The Senate

Environment and Communications References Committee

Stormwater management in Australia

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List of recommendations

Recommendation 1

6.12 The committee recommends that the Australian Government work with the state and territory governments to develop and implement a national policy framework for stormwater management (a National Stormwater Initiative).

Recommendation 2

6.13 To inform the development of the policy and regulatory framework under the National Stormwater Initiative, the committee recommends immediate audits to:

- **establish the scope of stormwater opportunities, taking into account water security, environmental issues and economic benefits; and**
- **collate stormwater knowledge into a central repository to aid future decision-making processes.**

6.14 The committee further recommends that the audits:

- **be conducted by a balanced, independent expert panel with input from relevant agencies, peak bodies and scientific representatives;**
- **give due consideration to industry practice, science and innovation; and**
- **use whole-of-community, whole-of-life-cycle and system analysis methodologies when assessing and prioritising potential stormwater projects and policy reforms.**

Recommendation 3

6.15 The committee recommends that the Australian Government place water policy on the agenda of an upcoming meeting of the Council of Australian Governments (COAG) and that COAG recognise the benefits that improved stormwater management can provide.

Recommendation 4

6.16 As part of the development of the National Stormwater Initiative, the committee recommends that the Australian, state and territory governments consider new funding models and financial incentives that would facilitate improved stormwater management outcomes in an economically efficient way.

Recommendation 5

6.17 The committee recommends that the Australian Government restore funding for stormwater research. As part of the development of the National Stormwater Initiative, consideration should also be given to how the overall level of research and development can be increased by attracting co-investment from other levels of government and the private sector to support and expand research activities that receive funding from the Australian Government.

Abbreviations

ATSE	Australian Academy of Technological Sciences and Engineering
COAG	Council of Australian Governments
CRC	Cooperative Research Centre
IAH-MAR	International Association of Hydrogeologists Commission on Managed Aquifer Recharge
IECA	International Erosion Control Association
PC	Productivity Commission
PMSEIC	Prime Minister's Science, Engineering and Innovation Council
WSAA	Water Services Association of Australia
WSUD	water sensitive urban design

Chapter 1

Introduction

1.1 On 16 March 2015, the Senate referred the following matter to the Environment and Communications References Committee for inquiry and report:

(a) the quantum of stormwater resource in Australia and impact and potential of optimal management practices in areas of flooding, environmental impacts, waterway management and water resource planning;

(b) the role of scientific advances in improving stormwater management outcomes and integrating these into policy at all levels of government to unlock the full suite of economic benefits;

(c) the role of stormwater as a positive contributor to resilient and desirable communities into the future, including 'public good' and productivity outcomes;

(d) model frameworks to develop economic and policy incentives for stormwater management;

(e) model land use planning and building controls to maximise benefits and minimise impacts in both new and legacy situations;

(f) funding models and incentives to support strategic planning and investment in desirable stormwater management, including local prioritisation;

(g) asset management and operations to encourage efficient investments and longevity of benefit;

(h) the role of innovation in supporting desirable outcomes and transparent decision-making, including access to information and novel technologies for planning, design and implementation; and

(i) any related matters.[1]

1.2 The committee was initially required to report by 25 June 2015. However, on 24 June 2015, the Senate granted an extension of time to report until 19 August 2015. On 10 August 2015, the Senate agreed to a further extension of time to report until 14 October 2015. On 13 October 2015, the Senate agreed to extend the reporting date further to 2 December 2015.

1 *Journals of the Senate*, 2013–15, no. 83 (16 March 2015), pp. 2283–84.

Conduct of the inquiry

1.3 The committee advertised the inquiry on its website and in *The Australian* newspaper. The committee also wrote to relevant organisations and individuals inviting written submissions.

1.4 The committee received 64 submissions, which are listed at Appendix 1. The committee held public hearings for this inquiry in Melbourne on 18 May 2015 and in Adelaide on 26 August 2015. A list of witnesses who appeared at the hearings may be found at Appendix 2.

1.5 The committee thanks all of the organisations, individuals and government departments and agencies that contributed to the inquiry.

Structure of the report

1.6 This report comprises six chapters. The matters covered in the remaining chapters of the report are outlined below:

- Chapter 2 provides an overview of the key issues related to stormwater by discussing the volumes of stormwater that Australian cities generate, the environmental damage that runoff can cause, and how urban stormwater has traditionally been managed through the use of extensive drainage systems. The evidence received by the committee that argued stormwater is an under-utilised resource is also introduced.
- Chapter 3 discusses uses for stormwater and areas where improved data, guidelines and training may help support improved outcomes.
- Chapter 4 considers the evidence received about the stormwater management roles performed by water utilities, local governments and state governments.
- Chapter 5 considers the role of the Australian Government in matters related to stormwater.
- The committee's findings and recommendations are contained in Chapter 6.

Note on references

1.7 References in this report to the Hansard of the committee's 18 May 2015 public hearing are to the official version of the transcript. References to the Hansard of the 26 August 2015 public hearing are to the proof version of the transcript. Page numbers may vary between the proof and the official Hansard transcript.

Chapter 2

Overview of stormwater in Australia

2.1 Stormwater is rainwater that runs off impervious or saturated surfaces in the urban environment, such as roofs, roads and pavements, and green spaces. In an undeveloped environment, natural vegetation and pervious areas allow for rainwater to infiltrate soils, allowing for transpiration by vegetation and evaporation into the atmosphere.[1] Urban development replaces large areas of vegetated ground with impervious surfaces, such as roofing and paving. Accordingly, the volume of stormwater runoff increases with urban development. Dealing with stormwater is essential for flood mitigation, which has shaped how stormwater has typically been managed.

2.2 Two broad issues are evident from the evidence received by the committee, namely that:

- stormwater is considered to be an under-utilised resource in Australia; and
- pollutants in urban stormwater runoff are a significant contributor to the degradation of urban waterways, and utilisation or better management of stormwater could reduce this damage.

2.3 This chapter outlines background information about stormwater in Australia, including the volume of stormwater, pollutants in urban stormwater and how stormwater is currently managed. The chapter then considers some of the benefits that stakeholders consider could be realised if stormwater is utilised to a greater extent.

Quantity of stormwater runoff

2.4 There is no clear record of stormwater volumes.[2] One estimate put to the committee is that Australia's urban areas produce around 3000 gigalitres of average annual runoff.[3] Another estimate put forward is that 'at least two-thirds' of the current urban stormwater runoff 'is in excess of what would have naturally occurred prior to settlement'.[4] A further estimate suggested that urbanised environments lead to a 90 per cent increase in the volume of water entering streams.[5]

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1 eWater, *Submission 9*, p. 3.

2 Australian Water Association, *Submission 47*, p. 1.

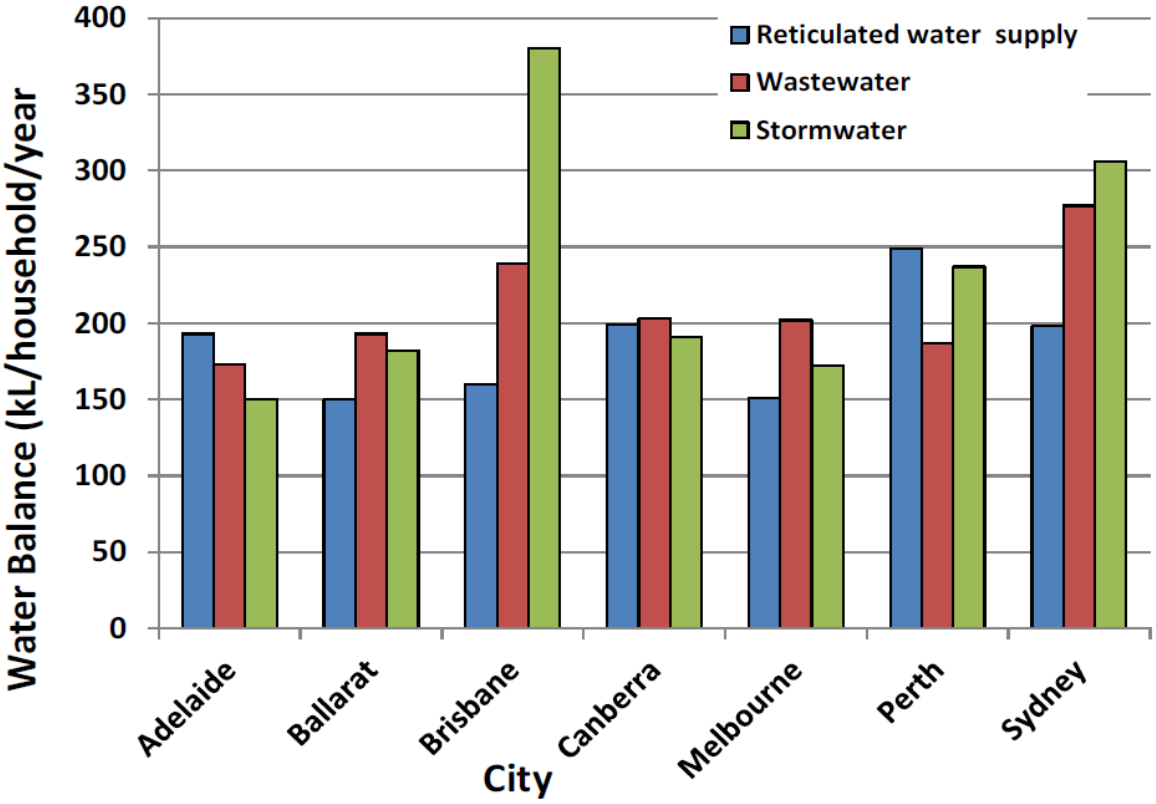
3 Stormwater Australia, *Submission 19*, p. 3. This figure includes all rainfall falling on urban areas (that is, both rainwater and stormwater).

4 Stormwater Australia, *Submission 19*, pp. 3, 8.

5 Mr Chris Beardshaw, Secretary, Stormwater Victoria, *Committee Hansard*, 18 May 2015, p. 11.

2.5 The runoff in Australian cities generally exceeds the volume of water that the cities draw from their catchments and groundwater sources, which is estimated to total 2100 gigalitres.[6] Figure 2.1 indicates how, for selected cities, the average annual volume of stormwater per household is similar to, and in some cases exceeds, the volume of other types of water used in the city.

Figure 2.1: Average annual water balances from households, various cities



Source: Urban Water Cycle Solutions, *Submission 41*, p. 5.

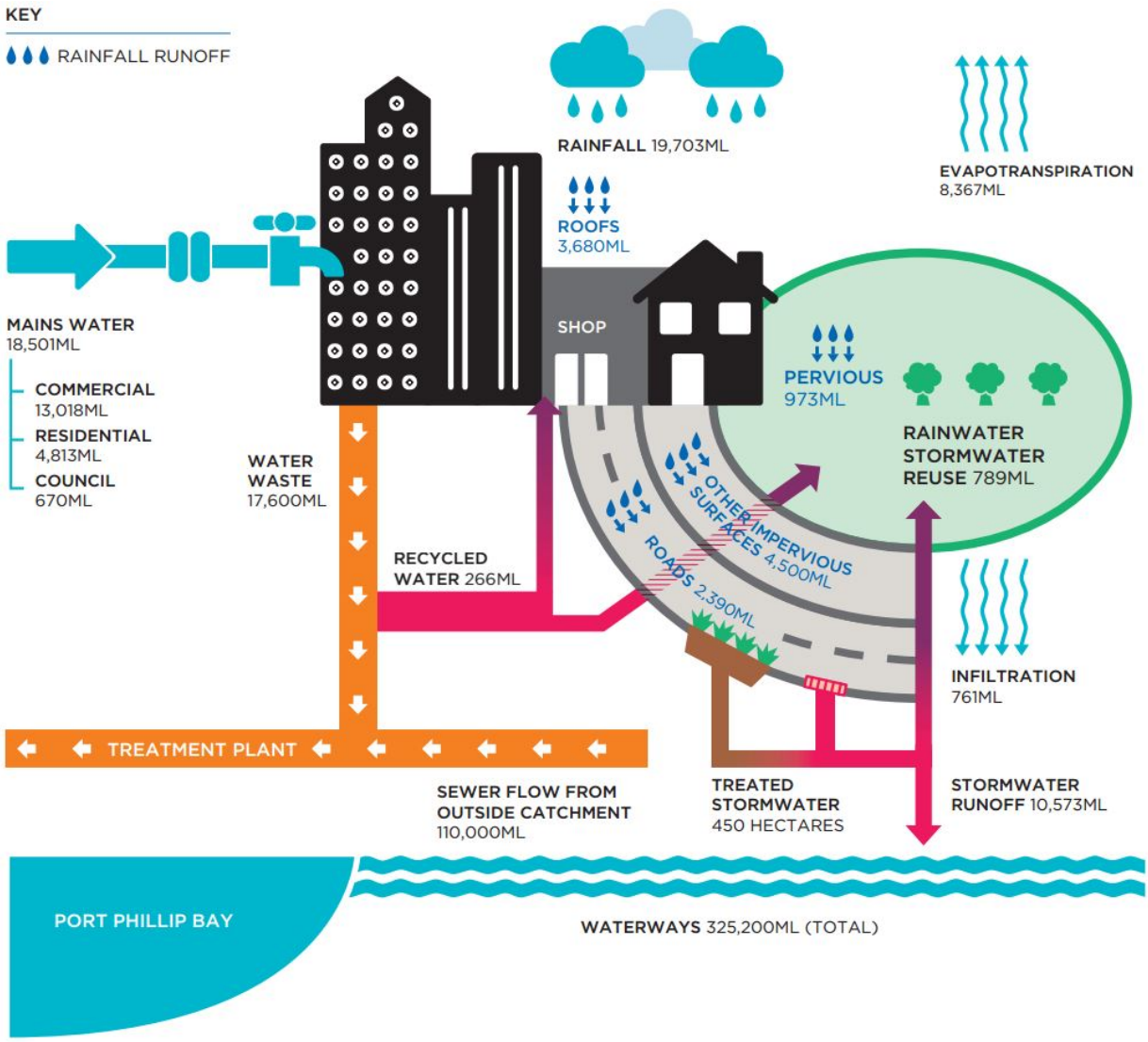
2.6 Using Melbourne as an example, Figure 2.2 illustrates the water cycle of a major Australian city, indicating the overall volume of stormwater received and the quantities of stormwater that are either utilised in the city or discharged as runoff.

