As a curse, stormwater is too abundant, causing floods, and too dirty or too different in its flow regime, causing environmental harm. As a virtue, stormwater can supplement urban water supplies and ‘green’ and enhance urban environments. Climate change magnifies this paradox by increasing floods and deepening water scarcity.

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<sup>11</sup> [https://www.nccarf.edu.au/sites/default/files/attached\\_files\\_publications/WATER\\_070313\\_A4.pdf](https://www.nccarf.edu.au/sites/default/files/attached_files_publications/WATER_070313_A4.pdf)

<sup>12</sup> [https://www.melbourne.vic.gov.au/AboutCouncil/PlansandPublications/strategies/Documents/climate\\_change\\_adaptation\\_strategy.PDF](https://www.melbourne.vic.gov.au/AboutCouncil/PlansandPublications/strategies/Documents/climate_change_adaptation_strategy.PDF)

<sup>13</sup> <http://www.nickxenophon.com.au/media/releases/show/billions-going-down-the-drain-by-not-harvesting-stormwater/>

<sup>14</sup> [http://www.depi.vic.gov.au/\\_\\_data/assets/pdf\\_file/0009/176319/DSE-8169-Improving-Flood-Warning-Systems\\_WEB.pdf](http://www.depi.vic.gov.au/__data/assets/pdf_file/0009/176319/DSE-8169-Improving-Flood-Warning-Systems_WEB.pdf)

<sup>15</sup> <http://www.melbournewater.com.au/aboutus/reportsandpublications/key-strategies/Documents/MW-SWS.pdf>

<sup>16</sup> [http://www.melbournewater.com.au/aboutus/reportsandpublications/key-strategies/Documents/Flood\\_Management\\_and\\_Drainage\\_Strategy\\_complete.pdf](http://www.melbournewater.com.au/aboutus/reportsandpublications/key-strategies/Documents/Flood_Management_and_Drainage_Strategy_complete.pdf)