2.7 Future growth in Australia's urban centres and more frequent extreme weather events due to climate change may increase volumes of stormwater further.[7]

6 Stormwater Australia, *Submission 19*, p. 3.

7 Stormwater Australia, *Submission 19*, pp. 6, 8 and 9; CSIRO, *Submission 42*, p. 2; Cooperative Research Centre (CRC) for Water Sensitive Cities, *Submission 44*, p. 1. However, the Eastern Metropolitan Regional Council noted that since the early 1970s, rainfall in the Perth region has been in decline, a trend that is expected to continue. The Council stated: 'Perth has not received the rainfall the Eastern States have and the rhetoric around the drought ending does not apply to the Perth region'. Eastern Metropolitan Regional Council, *Submission 26*, p. 2.

Figure 2.2: Melbourne's water cycle



Source: City of Melbourne, 'Total Watermark—City as a Catchment: Update 2014', *Tabled Document 4*, p. 13.

Environmental implications of stormwater

2.8 The committee received evidence on how stormwater transfers pollutants from the urban environment into local waterways, rivers and bays. For example, the University of Melbourne's Waterway Ecosystem Research Group submitted that stormwater 'is the primary driver of the degradation of streams, estuaries and embayments in Australia's cities, and indeed in cities around the world'.[8] This section outlines the types of pollutants that stormwater can contain and the damage runoff causes to the health of waterways.

Overview of pollutants

2.9 Stormwater can carry various pollutants including litter; soil; organic matter; grease, oil and metals collected from roads and properties; and fertilisers from gardens.[9]

2.10 The Adelaide and Mount Lofty Ranges Natural Resources Management Board provided an insight into the amounts of heavy metal pollutants (including copper, lead and zinc) stormwater transfers from metropolitan Adelaide to Gulf St Vincent. The Board referred to research that yielded the following findings:

> Mean and median total concentrations of copper, lead and zinc in most stormwater exceed the guidelines for marine species protection… Concentrations are highest in stormwater from highly urbanised catchments in the central metropolitan area. Median copper and lead concentrations are between 2 and 10 times, and 1.5 and 4 times the guideline values respectively. Median zinc concentrations also exceed the guideline values.[10]

2.11 IECA Australasia submitted that numerous studies have shown that construction sites are the largest contributor to pollution in stormwater. It advised that construction sites produce 50 to 200 times the amount of sediment and particulate pollution produced by completed urban areas.[11]

2.12 As stormwater can transport litter, the contribution of stormwater to marine pollution was also noted. SPEL Environmental submitted that 'because most litter makes it way to the worlds shared oceans and distant coastlines from land based stormdrains, litter solutions begin locally'. SPEL Environment noted that Victorian cities have installed 'more than 4000 side entry and in line litter traps, and in one year captured 2700 metric tonnes of litter from the stormdrains'.[12]

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8 Waterway Ecosystem Research Group, The University of Melbourne, *Submission 17*, p. 2;

9 Australian Water Association, *Submission 47*, p. 1. Australian Government, 'Your Home: Stormwater', www.yourhome.gov.au/water/stormwater (accessed 9 September 2015).

10 Adelaide and Mount Lofty Ranges Natural Resources Management Board, *Submission 11*, p. 1.

11 IECA Australasia, *Submission 2*, p. 1.

12 SPEL Environmental, *Submission 12*, p. 2.

Implications for ecosystems and waterway health

2.13 Stormwater can have significant environmental consequences for the waterways that receive it. Professor Timothy Fletcher, a professor of urban ecohydrology at the University of Melbourne, provided the following assessment of the health of Australia's urban waterways:

> Our urban rivers and creeks are greatly polluted and they require a great deal of investment to deal with erosion. As a result, they do not deliver any of the ecosystem services that a healthy stream might deliver—water purification, mitigation of flooding and, very importantly, protection of downstream waterways such as beaches and bays. Instead, our urban streams actually become a health hazard every time it rains.[13]

2.14 Professor Fletcher stated that the 'primary cause of this degradation is urban stormwater run-off'. He explained:

> We only need a very small proportion of a stream's catchment to be urbanised and to be draining that impervious run-off into the stream via pipes to end up with a highly degraded stream. So it really happens quite quickly.[14]

2.15 Professor Tony Wong from the Cooperative Research Centre (CRC) for Water Sensitive Cities offered similar comments about the effect that stormwater has on urban waterways:

> We…know from research and evidence presented by others that stormwater run-off has a significant impact on stream ecosystem health. Altered flow regimes and poor water quality as a result of stormwater run-off from impervious surfaces can render our restoration efforts for urban waterways largely ineffective. In fact, many cities have given that up and simply used concrete lining of our waterways to overcome the impact of stormwater on our urban waterways. The outcome of that, of course, is the significant degradation of the quality of our urban environment and the quality of the ecological health of our urban waterways.[15]

2.16 Or as Mr Andrew Allan from Stormwater Australia put it:

> Essentially, with most of the urban streams in [the] inner-city, once you have more than five or 10 per cent of the city drains collected through the pipes the ecological value of the waterways is essentially stuffed and that is

13 Professor Timothy Fletcher, Professor of Urban Ecohydrology, University of Melbourne, *Committee Hansard*, 18 May 2015, p. 33.

14 Professor Timothy Fletcher, *Committee Hansard*, 18 May 2015, p. 33.

15 Professor Tony Wong, Chief Executive Officer, CRC for Water Sensitive Cities, *Committee Hansard*, 18 May 2015, p. 24.

> for a range of pollution going in there but also the wrong quality of water at the wrong time of year.[16]

2.17 The Waterway Ecosystem Research Group referred to various published research to submit that:

- the ecological consequence of urban stormwater runoff 'is severe', with 'major loss of ecological values…observed if only a very small proportion of a catchment is developed and drained conventionally'; and
- the ecological health of streams that flow from urban catchments is generally much worse than degraded rural streams, with urban streams having 'greatly reduced biodiversity and failing to provide ecosystem services that could be provided by healthy streams (e.g. retention and treatment of pollutants; safe water bodies for primary contact; urban amenity)'.[17]

2.18 Submitters contrasted the acceptance of untreated stormwater entering urban waterways to the management of wastewater. Professor Fletcher remarked:

> …for waste water we do not consider it acceptable to just discharge it into waterways, because it poses a risk to the environment and to human health. Stormwater is exactly the same. In fact, in many of our cities it is a bigger threat to both the environment and human health, yet we still allow that to be discharged.[18]

2.19 It is not, however, the simple presence of stormwater that explains urban waterway degradation. The quantity of stormwater that enters the waterways must also be considered. Mr Andrew Allan, the National President of Stormwater Australia, discussed how the increase in impervious surfaces as a result of urban development has changed the volumes of water that waterways have to deal with during a storm event. He provided the following explanation:

> Broadly, if a stream in the past received 30 days of direct run-off and overland flow, the soil was saturated and reached capacity, and it flowed overland. That is historically or naturally. Now we might be getting up to 260 or 270 rainfall days every year where the streams are getting pummelled. So if it takes a few days for a plant to establish, flourish, lay down its roots and everything, and it is getting pummelled with water all the time, then that balance can never be there.[19]

16 Mr Andrew Allan, National President, Stormwater Australia, *Committee Hansard*, 18 May 2015, p. 8.

17 Waterway Ecosystem Research Group, The University of Melbourne, *Submission 17*, p. 2.

18 Professor Timothy Fletcher, *Committee Hansard*, 18 May 2015, p. 34.

19 Mr Andrew Allan, Stormwater Australia, *Committee Hansard*, 18 May 2015, p. 11.

2.20 As Professor Fletcher remarked: 'The thing about stormwater is there is actually far too much of it. That is a primary driver of the degradation of streams—there is too much of it'.[20] Professor Fletcher used the Yarra River in Melbourne to illustrate the effect that runoff from urbanisation has had on the environment:

> Before the city existed, and it was forest, around 90 per cent of the rainfall that fell on the catchment in a year would have actually been evapotranspired back up into the atmosphere by trees and only about 10 per cent would make its way through the soils and eventually get into the river. When we urbanise, we completely tip that on its head. So now, rather than 10 per cent making it to the river, 90 per cent makes it to the river—almost all by washing over surfaces, of course taking with it a whole lot of pollutants and causing erosion in the river.[21]

2.21 Despite the negative environmental implications of stormwater, it was observed that stormwater is unique among sources of water with respect to how the environmental outcomes can be addressed. As Professor Ana Deletic, Deputy Chair of the Australian Academy of Technological Sciences and Engineering's Water Forum, observed:

> Stormwater is maybe the only source of water which, if it is taken out of our rivers or prevented from going into our rivers, will help our rivers, which is totally the opposite, as you know, in rural settings.[22]

Stormwater infrastructure and common management techniques

2.22 The volume of stormwater generated has implications for the management techniques used, which in turn influences the environmental consequences that arise from stormwater. This section explores this relationship by outlining the traditional approach to stormwater management and the evidence received about the stormwater infrastructure in Australia's cities.

Current infrastructure

2.23 Various submitters explained that urban stormwater management has historically focused on mitigating property damage and risk to life, with the aim being 'to transport the stormwater as rapidly as possible from our urban areas to the nearest waterways'.[23] The infrastructure in place in Australian cities for stormwater reflects this: up to 90 per cent of rainfall ends up in 'hard drainage systems' that transport stormwater to receiving waterways without treatment.[24]

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20 Professor Timothy Fletcher, *Committee Hansard*, 18 May 2015, p. 33.

21 Professor Timothy Fletcher, *Committee Hansard*, 18 May 2015, p. 33.

22 Professor Ana Deletic, Deputy Chair, Water Forum, Australian Academy of Technological Sciences and Engineering (ATSE), *Committee Hansard*, 18 May 2015, p. 18.

23 eWater, *Submission 9*, p. 2. See also Stormwater Australia, *Submission 19*, p. 5.

24 eWater, *Submission 9*, p. 2.

2.24 The majority of stormwater assets in Australian cities are made of concrete and generally require replacement every 100 to 150 years.[25] The asset base 'is believed to be in the order of tens of billions of dollars across major urban centres'.[26]

2.25 Given the expected lifetime of stormwater infrastructure, examples of ageing urban infrastructure are apparent. The committee was provided with several case studies. The City of Melbourne, for example, advised that the majority of its drainage infrastructure is over 60 years old, although some drains date back to the 1850s.[27] This infrastructure was built when flood mapping 'was poorly charted and understood', which has implications for effective stormwater management. The City noted that 'much of the existing drain infrastructure is reportedly designed to accommodate one-in-five year events and many road locations are not designed to adequately accommodate overland flow'. Work is underway on some areas of flash flooding risk so that the infrastructure is upgraded to 'cater for one-in-twenty year rainfall events'.[28]

2.26 The committee was also informed by Stormwater South Australia that 'much of the existing trunk urban stormwater drainage infrastructure in Adelaide was constructed during the 1940s to 1980s'. Stormwater South Australia outlined some of the consequences of this:

> The engineering design of these systems was based on an assumed percentage of impervious area derived from the future expected degree of development at the time of design. Other information such as design rainfalls and a catchments response to rainfall improved over time such that the stormwater design gradually became established on a much more robust technical foundation.[29]

2.27 Stormwater South Australia added, however, that since the 1980s, the construction of trunk stormwater drainage systems in Adelaide has 'slowed considerably'. Yet the city has 'seen a push towards more intensive urbanisation resulting in increased stormwater flows and urban flooding'.[30] Stormwater South Australia noted that the increased stormwater flows and urban flooding is especially evident in the parts of Adelaide where the stormwater systems 'were never upgraded to a more appropriate standard by the 1980s', although more intensive urban

25 Australian Water Association, *Submission 47*, p. 4.

26 Stormwater Australia, *Submission 19*, p. 5.

27 City of Melbourne, *Submission 43*, p. 1.

28 City of Melbourne, *Submission 43*, p. 1.

29 Stormwater South Australia, *Submission 32*, p. 2.

30 Stormwater South Australia, *Submission 32*, p. 2.

development in the areas where the infrastructure was upgraded still presents challenges.[31]

Aquifer recharge

2.28 For geological reasons, stormwater management requirements and the possible techniques that can be utilised differ. In some areas, managed aquifer recharge for storage can be an alternative to other storage options. For example, the Stormwater Industry Association WA explained that, in the south-west region of Western Australia, rainwater 'has the potential to recharge the superficial aquifer, either prior to runoff commencing or throughout the runoff's journey in the catchment'.[32] As Mr Adam Lovell, Executive Director, Water Services Association of Australia, explained:

> …[Perth] has such shallow aquifers that stormwater is not stormwater. Basically what happens is: it rains, the water table rises, and they need to drain that groundwater which has risen.[33]

2.29 Managed aquifer recharge is also a 'common, cost effective solution for Adelaide'.[34]

2.30 These differences can present unique challenges. Dr Robin Allison from Stormwater South Australia observed that when stormwater enters the groundwater, the pollution from the stormwater causes groundwater nutrient problems. Stormwater discharged into other bodies of water, however, also causes damage. In Adelaide, for example, stormwater runoff eventually enters Gulf St Vincent, where it kills seagrass. Nevertheless, Dr Allison emphasised that the challenges presented by stormwater pollution are broadly similar. Dr Allison explained:

> The common thing is the stormwater hitting a hard surface, picking up pollutants and discharging somewhere. So I think the commonality is bigger than the differences.[35]

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31 Stormwater South Australia, *Submission 32*, p. 2. Regarding the increased urban development in areas where the trunk stormwater system had been upgraded, Stormwater South Australia noted 'the push towards more intensive urban development results in the assumed percentage of impervious area (the base assumption on which the design of the system is based) becoming outmoded'.

32 Stormwater Industry Association WA, *Submission 21*, p. 2.

33 Mr Adam Lovell, Executive Director, Water Services Association of Australia (WSAA), *Proof Committee Hansard*, 26 August 2015, p. 4.

34 Water Sensitive SA, *Submission 35*, p. 3.

35 Dr Robin Allison, Committee Member, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, p. 34.

Stormwater as an under-utilised resource

2.31 This chapter has outlined the quantity of stormwater that is generated in Australia's cities, the environmental implications of that stormwater, and the current infrastructure in place for discharging stormwater. The general thrust of the evidence taken by the committee is that stormwater fundamentally differs from other environmental problems. That is, although stormwater is a significant environmental problem, increasing the use of stormwater could benefit the environment and provide other economic and social benefits as well. For example, Professor Timothy Fletcher stated:

> Stormwater is a big environmental problem. It is a threat to the liveability of our cities. But it is actually quite different to almost all environmental problems because it is one where using stormwater as a resource…can actually have a big benefit [for] the environment. It is rare for us to be in that situation, I think…
>
> We should be using that water, retaining that water in the landscape, which means we have this very big resource…that the streams actually need us to use. It is not a matter of just, 'Here's a resource we could use;' it is actually a resource that if we do not use we are going to continue to have degradation. It is a rare win-win: a win for us and a win for the environment.[36]

2.32 This section introduces the evidence which argued that stormwater is an under-utilised resource and highlighted the benefits that could be realised from its greater use.

Environmental benefits

2.33 Many submitters commented on the environmental benefits that could be realised if stormwater was utilised as a water resource to a greater extent. The Waterway Ecosystem Research Group, for example, submitted that its research suggests that healthy urban streams are possible if uncontrolled flows of urban stormwater runoff are prevented from reaching those streams.[37] The CRC for Water Sensitive Cities wrote:

> Stormwater harvesting combined with filtration, infiltration and irrigation can reduce runoff volumes for the vast majority of storm events to close to pre-development levels whilst also helping to restore baseflows, return natural soil moisture levels to urban landscapes and maintain water quality. Capturing and storing rainwater and/or stormwater for subsequent passive irrigation reduces runoff volumes and increases the amount of time that it takes for stormwater to reach stream channels, thereby reducing the peakiness of flows. Directing rainwater and/or stormwater into raingardens for passive irrigation can also support this outcome. In addition, stormwater treatment and harvesting systems can reduce stormwater pollutant loads and

36 Professor Timothy Fletcher, *Committee Hansard*, 18 May 2015, p. 33.

37 Waterway Ecosystem Research Group, The University of Melbourne, *Submission 17*, p. 2.

> concentrations to levels appropriate for the protection of local receiving waters and downstream estuaries and bays…[38]

2.34 The interconnectivity of river systems was also noted, with an example provided of how reduced water use in Melbourne has implications for the volume of water that reaches the Murray River and Murray-Darling Basin communities:

> In terms of the Murray-Darling Basin we, potentially, in Melbourne can take water out of the Goulburn. That has an effect all the way over to Adelaide. By not turning on that system, and using the water locally, we are helping those greater basin catchments, and that covers a huge part of Australia.[39]

Costs that could be foregone

2.35 Direct and indirect costs associated with stormwater were noted, such as flooding-related costs and the need to build stormwater infrastructure, both as a result of increasing urban populations and to replace existing ageing infrastructure.

2.36 In relation to flooding, Mr Chris Beardshaw, Secretary, Stormwater Victoria, suggested that improved stormwater management may alleviate the need to expand existing infrastructure or to identify other water management solutions. He stated:

> Flooding in Australia is a lot about antecedent conditions or how wet the catchment is. In 2011, there was lots of rain and then rain on top of rain, and lots of flooding. In the urban environment we do not have that because we are concrete. We do not fill the voids to start with. So on climate change and more intensity, we cannot make all our small pipes bigger. Are there ways that we can protect ourselves from flooding without having to do other things? That is one of the real opportunities here.[40]

2.37 Stormwater Australia argued that storm flooding in urban areas is 'a significant, but poorly understood cost to society'.[41] Mr Andrew Allan, President, Stormwater Australia told the committee:

> Flooding is a significant issue, particularly in cities that have been developed pre the 1970s, before recognised standards were in place, and for many people who suffer from flooding impacts there are insurance costs and disruption to life cycle costs that are quite significant…Also, into the future, climate change is something of concern. We know the science is

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38 CRC for Water Sensitive Cities, *Submission 44*, p. 5. The CRC's submission cited the following research: T Wong, R Allen, R Brown, A Deletic, L Gangadharan, W Gernjak, C Jakob, P Jonstone, M Reeder, N Tapper, G Vietz and C Walsh, 2013, *bluprint2013 – Stormwater Management in a Water Sensitive City*, Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities, July 2013.

39 Mr Ralf Pfleiderer, President, Stormwater Victoria, *Committee Hansard*, 18 May 2015, p. 8.

40 Mr Chris Beardshaw, Stormwater Victoria, *Committee Hansard*, 18 May 2015, p. 4.

41 Stormwater Australia, *Submission 19*, p. 5.

> telling us that there is going to be less water overall and when it rains we are likely to get more intense rainfalls, which is going to exacerbate both our need to have water not only to supply for consumptive needs in the cities but also to manage the drainage and the impacts as well.[42]

2.38 One potential indicator of the cost of storm damage is insurance premiums. Stormwater Australia stated that it 'is not currently well understood how insurance companies account and charge for flood risk'; however, it suggested that insurance premiums for houses located near stormwater systems and waterways had, in recent years, increased by a greater amount than the premiums for houses located in rural areas away from stormwater systems and waterways.[43]

2.39 Estimates were also provided about the expected cost associated with upgrading ageing infrastructure. Professor Ana Deletic told the committee that to maintain the same level of flood protection in Melbourne, it is estimated that $8 billion will need to be invested in the next few decades to keep up with development and to address ageing infrastructure. Professor Deletic remarked that it 'costs a fortune to…put bigger pipes in'. In her view, the implementation of green systems (which are discussed later in this chapter: see paragraph 2.54), could 'delay the accumulation of ageing infrastructure' and prevent additional stormwater from entering urban drainage systems.[44]

Potential uses for stormwater

2.40 Stormwater Australia advised that, with the exception of Perth, it is estimated that less than three per cent of rainwater and stormwater is used.[45] As this chapter has already noted, the volume of stormwater runoff is similar to, and in some cities exceeds, the amount of water that urban areas draw from their traditional water catchments (see Figure 2.1). Given this, submissions considered the possibility and benefits of utilising stormwater so that the urban areas themselves became a water catchment. It was also noted in relation to this that stormwater runoff is unique as a water resource because it 'grows with increasing urban development'.[46]

2.41 The potential for stormwater to support other water sources during periods such as drought was noted in several submissions. For example, the CRC for Water Sensitive Cities stated:

> As many Australian cities and towns experienced severe drought in recent times, we now recognise that we are entering an era where natural resources

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42 Mr Andrew Allan, Stormwater Australia, *Committee Hansard*, 18 May 2015, p. 1.

43 See Stormwater Australia, *Submission 19*, p. 7.

44 Professor Ana Deletic, ATSE, *Committee Hansard*, 18 May 2015, p. 20.

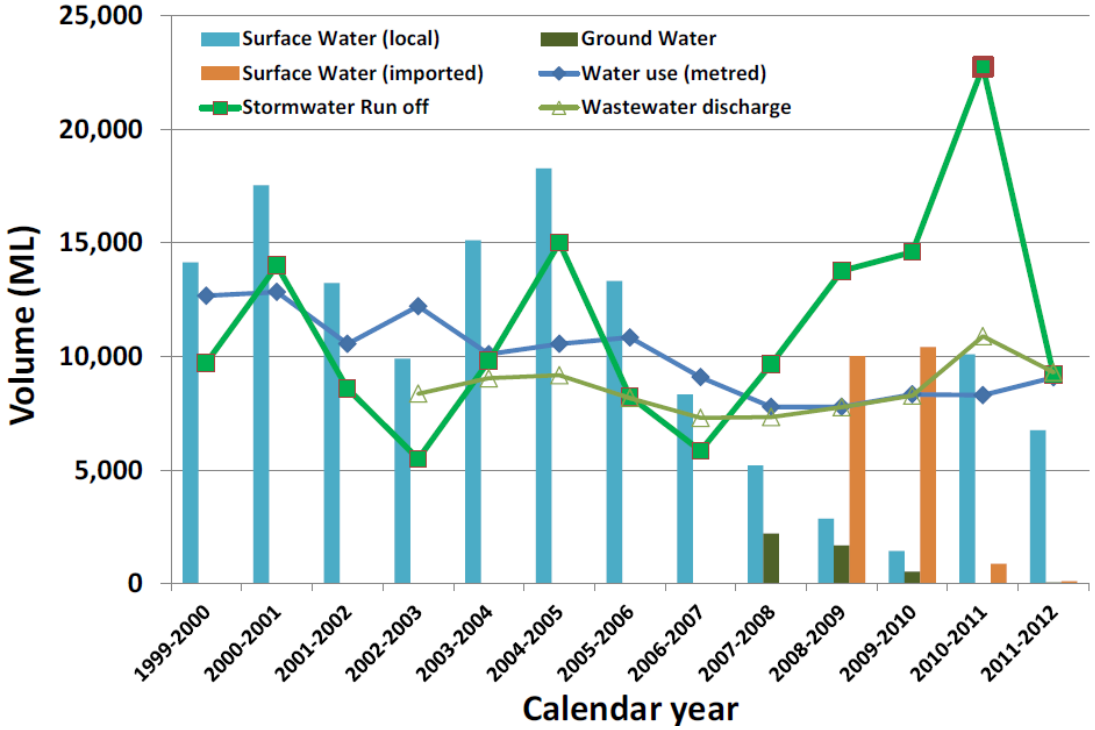
45 Stormwater Australia, *Submission 19*, p. 3. Similarly, Urban Water Cycle Solutions argued that the water from rainwater, stormwater and wastewater sources 'is not fully exploited'. Urban Water Cycle Solutions, *Submission 41*, p. 5.

46 Waterway Ecosystem Research Group, The University of Melbourne, *Submission 17*, p. 3.

are reaching their carrying capacity limits. We need to do more with what we have.[47]

2.42 The CSIRO stated that stormwater harvesting and water recycling 'could help to generate long term water storage for drought and emergency supplies in all major cities'.[48] The potential benefits of stormwater harvesting during a drought were illustrated in the submission from Urban Water Cycle Solutions. Using the city of Ballarat as an example, it was argued that substantial volumes of local stormwater runoff were available throughout the 2000s drought, however, the Ballarat region instead imported surface water from distant communities and irrigation districts (see Figure 2.3).[49]

Figure 2.3: Water cycle processes in the Ballarat Water District from 1999 to 2012



Source: Urban Water Cycle Solutions, *Submission 41*, p. 8.

2.43 Potential uses for stormwater in agriculture were also noted. The CSIRO suggested that fresh stormwater could be blended with high salinity recycled water to 'expand the current use of recycled water in irrigation and increase productivity through application to high value crops which are sensitive to the salinity of the irrigation supply'.[50]

47 CRC for Water Sensitive Cities, *Submission 44*, p. 1.

48 CSIRO, *Submission 42*, p. 3.

49 Urban Water Cycle Solutions, *Submission 41*, p. 9.

50 CSIRO, *Submission 42*, p. 3.

2.44 The key challenges associated with utilising stormwater were identified in a 2007 report of the Prime Minister's Science, Engineering and Innovation Council's working group. The report, *Water for our cities: building resilience in a climate of uncertainty*, stated that challenges to utilising stormwater include that:

- the water requires treatment to remove the pollutants that are harmful to human health;
- stormwater would need to be captured and stored during a storm 'in an urban environment where space is at a premium'; and
- the infrastructure required for water capture and treatment would, because of the intermittent nature of storm events, 'be used only intermittently, thus increasing the per unit capital cost'.[51]

2.45 The report noted that the storage of stormwater in underground aquifers is 'a possible way to both store and treat the captured water but for geological reasons this is an option only available to a few cities such as Perth and Adelaide'.[52]

Improving the liveability of cities

2.46 Submitters argued that the increased use of stormwater has the potential to improve the sustainability, resilience and liveability of cities by supporting the greening of cities.

2.47 In addition to improving the health of urban waterways by reducing the volume of stormwater that enters them, the CRC for Water Sensitive Cities argued that stormwater could support green spaces in cities. The CRC identified that increased greening of cities through the use of stormwater could result in:

- 'improved human thermal comfort', leading to reduced heat-related stress and mortality;
- 'productive vegetation and increased carbon sequestration';
- improvements in 'air quality through deposition'; and
- improved landscape amenity.[53]

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51 Prime Minister's Science, Engineering and Innovation Council (PMSEIC) Working Group, *Water for our cities: building resilience in a climate of uncertainty*, June 2007, www.industry.gov.au/science/PMSEIC/Documents/WaterforOurCities.pdf (accessed 8 May 2015), p. 33.

52 These aquifers are 'porous layers of soil or rock that allow water to be stored and recovered, hence the name aquifer storage and recovery'. Under this process, passive pre-treatment is provided by a wetland or reedbed. PMSEIC Working Group, *Water for our cities*, p. 33.

53 CRC for Water Sensitive Cities, *Submission 44*, pp. 6–7.

2.48 Ms Mellissa Bradley from Water Sensitive SA indicated how the use of stormwater for green spaces in cities would support the health of those spaces and return a greater volume of water to the groundwater. Ms Bradley explained:

> The imbalance in the water cycle has become so great that we are no longer replenishing the groundwater supplies. Therefore, our green spaces are just so moisture depleted because we are really messing so much with the urban water cycle, and to sustain those green spaces we are going to have to bring more water in.[54]

2.49 Dr Robin Allison from Stormwater South Australia also observed that stormwater could support existing parks:

> Every iconic park in Australia, if not the world, has water involved in it. If you can make stormwater part of that, whether it is harvesting or treatment system, it is a huge benefit to the community.[55]

2.50 How parks and green spaces can improve liveability in cities by mitigating heat was addressed during the committee's hearings. Mr Andrew King, Chair, Stormwater South Australia, explained how urban heat is distributed in Adelaide:

> …on an early March morning at break of dawn, the temperature over Adelaide's city centre was 10 degrees warmer than it was over the Parklands. That is because of the hard surface, the heat sink and everything else like that. That relates back to a suburban environment. If you have all house and hard space—all impervious area—in an urban environment, that one park at the end of every three or four streets, no matter how well it is manicured or preserved, is not going to provide that cooling effect. It needs to be done street by street. So they provide amenity; they provide greenery.[56]

2.51 Professor Ana Deletic outlined the microclimatic benefits that systems such as wetlands and rain gardens can provide for cities. Professor Deletic noted that 'having trees or greenery is good for our cities; it not only reduces temperature but provides human comfort'.[57] Related to this, the effect that urban heat can have on hospital costs was also highlighted. Mr Andrew King explained:

> Hospitals have a key temperature in the high thirties where they put on extra staff, and the cost to the health service every year of that cut-off point is hundreds of millions of dollars. They budget that they are going to get five or six of those days a year. That is budgeted in. If we raise our city temperatures by 10 degrees and those five or six days become 12, even

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54 Ms Mellissa Bradley, Program Manager, Water Sensitive SA, *Proof Committee Hansard*, 26 August 2015, p. 26.

55 Dr Robin Allison, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, p. 30.

56 Mr Andrew King, Chair, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, p. 30.

57 Professor Ana Deletic, ATSE, *Committee Hansard*, 18 May 2015, p. 19.

> doubling it, you have hundreds of millions. That one cost alone blows out any water-saving cost that you would ever put to green infrastructure in a city environment.[58]

2.52 Mr Ralf Pfleiderer, representing the City of Melbourne, highlighted the City's Urban Forest Strategy. The Strategy supports healthy trees that 'provide greater canopy', helping to shade streets and mitigate summer heat. Mr Pfleiderer noted that water for soil moisture 'is a key part of keeping those trees healthy'. He added:

> Stormwater, either from irrigation or passive infiltration, is something we are promoting quite strongly and are trying to put in place wherever we can. It is a slow process in terms of cost and finding the space for it.[59]

2.53 The committee also received specific examples of how addressing water quality issues could improve the liveability of cities. For example, Mr Andrew King, Chair, Stormwater South Australia, noted that addressing water quality can limit blue-green algae growth and the odour that this brings. He used Torrens Lake in Adelaide as an example:

> One of the things that Adelaide is somewhat iconic for, for the wrong reasons, is its Torrens Lake. Every time we try to run a major event in the middle of the city in summer, we inevitably end up with a blue-green algae bloom which adds a wonderful odour to Adelaide. The key thing producing that algae bloom is the nutrient pollutant in stormwater run-off.[60]

2.54 New types of projects that use stormwater to improve liveability were also noted. The committee received evidence on 'green infrastructure', which the CRC for Water Sensitive Cities argued 'provides benefits by creating more liveable and resilient urban environments'.[61] In an article on green infrastructure that was provided to the committee, Professor Ana Deletic wrote that raingardens, green roofs, green walls and living walls, collectively called biofiltration, are 'affordable, attractive solutions'. Professor Deletic explained how biofilters are beneficial:

> They act as natural filters—carefully selected soils and plants trap and clean water as it sinks through roots. At the same time they green and cool our cities. Because they are made from natural materials and are often gravity-fed, their costs are minimal.[62]

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58 Mr Andrew King, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, p. 31.

59 Mr Ralf Pfleiderer, Water Sensitive Urban Design Coordinator, City of Melbourne, *Committee Hansard*, 18 May 2015, p. 14.

60 Mr Andrew King, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, pp. 30–31.

61 CRC for Water Sensitive Cities, *Submission 44*, p. 8.

62 A Deletic, 'Integrated water management can boost "liveability" in cities', *ATSE Focus*, no. 181, December 2013, p. 3; *Additional Information 12*, p. 1.

2.55 In the article, Professor Deletic outlined research undertaken by the Monash Water for Liveability Centre and the CRC for Water Sensitive Cities that aims 'to develop low-energy, affordable biofilters for both stormwater harvesting and wastewater recycling'. Professor Deletic wrote:

> …we are currently developing living walls that can treat light greywatcr (from wash basins, baths or showers) for safe irrigation and, with minimal additional treatment, for non-potable uses such as toilet flushing.
>
> Imagine a wall of plants—a vertical canopy—comprising two to three storeys, each with species chosen for their talents as organic filters. Deciduous climbing plants on upper storeys allow for sunlight to be screened in summer for cooling (wall-climbing vines can significantly reduce temperatures of buildings and adjacent areas) and captured in winter for heating.
>
> On lower storeys, evergreen sedges and flowering plants enable greywater treatment in winter months. Living walls thus address both water supply and urban heat wave problems—a living wall for greywater recycling installed at a typical residential apartment could save more than 20 per cent of the potable water needs of its residents, while reducing temperature of the building surface by more than 10°C.[63]

2.56 When considering green infrastructure, another relevant matter is the evidence that indicates it has a positive effect on property values. Professor Ana Deletic explained:

> A very recent study, which we cited in our submission, talks about how there is now evidence that the value of properties near these systems is increased substantially. Our colleagues who work with us within the CRC for Water Sensitive Cities looked into the prices of over 4,000 houses in Sydney and linked them to where they are placed. They found that, if your house is overlooking a rain garden 50 metres from one of these stormwater measurement systems, the price goes up six per cent, which is roughly $54,000. The value of such a garden is only $15,000 or $20,000. So, on the pure amenity value, we see a huge return.[64]

2.57 The CRC for Water Sensitive Cities provided further research that supported the argument that property price values increase with proximity to natural systems and when water sensitive urban design infrastructure, including rainwater tanks, raingardens and stream restoration, is present. The CRC for Water Sensitive Cities used research that considered Perth property prices as an example:

> A hedonic house price analysis in Perth suggests there is a premium of up to AU$18,000 built into the sale prices of houses with tanks installed. The premium is likely to be greater than the costs of installation, even allowing for the cost of time that home owners must devote to research,

63 A Deletic, 'Integrated water management can boost "liveability" in cities', p. 3; *Additional Information 12*, p. 1.

64 Professor Ana Deletic, ATSE, *Committee Hansard*, 18 May 2015, p. 19.

> purchase and installation. The policy implication is that government need not rely on financial incentives for installation of rainwater tanks, but instead use information provision as their main mechanism for promoting uptake…[65]

2.58 Finally, it was suggested that a greater emphasis on more liveable public open spaces will inevitably occur as a result of growing urban populations. Professor Tony Wong explained:

> …there are many other benefits in innovative management of urban stormwater, beyond the droughts, the floods and the improvement of water quality. Those multiple benefits would include issues of creating higher biodiversity in our urban environment, creating significant opportunity for mitigating urban heat and introducing microclimate environments, and opportunity for urban stormwater to be a central feature in how we deliver green spaces in our cities. That is connected very much to the fact that our urban environments have a growing population and that the shift in emphasis from the amenity of a private open space to a public open space will occur. As you see this shift, you will see that the public realm and public open space will become more and more important to the liveability of our space.[66]

Conclusion

2.59 Australia's cities generate enormous volumes of stormwater. Not only does this stormwater cause significant environmental damage, it is a resource that is clearly not utilised to its full potential.

2.60 This chapter has highlighted many of the interesting opportunities that exist to utilise stormwater to a greater extent. Increased utilisation of stormwater will deliver various environmental benefits, however, it is apparent that other economic and social benefits are also possible. This chapter has demonstrated the attention that experts in this field have given to these possibilities. The remaining chapters of the report examine the efforts to date, and the challenges and impediments that may affect the speed and rate at which stormwater projects are developed.

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65 CRC for Water Sensitive Cities, *Submission 44*, p. 9. The research cited was: F Zhang, M Polyakov, J Fogarty and D J Pannell, 2015, 'The capitalized value of rainwater tanks in the property market of Perth, Australia', *Journal of Hydrology*, 522, 317–325.

66 Professor Tony Wong, CRC for Water Sensitive Cities, *Committee Hansard*, 18 May 2015, p. 24.

Chapter 3

Uses for stormwater and improving how stormwater is managed

3.1 Stormwater is generally managed through the use of drains, pipes and channels that ultimately discharge the untreated water into larger waterways; however, stormwater can also be captured and recycled for use. This chapter examines stormwater harvesting, which is the recycling component of stormwater management. This chapter also considers the concept of water sensitive urban design, which seeks to better integrate water sources such as stormwater into urban planning.

Stormwater harvesting

3.2 Stormwater harvesting involves the capture, treatment, storage and use of urban stormwater runoff. Stormwater harvesting is differentiated from rainfall or roof-water harvesting projects, such as rainwater tanks. Rainwater harvesting, however, can ultimately reduce the volume of stormwater that enters drains or creeks. Consequently, rainfall harvesting projects such as rainwater tanks were raised in evidence and are discussed in this chapter.

3.3 Potential non-potable uses for stormwater include:

- agricultural uses, such as for horticulture, trees or woodlots, pasture or fodder, dairy pasture, lucerne, flowers, orchard, nursery, vegetables, viticulture, hydroponics and turf farms;
- fire-control uses, including for controlling fires, testing and maintenance of fire-control systems and training facilities for firefighting;
- various municipal uses, such as roadmaking, dust control and street cleaning;
- residential and commercial property uses within buildings (such as toilet flushing) and for garden watering, car washing, water features and systems (ponds, fountains, cascades) and utility washing (such as washing paths, vehicles and fences); and
- industrial and commercial uses, such as for cooling water, process water and washdown water.[1]

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1 Natural Resource Management Ministerial Council, the Environment Protection and Heritage Council, and the National Health and Medical Research Council, *Australian Guidelines for Water Recycling (Phase 2): Stormwater Harvesting and Reuse*, July 2009, www.environment.gov.au/system/files/resources/4c13655f-eb04-4c24-ac6e-bd01fd4af74a/files/water-recycling-guidelines-stormwater-23.pdf (accessed 7 September 2015), p. 112.

3.4 As will be examined in this chapter, however, there is potential for potable use of stormwater. Whether stormwater is used for non-potable or potable purposes, the various operational, environmental and health risks it presents need to be addressed. Public health and environmental risks arise as stormwater contains coarse materials and organic matter (such as sediment and leaves), chemicals and disease-causing microorganisms (pathogens) that need to be managed or treated.[2] Operational risks for stormwater harvesting projects also arise because of stormwater quality. Among other problems, coarse and organic material carried by runoff can block pipes; high nitrogen and phosphate levels may support algal growth; and high iron concentration or high levels of calcium carbonate may block irrigation systems over time.[3]

Examples of stormwater projects and harvesting schemes

3.5 Many submitters highlighted stormwater and rainwater harvesting efforts that are currently underway. Stormwater and rainwater harvesting schemes outlined in submissions included the following:

- 'Green roofs' in dense urban environments that 'harness rainfall, reduce heat island effects, insulate buildings, and reduce energy costs for air conditioning'.
- Mandatory rainwater tanks in south-east Queensland, a policy that was discontinued in 2013.[4] Stormwater Australia contended that public health arguments against rainwater tanks 'ignore the differences in risk posed by centralised, reticulated systems (where failures expose many to health risks) and private supplies'.[5]
- Stringybark Creek in Melbourne, where 'leaky tanks' and onsite treatments 'have been used to reduce the impact of a typical, developed suburb on the surrounding creeks and ecosystems'.[6]
- The Blackmans Swamp stormwater harvesting scheme in Orange, New South Wales, which can provide up to 40 per cent of Orange's total water needs.[7]

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2 *Australian Guidelines for Water Recycling: Stormwater Harvesting and Reuse*, pp. 2, 23.

3 *Australian Guidelines for Water Recycling: Stormwater Harvesting and Reuse*, pp. 23–24.

4 See Dr Darren Drapper, *Submission 10*, p. 2; SPEL Environmental, *Submission 12*, p. 1; Health Waterways, *Submission 30*, p. 4.

5 Stormwater Australia, *Submission 19*, p. 18.

6 Stormwater Victoria, *Submission 20*, p. 5.

7 Stormwater Australia, *Submission 19*, p. 18; Orange City Council, 'Blackmans Swamp Creek Stormwater Harvesting Scheme', www.orange.nsw.gov.au/site/index.cfm?display=147115 (accessed 10 May 2015).

3.6 Stormwater is being utilised by local governments for parks and gardens. The City of Melbourne advised that 25 per cent of the water it uses, primarily for parks and gardens, is supplied by harvested stormwater.[8] One of the City of Melbourne's stormwater harvesting schemes is located in Fitzroy Gardens.[9] According to a description of the project published by the City, Fitzroy Gardens 'is an ideal location to capture and treat stormwater runoff' because Fitzroy Gardens includes the 'natural low point for the surrounding 67-hectare catchment' and 'rainwater naturally flows there'.[10]

3.7 The following description of the Fitzroy Gardens scheme provides an insight into the design and operation of a stormwater harvesting project (an illustration of the operation of the Fitzroy Gardens system is at Figure 3.1):

> The treatment process begins with a gross pollutant trap that removes large pollutants, such as litter and leaves. The water then flows to a sedimentation chamber. In this chamber, we remove suspended particles of pollution such as fine sands and oils.
>
> Next to the chamber is the primary storage tank, which can store four million litres of partially treated water. From here, the water is pumped to the surface where a biofiltration bed naturally removes invisible pollutants like nitrogen and phosphorus. One million litres of treated stormwater is stored in a secondary tank and used for irrigation. Any excess treated water returns to the stormwater drains.
>
> Finally, before the water is pumped to the Fitzroy Gardens irrigation network, it is passed over ultraviolet (UV) light tubes to kill any remaining bacteria.[11]

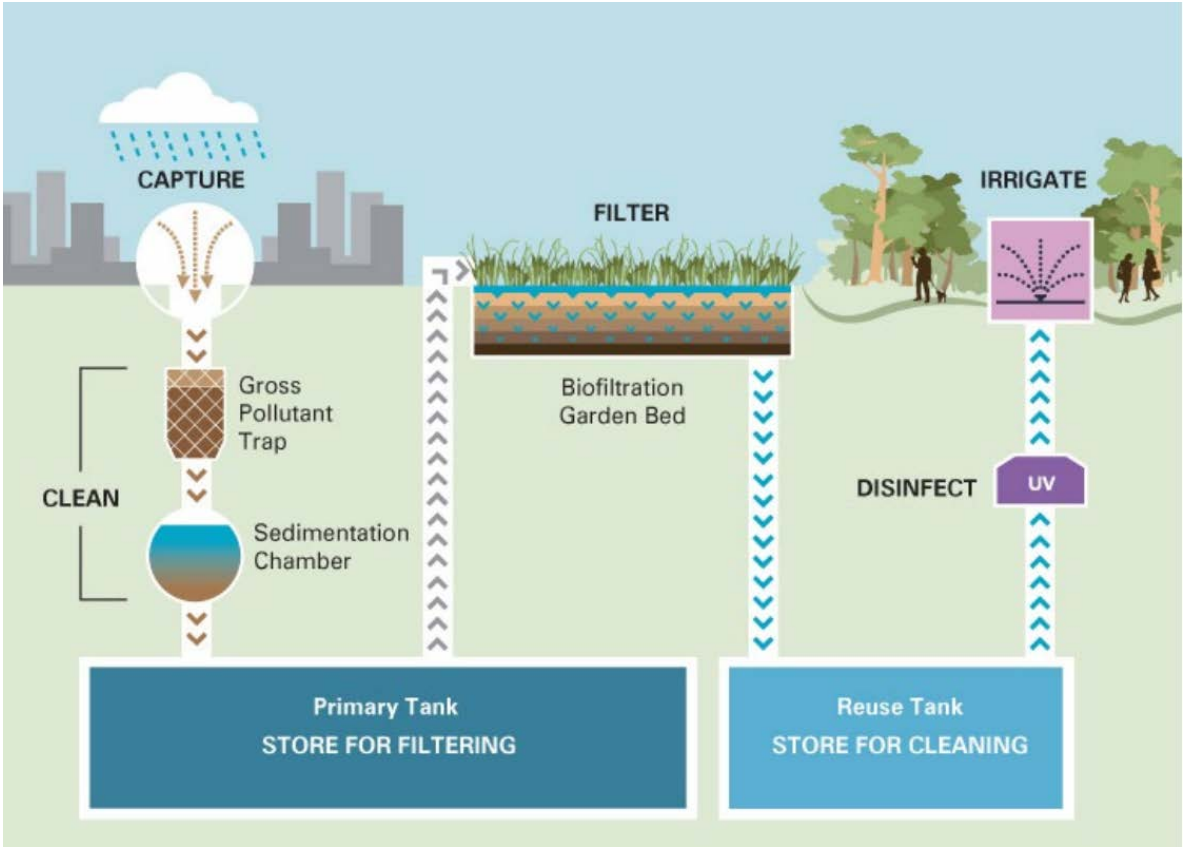
8 City of Melbourne, *Submission 43*, p. 3.

9 This project was referred to at a public hearing by Mr Ralf Pfleiderer, Water Sensitive Urban Design Coordinator, City of Melbourne. See *Committee Hansard*, 18 May 2015, p. 17.

10 City of Melbourne, *Urban water: Fitzroy Gardens case study*, http://urbanwater.melbourne.vic.gov.au/wp-content/uploads/2015/02/Urban-Water_Fitzroy-Gardens-Stormwater-Harvesting-System.pdf (accessed 18 September 2015), p. 2.

11 City of Melbourne, *Urban water: Fitzroy Gardens case study*, p. 2.

Figure 3.1: Stormwater harvesting system, Fitzroy Gardens, Melbourne



Source: City of Melbourne, *Urban water: Fitzroy Gardens case study*, http://urbanwater.melbourne.vic.gov.au/wp-content/uploads/2015/02/Urban-Water_Fitzroy-Gardens-Stormwater-Harvesting-System.pdf (accessed 18 September 2015), p. 2.

3.8 A project that the committee received extensive evidence on involves Michell Wool in the City of Salisbury, which is located in the Adelaide metropolitan area. Mr Bruce Naumann, who is currently the manager of Salisbury Water at the City of Salisbury, explained to the committee that in 1995, he was employed by Michell Wool and assigned the task of finding an alternative water supply for the business. At the time, Michell Wool was using three million litres per day of mains water to wash greasy wool supplied by the farms. Mr Naumann described the situation as 'just crazy', as Michell Wool was using water that had been treated to drinking standard and paying 'a small fortune' to SA Water. Mr Naumann outlined how the stormwater project for Michell Wool came about:

> We sought the help of the City of Salisbury and, having dealt with state government departments—and I will not bag state government too much—we had Salisbury come out and say, 'Yes, we can help you.' It was a customer service ethic that still exists today, and much of our focus in the City of Salisbury is on trying to sustain and maintain existing industry and attract new industry to create jobs for local people. We set up a partnership between the City of Salisbury, the federal government and Michell Wool. Very importantly, it was the first one where we got significant funding from the federal government. The federal government funded the clean seas program, giving us $1 million; Michell Wool put up $1 million; and the

> City of Salisbury put in $1 million, creating the Parafield Partnerships Urban Stormwater Imitative.[12]

3.9 With the $3 million in funding, four hectares of land was leased from Parafield Airport to build wetlands needed for the project. Mr Naumann explained that, from the perspective of the City of Salisbury, this was 'our first major step into water harvesting'. Mr Naumann added that the Michell Wool project 'is still the cornerstone of our scheme today' and is 'many times bigger', with over 500 customers.[13] Mr Naumann highlighted how the stormwater harvesting has helped to support Michell Wool's operations and, in turn, the local economy:

> Twenty years ago, back before the collapse of the wool industry, they were processing 20 per cent of the Australian wool clip, and there were something like 19 competitors in Australia. Most of Australia's wool was actually being scoured before it got processed further, so at least there was early-stage processing. The sad thing today is that it is almost all going straight overseas from the farm. Michell themselves dabbled in building a plant in Shanghai, and they are now actually moving production from Shanghai back to Salisbury. They are, sadly, the only wool-scouring or wool-processing operator in Australia now. Everyone else has gone bust. They certainly give us credit for that. They get a very good deal on their water, very cheap—unfortunately, because I have now changed sides! I am now on the Salisbury side rather than the Michell side, trying to sell water. Certainly, the water price they have does not help our bottom line. But they made the investment when it was in the very early stages and it was a very high risk project. They put their money out there and they have reaped the rewards. But so has Salisbury, and jobs in that area have been retained.[14]

3.10 The committee was also informed of the Oaklands Park project in the City of Marion, which is also located within the Adelaide metropolitan area. The project involves between 400 and 500 megalitres per year. Dr Robin Allison from Stormwater South Australia highlighted the multidisciplinary aspects and multiple objectives of the project:

> One that comes immediately to mind for me is one in Oaklands Park in the City of Marion, mainly because it was a project that was very much multidisciplinary and had multiple objectives. It is a stormwater-harvesting project, but that was not its only objective. It was the most visited park in the City of Marion. Half of the area was dedicated to a driver school, and that was 80 per cent bitumen roads—the old driver school on Oaklands Road. This project—it was driven by some state agencies and the federal funding that gave it the catalyst to go ahead—converted that park from a driving school, basically mainly bitumen, into a community asset as well as a feature treatment wetland. It had multiple inputs from design disciplines,

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12 Mr Bruce Naumann, Manager, Salisbury Water, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 36.

13 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 36.

14 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, pp. 36–37.

> and it provided green infrastructure to the residents as well as being a stormwater-harvesting facility. When you go there at a weekend and there are kids running around, the average pundit would not know that it is an active stormwater-harvesting system. It is harvesting the water and storing it underground, and the water is then plumbed to 30 reserves around the City of Marion.[15]

3.11 Dr Peter Coombes discussed the Wannon water harvesting scheme in Victoria, where water is harvested from roofs into centralised supply (a dam). Dr Coombes stated that the project 'is far more efficient than their water supply catchment, so it is drought-proofing their area' and emphasised how the scheme is cost-effective:

> …the full cost of their roof water harvesting scheme, without carrying in any of the stormwater benefits—just the water supply—was under $2,000 a megalitre. This is under $2 a kilolitre, which was cheaper than their mains water supply.[16]

3.12 Large-scale schemes in other countries were also noted—Stormwater Australia advised that in Singapore, all stormwater can be collected and used for potable water supply.[17]

Views on stormwater harvesting

3.13 As has been already noted in this report, the volume of stormwater in Australian cities is similar to, and in some cases exceeds, the volume of other types of water used. It follows that stormwater harvesting could provide another source of water for cities. For example, the CSIRO stated that stormwater harvesting has 'proven potential to meet large urban water demand' with added environmental benefits, such as improved coastal water quality and lower greenhouse gas emissions 'relative to alternative more engineered supplies'.[18]

3.14 The Waterway Ecosystem Research Group argued that stormwater harvesting stores did not need to be very large 'to achieve a supply reliability comparable to that achieved by large water supply dams'. It explained:

> …a storage volume of 25 litres per square metre of roof (equivalent to 5000–6000-litre storage for an average house) or road area would retain 99.6% of runoff, in Melbourne if there were sufficient demand (as would be achieved, for instance, by plumbing roof-top tanks on a multi-storey building into all of the building's toilets, or by directing the runoff to a treatment system for augmentation of the potable water supply). Such a

15 Dr Robin Allison, Committee Member, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, p. 30.

16 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, pp. 11–12.

17 Stormwater Australia, *Submission 19*, p. 18.

18 CSIRO, *Submission 42*, p. 2.

> harvesting system would greatly reduce the cost and area required for infiltration systems that are required to retain and treat unharvested runoff, to restore lost baseflows. If such systems were applied to every roof of Melbourne, they would supply 60% of Melbourne's total water demand.[19]

3.15 Stormwater harvesting projects have been encouraged by Commonwealth funding (discussed in Chapter 5) and state government policies. Water Sensitive SA, for example, advised that the 2011 South Australian State Strategic Plan has set a targeted for up to 35 gigalitres of stormwater to be harvested each year by 2025. In 2008–09, the state's recycled stormwater harvesting capacity was 5.8 gigalitres per year; after the completion of various stormwater harvesting and reuse projects, by June 2014 capacity had increased to 22.7 gigalitres.[20]

3.16 The Adelaide and Mount Lofty Ranges Natural Resources Management Board submitted that harvesting needs to be supported by a greater array of management practices and policies so that it can meet the challenges unmanaged stormwater presents to urban and natural environments.[21]

3.17 The CSIRO suggested that stormwater harvesting should be undertaken on a 'fit for purpose basis', with a view to using stormwater where low quality water is suitable. For example, the CSIRO observed that high quality drinking water is not needed for greenspace irrigation. Such action would 'improve the resilience of the water supply system', by:

> …providing a buffer against increasing urban demand from a growing population and increased uncertainty in future inflows to drinking water catchments due to climate variability.[22]

Potable or non-potable use?

3.18 An issue that divided stakeholders is whether the aim of stormwater harvesting should be to provide water for potable or non-potable use.

3.19 Mr Adam Lovell, Executive Director, Water Services Association of Australia (WSAA), expressed his view that 'stormwater recycling is more in the non-potable, liveable city type domain'. He noted that, at present, he was aware of only one project in Australia that is considering stormwater recycling for potable use.[23]

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19 Waterway Ecosystem Research Group, The University of Melbourne, *Submission 17*, p. 4.

20 Water Sensitive SA, *Submission 35*, p. 3.

21 Adelaide and Mount Lofty Ranges Natural Resources Management Board, *Submission 11*, p. 1.

22 CSIRO, *Submission 42*, p. 4.

23 The project Mr Lovell referred to was in Kalkallo, a town north of Melbourne.
Mr Adam Lovell, Executive Director, Water Services Association of Australia (WSAA), *Proof Committee Hansard*, 26 August 2015, p. 2.

3.20 Dr Peter Coombes, however, suggested that stormwater could be used for potable supply in a cost-effective way, and that the technology and ability to do this exists. He explained:

> I was a judge in the Victorian stormwater industry awards. Without naming the consortium, they presented, in an area to the west, harvesting the stormwater where it is and injecting it straight into the existing distribution system…If you are treating it, obviously you are eliminating those health risks. We treat mains water with a multibarrier approach. If we did not treat mains water, there would be health risks also. We seem to forget that we treat mains water from catchments. If we are treating some other water, we would obviously treat it to the same health requirements—and yes we can do it. We have been able to do it for nearly 30 years…The point is that if you did that, because you were backed up from other water sources, you do not need big storages. You are injecting straight into the distribution system at opportune places, with treatment. Obviously you are trading off the economies of the right scale to do it.[24]

3.21 Under this model of stormwater management, Dr Coombes observed that 'it does not have to rain all the time'. Dr Coombes added that the use of stormwater in this way presents 'very strong economic benefits' as the water management that is occurring within the catchment manages run-off and flooding, but also allows more water in the large dams to be saved for use during a drier period.[25]

3.22 Stakeholders, however, identified challenges about the use of stormwater for potable supply. One of the key challenges that would need to be overcome is perceptions about water treatment. Dr Peter Coombes recalled that when he was the Chief Scientist at the Office of Living Victoria and stormwater harvesting for potable purposes was first proposed, 'the health department got very upset'. He explained:

> There was this absolute assumption that if it is reticulated water, mains water, or whatever you want to call it, it is magically okay, and any other water can never get to that standard. That is nonsense. I heard on the ABC the other day that some of my colleagues that are in WSAA are saying it is okay to drink wastewater. Yes it is, because we have to treat it to the point where it is okay.[26]

3.23 Mr Naumann from the City of Salisbury made a similar observation about the ability to treat stormwater in a cost-effective way and acknowledged that, despite this, there is 'fear in the community about getting recycled water into drinking water'. Mr Naumann commented:

> We can already treat stormwater for less than $2 a kilolitre. We can get it to the drinking water standard needed but the public are not ready for it yet. The focus groups we have had are not ready for it. Whenever we put up a

24 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 11.

25 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 11.

26 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 11.

> new project, people come to us and say, 'Hey, I hope you're not doing that into our drinking water.'[27]

3.24 Mr Naumann added that SA Water and the Department of Health refuse to let recycled water 'anywhere near the drinking water networks'. He explained that the principal concern is that at the moment 'millions of dollars' are spent monitoring water quality in a system where all water is brought through one quality assurance point.[28] Mr Naumann explained:

> It is really about controlling the risk and that is what SA Water and the department of health are quite rightly concerned about. That is where we have to be a little bit careful of just charging ahead and putting recycled water back into the networks. I think it is a worthwhile target. I think we should be setting a framework or a time frame of saying that 10 or 15 years out we would like to have a deregulated drinking water network and then look at how we go about getting there over that time frame.[29]

3.25 Mr Naumann suggested that the recycled water networks built in Salisbury provide 'a chance to practice, to get things right, to get the community's confidence up to know that the private operators who will deliver cost savings in the long run are good enough to deliver drinking water'.[30]

3.26 Mr Andrew King, Chair, Stormwater South Australia, noted that 'research into the ability to take stormwater for potable use suddenly opens the marketplace up in terms of what that water can be used for'. However, he also highlighted that the supply of stormwater for potable use presents a distribution problem in getting the harvested stormwater to the user. He explained:

> A lot of the schemes that have been built to date have taken the opportunity of that connectivity between location of harvest and ability to harvest and close-proximity utilisation of that by building their own small networks for distribution. Taking water to potable opens up the practicality of being able to then utilise existing water distribution networks, removing any legislative issues about tapping into in the South Australian environment the SA Water network. As soon as you get a greater market for that and that technology and the reassurance of being able to take stormwater to potable the pricing will come down.[31]

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27 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 38.

28 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 38.

29 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 38.

30 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 38.

31 Mr Andrew King, Chair, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, pp. 28–29.

3.27 Dr Robin Allison, who also represented Stormwater South Australia at the committee's Adelaide hearing, suggested that indirect potable reuse 'may be feasible in terms of bulk stormwater feeding into reservoirs and then shared treatment and further infrastructure'; that is, the stormwater would be sold to the water utility who would then treat and supply it using existing practices. Dr Allison concluded:

> I think we are a fair way from going directly from a stormwater harvest site into the mains network. I think that is a bigger step than the indirect process…[b]ecause of the quality controls required and the number of people handling at changeover.[32]

Need to find demand for stormwater

3.28 Regardless of whether the objective is for stormwater to have a potable or non-potable use, several submitters concluded that for stormwater harvesting efforts to expand, a greater demand for stormwater is needed.

3.29 To meet the South Australian Government's target of 35 gigalitres of annual stormwater harvesting by 2025, Water Sensitive SA argued that 'greater emphasis now needs to be placed on developing the customer/end user base and driving demand'. Water Sensitive SA considers that in South Australia, a 'lack of distribution networks and water pricing policy across all water sources (potable water, River Murray allocations or groundwater resources) is limiting demand for treated stormwater'.[33]

3.30 The CSIRO noted that uptake of stormwater harvesting 'has been slow to date'. The CSIRO's submission suggested that 'the encouragement of the use of additional demonstration projects may assist to gain public and regulator confidence' in stormwater.[34]

3.31 The Waterway Ecosystem Research Group noted that stormwater harvesting and treatment to provide potable water was one option to increase demand for stormwater, thereby protecting receiving waters from polluted urban stormwater. However, other options include:

- urban planning that ensures 'high-demand non-potable uses (e.g. agriculture, water-using industries) are placed closed to urban areas'; or
- ensuring that 'sufficient areas of vegetation are retained in the urban landscape…to maintain pre-development evapotranspiration rates, and urban stormwater runoff is directed to these vegetated areas'.[35]

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32 Dr Robin Allison, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, p. 29.

33 Water Sensitive SA, *Submission 35*, p. 3.

34 CSIRO, *Submission 42*, p. 2.

35 Waterway Ecosystem Research Group, The University of Melbourne, *Submission 17*, p. 4.

3.32 The need to find additional demand for stormwater was effectively demonstrated by the experience of existing stormwater projects. Although the committee was provided with examples of successful stormwater harvesting projects, the committee also was told that there were difficulties in expanding these projects. Mr Naumann told the committee that the stormwater harvesting projects in Salisbury harvested three gigalitres in 2014. The existing projects 'could potentially be harvesting up to eight gigalitres', however, as only 2.5 gigalitres were sold in 2014, harvesting has been 'cut back because it costs money to harvest…So we only harvest what we need'.[36]

3.33 Nevertheless, opportunities for expansion are being considered. Mr Naumann advised that research from the CSIRO is assisting Salisbury Water to focus on industrial companies that need water of a higher standard than drinking water, which the companies are currently obtaining from the main water supply and treating further before use.[37] Mr Naumann also suggested that an expansion of the City of Salisbury's network into neighbouring council areas 'that have not had either the initiative or the opportunity to get the funding that we have had' would allow for growth, although additional funding would likely be needed to accelerate this process.[38] Mr Naumann added:

> If we really wanted to take another big leap forward, and I think we are ready for that, we need about $15 million to link all of the different little council networks around the place. It has also been touched on before that the risk with stormwater is that we go into another period of drought. Stormwater is notoriously unreliable. We found in the previous seven-year drought that Adelaide went through that we got caught out in a couple of our schemes where they were not large enough to support the customer base that we had, so we scrambled to connect them.[39]

3.34 Another barrier to the increased utilisation of stormwater is potential 'competition' from recycled wastewater, as 'the combined volume of the two resources will far exceed the likely demand for water in a given area'.[40] However, some stakeholders considered that stormwater could be used in conjunction with wastewater. Ms Mellissa Bradley from Water Sensitive SA suggested that there are opportunities to mix stormwater and wastewater in some projects, as 'the salinity of wastewater is high and stormwater can be added to the supply to dilute the salinity'.[41] Mr Bruce Naumann from the City of Salisbury observed that if stormwater schemes within a city were linked together to form a city-wide network for non-potable use of

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36 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 39.

37 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 39.

38 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 39.

39 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 40.

40 Waterway Ecosystem Research Group, The University of Melbourne, *Submission 17*, p. 4.

41 Ms Mellissa Bradley, Program Manager, Water Sensitive SA, *Proof Committee Hansard*, 26 August 2015, p. 23.

stormwater to green schools and reserves, the wastewater could be used in that network. Mr Naumann concluded that the use of wastewater in this way would be 'a great opportunity to maximise the use of stormwater and waste water and get it back into the suburbs'.[42]

Water sensitive urban design and water sensitive cities

3.35 As outlined in Chapter 2, one of the benefits of stormwater put to the committee is that stormwater projects can help make cities 'more liveable'. In relation to this, several submissions referred to the concepts of water sensitive urban design (WSUD) and water sensitive cities. WSUD involves the integration of the urban water cycle, such as water supply, stormwater and wastewater, into urban planning processes. WSUD projects use vegetated stormwater treatment systems,[43] examples of which include bioretention swales, wetlands and raingardens in urban residential developments.[44] In addition to improved water management, WSUD can provide other benefits, such as the creation of recreational spaces.[45]

3.36 Water sensitive cities combine elements such as WSUD with social systems. Water sensitive cities:

> …interact with the urban hydrological cycle in ways that:
>
> - provide the water security essential for economic prosperity through efficient use of the diversity of water resources available;
> - enhance and protect the health of watercourses and wetlands;
> - mitigate flood risk and damage; and
> - create public spaces that harvest, clean, and recycle water.[46]

3.37 An example of urban planning that presented challenges for WSUD principles was outlined to the committee. Ms Mellissa Bradley, Program Manager, Water Sensitive SA, referred to two local government areas within Adelaide where impervious surfaces account for 65 per cent of the total surface area. With additional development planned over the next 30 years, the amount of impervious area in the council districts is expected to increase to approximately 89 per cent. Ms Bradley stated:

> You are talking about 10 per cent of a whole council area, left, that is not impervious. That means we will have to be extremely clever to get those liveable outcomes for the people who live in those areas so that they do not become big, hot heat islands with no amenities.

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42 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 40.

43 ATSE, *Submission 51*, p. 2.

44 Cooperative Research Centre (CRC) for Water Sensitive Cities, *Submission 44*, p. 3.

45 Stormwater Industry Association WA, *Submission 21*, p. 4.

46 CRC for Water Sensitive Cities, *Submission 44*, p. 2.

> I drive down some of those suburbs that have already been converted and I feel for the people who reside there. For our image galleries, our website, I am trying to take photos of good practice water-sensitive urban design and where it can be improved, and I feel that some suburbs are struggling from becoming highly impervious heated areas. Water-sensitive urban design can do a lot to mitigate that…[and stormwater] is absolutely integral to that.[47]

3.38 eWater argued that all government authorities should recognise the value of WSUD principles and adopt these principles in land and infrastructure development codes. According to eWater, nationally consistent WSUD guidelines should be developed that aim to provide 'a nationally consistent approach for managing stormwater in an integrated way'.[48] eWater stated:

> …the full and consistent implementation of WSUD practices are limited to only a handful of large and/or innovative local government authorities. The problem seems to be that most councils don't have the human or financial resources to implement WSUD principles even if they want to. A broader recognition and funding of WSUD practices across all stormwater management authorities is essential.[49]

3.39 Stormwater Victoria referred to innovative WSUD projects in Melbourne, however, it emphasised that ongoing support for innovation is critical. It explained:

> Water sensitive urban design is less than 20 years old and has yet to reach full maturity as a discipline. The industry has noted a decline in recent years for the support of research as industry and government budgets tighten. Stormwater Victoria sees this as a potential issue as without innovation and scientific research further progress will be hampered.[50]

3.40 The Australian Academy of Technological Sciences and Engineering (ATSE) argued that Australia needs to 'further develop its vegetated stormwater harvesting technologies, as they currently lag far behind other water treatment technologies'. The ATSE further argued that ongoing investments to implement stormwater WSUD technologies 'will ensure that we can delay augmentation of existing drainage infrastructure, making considerable savings'.[51]

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47 Ms Mellissa Bradley, Water Sensitive SA, *Proof Committee Hansard,* 26 August 2015, p. 26.

48 eWater, *Submission 9*, p. 2.

49 eWater, *Submission 9*, p. 3.

50 Stormwater Victoria, *Submission 20,* p. 4.

51 ATSE, *Submission 51,* p. 4.

3.41 Other issues affecting the widespread adoption of WSUD that the committee was informed of include:

- lack of willingness from developers;[52]
- insufficient project experience in WSUD—Water Sensitive SA submitted that, in Adelaide, knowledge about WSUD projects is 'confined to a limited number of individuals and organisations' and there are relatively few examples in Adelaide that can be used for training and other educational uses; and
- a lack of awareness and application of existing WSUD technical guidelines—this was highlighted as an issue in South Australia.[53]

Limits to stormwater harvesting and alternative options

3.42 Although witnesses were generally optimistic about the potential for stormwater to be better managed and utilised to a greater extent, some of the evidence received by the committee recognised potential limits to the use of stormwater. This section considers this evidence.

3.43 Mr Adam Lovell, Executive Director, WSAA, suggested that stormwater and rainwater can contribute to the water supply of a city, 'but it is certainly not going to save a city'. To demonstrate this point, Mr Lovell used the water demand of Sydney:

> Sydney has, in a drought year, a 500-gigalitre-per-year demand. In a normal year it is 600 gigalitres per year. If you put a five-kilolitre rainwater tank in every household and you have them operating for the toilet, the washing machine and things like that—operating absolutely optimally—the best you could get would be 70 gigalitres per year—10 to 15 per cent of supply.[54]

3.44 Mr Lovell also noted that the demand and supply for stormwater may not match up. He observed that 'industry needs to operate 24/7 and customers need water 24/7, but it might not rain for three months'.[55] Mr Lovell also drew attention to the large storage spaces that are needed for water supply. He explained:

> The biggest problem we find in urban areas is that people just do not understand the size of storage required. All this water is going down the drain, but they do not realise there is another drain down there and another one down there—and all of a sudden you need Sydney Football Stadium sized storage for one rain event. We all know that that is not possible—the cost and the use of that. And then you have got to store and treat it. [56]

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52 Adelaide and Mount Lofty Ranges Natural Resources Management Board, *Submission 11*, p. 3.

53 Water Sensitive SA, *Submission 35*, p. 2.

54 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, pp. 4–5.

55 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 8.

56 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 6.

3.45 Mr Lovell concluded that, because of these considerations, it 'is really important to say: what do we actually want?'. In this regard, Mr Lovell highlighted the 'fantastic opportunities' that stormwater presents for contained projects that relate to liveable cities and parks. Mr Lovell uses the Central Park development near Central Railway Station in Sydney as a an example:

> It has beautiful green walls coming down. There is a big capital uplift. People pay a green premium. They are pulling stormwater off that site and recycling it on site. That is the type of disruption and innovation we are seeing. And that is not being provided by Sydney Water. I am not speaking on behalf of them. It is provided by the private sector, through innovation. I think that is a fantastic thing.[57]

3.46 Submitters also suggested that some of the pollution from stormwater could be addressed directly at the source. The Australasian Chapter of the International Erosion Control Association (IECA) argued that greater funding and resources should be given to addressing the pollutants in stormwater linked to the construction sites as 'managing stormwater quality during construction is cheaper (per kg of pollution) than during the operational phase of development and has far greater potential for large-scale catchment benefits'.[58]

Stormwater as a substitute for desalination

3.47 Another matter examined during this inquiry is the implications for stormwater use of investments made in desalination plants. In particular, stakeholders considered whether stormwater can be a substitute for desalination, or whether desalination capacity is required regardless.

3.48 The CSIRO noted that stormwater harvesting could replace other sources of water that supplement traditional supplies, such as desalination plants. The CSIRO submitted:

> Previous reliance on desalination plants over other alternative water sources, such as stormwater harvesting has increased energy use in the urban water cycle…with associated implications to greenhouse gas emissions…
>
> [H]arvesting of stormwater for local uses has the potential to reduce greenhouse gas emissions associated with alternative sources which involve intensive pumping to transfer water across large metropolitan areas.[59]

3.49 Mr Andrew Allan from Stormwater Australia suggested that 'some of the desalination type investments have been justified on the need to have a rainfall-independent source of water'. Mr Allan observed that this applies in 'a

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57 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 6.

58 IECA Australasia, *Submission 2*, p. 1.

59 CSIRO, *Submission 42*, p. 3. See also Urban Water Cycle Solutions, *Submission 41*, pp.17–19.

traditional catchment-type water source where, when it rains, water soaks into the soil and the trees evapo-transpire it'. He argued, however, that in the urban environment the rainwater does not disappear; rather, rain that falls on hard surfaces becomes an 'efficient way of generating run-off'. Mr Allan concluded that stormwater 'generates problems but also generates opportunity'.[60]

3.50 Some downsides of desalination were highlighted. In particular, the committee received evidence about the limitations and costs of operating a desalination plant. For example, Mr Pfleiderer from Stormwater Victoria discussed the 'shadow cost' associated with a desalination plant:

> Once you do turn it on, the cost of that water is pretty high, much higher than what you are paying for out of your tap, so if that is actually recognised then stormwater does become quite competitive, rather than just fixing on that dollar per kilolitre that you have on your water bill.[61]

3.51 Witnesses also observed that desalination plants do not assist with flood mitigation, urban heat islands, or addressing environmental degradation.[62] It was further noted that the process of desalinating seawater is energy intensive; although stormwater has pollutants that need to be extracted, representatives of Stormwater Australia and Stormwater Victoria argued that salt is the most challenging substance to extract.[63]

3.52 Whether stormwater could be used at a lower cost than desalination was explored. In regions where managed aquifer recharge is possible, such as Adelaide and Perth, Professor Ana Deletic referred to a trial that is examining the injection of treated stormwater into the aquifer for access downstream in subsequent years. Professor Deletic indicated that such activities should not incur significant costs.[64]

3.53 Some witnesses were asked whether the significant investment made in desalination created an incentive for the owner of the desalination plant to resist large-scale stormwater projects to ensure that their investment will be financially viable. Mr Allan provided the following response to this reasoning:

> Just thinking this through: there is only so much money in the system, so there is a need to look at what money has been spent on. Those desalination type options were put in during the drought years towards the end:

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60 Mr Andrew Allan, National President, Stormwater Australia, *Committee Hansard*, 18 May 2015, p. 4.

61 Mr Ralf Pfleiderer, President, Stormwater Victoria, *Committee Hansard*, 18 May 2015, p. 5.

62 Mr Ralf Pfleiderer, President; Mr Chris Beardshaw, Secretary, Stormwater Victoria, *Committee Hansard*, 18 May 2015, p. 5.

63 Mr Andrew Allan, Stormwater Australia; Mr Ralf Pfleiderer, Stormwater Victoria, *Committee Hansard*, 18 May 2015, p. 6.

64 Professor Ana Deletic, Deputy Chair, Water Forum, Australian Academy of Technological Sciences and Engineering (ATSE), *Committee Hansard*, 18 May 2015, p. 22.

> 'Okay, we're running out of water. We need a really quick fix. This is the insurance policy that we can buy.' Depending on where you are, they cost more or less to build.[65]

3.54 Mr Allan added:

> We now find, as we are coming out of the drought, that we have those plants there. They are not being used, largely, because we do not need them because it is raining and the dams are filling up and everything, but we have to pay for them. I think what happened in the past was that we got a solution, and then people forgot that we almost ran out of water and you have to pay back what you have bought. I think we are in that paradigm now.[66]

3.55 Professor Tony Wong from the CRC for Water Sensitive Cities, however, disagreed with the argument that capital investment in desalination has negative implications for stormwater harvesting investment. Professor Wong countered that desalination plants provide a safety net that allows for innovation. He explained:

> A lot of the innovation that the CRC for Water Sensitive Cities is developing, fostering and creating adoption for is very sustainable solutions with a very long incubation period simply because of the need for us to diffuse that solution. The long incubation period in the past has been the key impediment to any uptake of innovation in this area because in a crisis you cannot deliver some of those solutions. The desalination plants—certainly in Melbourne—have given us an era of stability in terms of our resilience to drought at least for the next 25 to 30 years. It gives us the opportunity to deliver much more innovative solutions and to incubate that before we get to the 30-year useful life of the current desal. The aim is not to have to build another desal plant rather than to not build the first one. The first one is a foundation, a safety net for innovation.[67]

3.56 Mr Adam Lovell of the WSAA argued that desalination and stormwater need to be considered separately. He provided the following reasoning:

> First of all, for the capital cities that have desalination, it is an insurance policy they are in. They are properly priced. Some of them received government funding and some of them did not. For instance, Sydney Water's desalination plant has been sold to the private sector. Sydney Water does not have control over the operating procedures of that plant. That is not Sydney Water's call; that is the call of the government, which says when that desal plant can be turned on. Utilities do not overall have control about whether stormwater should or should not be part of the diverse range of sources available for potable supply. Desal is climate independent potable supply, very clearly. I think stormwater recycling is more in the

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65 Mr Andrew Allan, Stormwater Australia, *Committee Hansard*, 18 May 2015, p. 5.

66 Mr Andrew Allan, Stormwater Australia, *Committee Hansard*, 18 May 2015, p. 5.

67 Professor Tony Wong, Chief Executive Officer, CRC for Water Sensitive Cities, *Committee Hansard*, 18 May 2015, p. 29.

> non-potable, livable city type domain. There is only one instance that I know of, Kalkallo, just north of Melbourne, that is looking at it from a potable use scenario.[68]

3.57 Despite some disagreement between stakeholders about the implications presented by existing desalination investment, there was general agreement that long-term changes would necessitate the consideration of greater investment in stormwater harvesting. For example, Mr Allan considered that population growth and climate change requires that consideration be given to the water that could be harvested from stormwater. He told the committee:

> …if we were smart about things going forward, we have these investments now and they are going to have to be paid back, but some of the modelling that has been done suggests that with population growth and with climate change we are probably going to find that we need to build another desal plant or something else into the future, so we should be making those co-investments, smaller over a longer period of time, that are actually going to help us out. I think they are a reality of the landscape, but they are also competing for a scarce resource, and, moving forward, we need to be investing more in a stormwater fix for a whole range of other reasons which are not just water supply.[69]

Need for better data, guidelines, planning and training

3.58 Submissions called for studies and guidelines on various matters to support better stormwater management outcomes.

3.59 Although detailed flood studies have been undertaken, the CSIRO noted that additional data on stormwater quality and capturability, as well as further research on the environmental impacts, costs and benefits associated with stormwater and stormwater harvesting may be needed.[70] The CSIRO stated that an impediment to the adoption of scientific advances is 'the lack of sufficient data for an effective cost-benefit analysis on the value of capturing and reusing stormwater compared to other potential water sources'. In particular, the CSIRO noted that there is insufficient information 'on the value to the environment and social amenities for reducing the stormwater flows in urban creeks and drains'.[71]

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68 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 2.

69 Mr Andrew Allan, Stormwater Australia, *Committee Hansard*, 18 May 2015, p. 5.

70 The CSIRO noted that initial research has 'shown the importance of fully understanding the environmental impacts, costs and benefits of stormwater and stormwater harvesting on coastal water quality, urban stream ecology, flood mitigation, urban landscape amenity, and land value'. CSIRO, *Submission 42*, p. 2.

71 CSIRO, *Submission 42*, p. 3.

3.60 The current approach to assessing the costs and benefits of different stormwater management approaches was an issue raised by several submitters. Mr Adam Lovell told the committee that 'the biggest problem in stormwater is: who benefits and who pays'. He explained that the answer to this question is:

> …easy in a water utility provision, because you are providing drinking water and you know exactly who is getting it and you know exactly who pays for it, in water and waste-water services. Stormwater is different. The beautiful parks and gardens of Adelaide or downtown Sydney or Brisbane—those are for the benefit of all. But they come from good stormwater management. So I think that that is where the community cost becomes really important in terms of how you would enable innovation.[72]

3.61 Mr Lovell argued that consideration of cost 'should be on the basis of total community cost, not on the cost to the individual entities that are involved in delivering that stormwater program'.[73]

3.62 The CRC for Water Sensitive Cities hinted at the difficulty in fully considering the liveability of a city based on the current measurement of economic benefits that could arise from stormwater management. The CRC explained:

> The economic benefits of innovation in stormwater management are poorly and narrowly defined. The notion of 'liveability' has wide ranging connections to the economy of a city and it is necessary to have these benefits, many of which are non-market benefits, understood and quantified.[74]

3.63 The CRC for Water Sensitive Cities outlined other potential costs that are not currently taken into account or are difficult to monetise, although some of these costs can be quantified. The matters highlighted by the CRC included:

- health costs related to urban heat effects;[75]
- 'system resilience', which 'has intrinsic economic value that could be quantified through a combination of real option analysis for water security, flood management and aquatic ecosystem health in combination with scenario modelling';
- increased biodiversity and ecological health of the aquatic ecosystem; and

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72 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 3.

73 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 3.

74 CRC for Water Sensitive Cities, *Submission 44*, p. 8.

75 The CRC for Water Sensitive Cities explained that these costs 'can be broadly quantified': 'A study by Monash University in partnership with the National Climate Change Adaptation Research Facility (NCCARF) has identified threshold temperatures above which mortality and morbidity increases in all Australian capital cities. The reduction in surface and air temperature attributed to WSUD and green infrastructure can be broadly extrapolated to corresponding reductions in community morbidity and mortality, and associated costs of health care'. CRC for Water Sensitive Cities, *Submission 44*, p. 9.

- improved 'physiological health and recovery of people that are more connected with green space and being more physical active (such as walking through green corridors in their suburbs)'.[76]

3.64 Dr Peter Coombes argued that the future costs have not been taken into account adequately. Dr Coombes suggested that the centralised nature of water supply will lead to higher costs. He explained:

> …there have been substantial increases in operating costs of our major urban utilities versus other utilities that have more distributed solutions where their operating costs have not grown. Operating costs are not really counted in these processes. So, some of the things that we are not counting are costing us billions of dollars a year.[77]

3.65 Dr Coombes also argued that better performance data could lead to improved outcomes. Dr Coombes called for the creation of a national monitoring program and reporting agency for urban water and stormwater issues. This agency would provide 'annual reports on the status of water cycle resources (including stormwater), forward plans and policies, facilitate monitoring of urban catchments and arbitration on the decisions about innovation'.[78] In support of this recommendation, Dr Coombes remarked:

> One of the best things that happened in water management in Australia was the provision of a national performance report for our urban utilities. That then allowed things to be compared and contrasted. It also allowed federal and state governments to more fully understand where they stood, the status of the resource, the economic situation they were in and so on.[79]

3.66 The CSIRO suggested that a centralised repository of data on water source, supply, discharge, and quality, such as a 'water bank', could improve future decision-making on water infrastructure investments.[80]

3.67 Better networks between stormwater organisations, researchers and project developers could also yield benefits. Ms Mellissa Bradley, Program Manager, Water Sensitive SA, told the committee that:

> While we are working in an informal manner together, across state based capacity within programs, it would be advantageous if we could have some national cohesion. It might save our limited funds, because we are all struggling financially, to get better consistencies and efficiencies.[81]

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76 CRC for Water Sensitive Cities, *Submission 44*, p. 9.

77 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, pp. 15–16.

78 Dr Peter Coombes, *Submission 60*, p. 3.

79 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 14.

80 CSIRO, *Submission 42*, p. 6.

81 Ms Mellissa Bradley, Water Sensitive SA, *Proof Committee Hansard*, 26 August 2015, p. 25.

3.68 Ms Mellissa Bradley added that her organisation considers that:

> …continued and expanded effort is required to bring research learning to practitioners who need to apply these learnings. The state based capacity-building programs for water-sensitive urban design are an excellent conduit to bring these research outcomes to practitioners and can add value to research adoption pathways, because we feel there is a lot of research going on but it is not actually getting out to the people who need it, and we can see that there are opportunities there.[82]

3.69 Matters regarding planning and training were also noted. These included:

- Water security—given the potential contribution stormwater could make to a diversified water supply and, therefore, water security, it was argued that water authorities should conduct detailed risk assessments and environmental impact assessments on water security. The studies would focus on the costs and benefits associated with using stormwater for potable purposes.[83]
- Training—the Institute of Public Works Engineering Australasia (NSW Division) suggested that operational staff need upgraded skills. The Institute observed that it 'is easy to understand how a pipe works, but understanding how a bio retention basin works is a whole different ball game'. Further, the Institute argued that stormwater projects should be kept simple as 'if you need a degree to understand how it works, it will not be operated or maintained properly or cheaply'.[84]

82 Ms Mellissa Bradley, Water Sensitive SA, *Proof Committee Hansard*, 26 August 2015, p. 23.

83 Central West Councils Salinity & Water Quality Alliance, *Submission 16*, p. 6.

84 Institute of Public Works Engineering Australasia (NSW Division), *Submission 38*, p. 4.

Chapter 4

Management of stormwater by state governments, local governments and water utilities

4.1 Stormwater management is the responsibility of state and local governments. This chapter considers the evidence received about the roles that water utilities, local governments and state governments perform in stormwater management, and the implications of these arrangements for how stormwater is managed.

Local governments and water utilities

4.2 Many submissions commented on the stormwater management roles performed by water utilities and local governments. One issue that was noted is the legal ownership of stormwater as a resource, and the implications that this has for the overall approach to stormwater management. The limited resources available to local governments were also noted. These issues were summed up by the Cooperative Research Centre (CRC) for Water Sensitive Cities, which observed in its submission:

> There are very few incentives for water authorities/utilities to co-develop water resource management strategies with local government, and local governments have limited resources and jurisdictional role in delivering public space strategies around the cleansing of stormwater and managing it as a resource.[1]

4.3 The following paragraphs explore these issues.

The 'ownership' of stormwater is seen as a problem

4.4 The Australian Water Association noted that the one consistent attribute in how water and wastewater is managed is that 'the water utilities do not manage or own the stormwater assets'. Instead, local government is responsible.[2] Various stakeholders consider that this arrangement, where different water sources are managed by different entities, is problematic. The Stormwater Industry Association WA, for example, argued that:

> Significant pressures on our water resources in recent times, particularly from declining rainfall runoff and population growth, have highlighted the importance of urban and regional water planning. It is no longer appropriate to consider elements of the water cycle independently, in order to provide for water supply, sewerage or drainage, as this will result in disconnected systems which often lead to impacts on the water quality of waterways,

1 Cooperative Research Centre (CRC) for Water Sensitive Cities, *Submission 44*, p. 12.

2 Australian Water Association, *Submission 47*, p. 2.

> wetlands and the groundwater as well as the inefficient, single use of water.[3]

4.5 Some submissions argued that stormwater has been seen by local councils as a problem that needs to be 'avoided and discharged as quickly as possible', and that this has shaped the approach taken to stormwater management.[4] As Stormwater Australia put it, 'stormwater is not "owned" by any agency'.[5] Mr Andrew Allan, President, Stormwater Australia, observed that stormwater-related projects are, at present, 'probably a public good type investment' because stormwater is not owned by anyone at the moment. As such, Mr Allan reasoned that stormwater management 'is different to the other types of water supply and services that are provided in the urban context'.[6]

4.6 The CSIRO stated that the 'separation of management functions among and within institutions in each jurisdiction for water supply and sewage, stormwater, groundwater, streams, and aquatic ecosystems in and near urban areas' has been a factor in the urban water sector being 'slow to adopt basin water planning approaches'.[7]

4.7 The City of Melbourne explained that the governance of stormwater, which it considers is 'currently quite complicated', has implications for decision-making on the use of stormwater as a resource. The City explained that although the council owns and manages the majority of stormwater drainage infrastructure, it does not own the water. The following overview of the legal status of stormwater in Victoria, and some of the implications of the current arrangements, was provided:

> Current legislation is interpreted to state that water falling on building roofs (rainwater) is the property of the building owner, but once it reaches the ground and becomes stormwater it become the property of the crown. This puts council in a position of owning and maintaining the assets but not its contents. To date this has not been a problem as it is an undervalued resource and we have good working relationship with the relevant authorities. But there is not surety of supply with upstream landowner able to capture water irrespective of any downstream systems. For example, if the parliament building in Spring St was modified to capture all the stormwater falling on it, then the 45 million [litre] Fitzroy garden scheme

3 Stormwater Industry Association WA, *Submission 21*, p. 2.

4 Dr Darren Drapper, *Submission 10*, p. 2.

5 Stormwater Australia, *Submission 19*, p. 16.

6 Mr Andrew Allan, National President, Stormwater Australia, *Committee Hansard*, 18 May 2015, p. 3.

7 The CSIRO observed that 'approvals have been required from up to eight or more organisations in some cases for establishing schemes such as the harvesting of stormwater via managed aquifer recharge'. CSIRO, *Submission 42*, p. 5.

> would lose 25% of its catchment and hence the corresponding inflow volume.[8]

4.8 Different approaches and policies of various local governments also present challenges for the stormwater industry. Stormwater Industry Association WA advised that 'standards and policies of local governments are often inconsistent and this significantly reduces efficiency of approach for the stormwater industry as time is spent negotiating minutia instead of focussing on outcomes'.[9]

4.9 The Waterway Ecosystem Research Group stated that 'certainty around "ownership" of the stormwater resource is required to facilitate investment'. It was suggested that the committee 'should consider the merits of facilitating the involvement of water authorities and municipalities as "providers" of stormwater services (treatment, mitigation and supply as a resource), overseen by a suitable body with the power to ensure optimal outcome'.[10] The Australian Water Association called for the management of stormwater infrastructure to be integrated into the water/wastewater utility 'once the basic flood mitigation role has been resolved'. The Association noted that 'the skill sets involved in management and maintaining water and wastewater assets are very similar to those required to manage and maintain stormwater assets'. Water utility models in New Zealand were cited as examples.[11]

4.10 In Australia, Melbourne Water was put forward as being 'one of the better models in existence'. Mr Adam Lovell, Executive Director, Water Services Association of Australia (WSAA), explained that as Melbourne Water operates the trunk mains for water, wastewater and stormwater, they are well-placed to work with retail water companies. Mr Lovell continued:

> In Melbourne there is the bulk supply, which is Melbourne Water, and you have got the three retailers that operate in the rest of the city. They operate the smaller, defined area of water and wastewater reticulation systems. But what Melbourne Water can do under their model, because of their legislative nature, is bring in councils, the local water utilities and government very effectively to deliver fantastic projects. In our submission there is a case study of a project in Clayton, in the wetlands, which produced a fantastic outcome. That is the sort of model which could

8 City of Melbourne, *Submission 43*, p. 8. Sydney Water also noted that both it and local councils are involved in stormwater, and consequently there is an opportunity to improve stormwater management. See *Submission 36*, p. 1.

9 Stormwater Industry Association WA, *Submission 21*, p. 10.

10 Waterway Ecosystem Research Group, The University of Melbourne, *Submission 17*, p. 6.

11 Examples of water utilities that manage stormwater include Capacity Infrastructure Services (trading as Wellington Water) in Wellington, New Zealand and Metrowater, in Auckland. See Australian Water Association, *Submission 47*, p. 3.

> potentially apply here or in other places. Brisbane City Council had a very similar type of model.[12]

4.11 Mr Lovell argued that, although debates about ownership tend to arise, he considers that attention should instead be given to 'who has actually got the stewardship to bring in stormwater as part of the urban water cycle'. He concluded:

> That is our last frontier in Australia. We lead the world in everything except having stormwater properly incorporated into the urban water cycle. So one model for South Australia could be the Melbourne water model.[13]

4.12 Professor Tony Wong, the Chief Executive Officer of the CRC for Water Sensitive Cities, highlighted how the growing global population will require a reassessment of current practices. Professor Wong observed that the traditional approaches to managing this pollution 'served us well when we had plenty of resources and the environment had plenty of capacity to assimilate the pollution that we discharge'. In relation to water management, he argued that a different institutional framework is now required so that better outcomes are encouraged. Professor Wong explained:

> …many cities all over the world—it is not just us—were able to get away with simply compartmentalising water management in the past. The delivery of taps and toilet services was seen as one that would be revenue generating, while the delivery of flood mitigation, water quality protection and drainage is simply seen as a community service. We have now got to a point whereby those institutions are impeding our ability to integrate all of those services such that we can actually look at multiple outcomes delivered by multiple stakeholders to address this issue of climate extremes.[14]

4.13 Witnesses suggested that there are business opportunities available from alternative water management models. When asked why water utilities do not appear to utilise stormwater to a greater extent, Professor Timothy Fletcher, a professor of urban ecohydrology at the University of Melbourne, suggested that this outcome can be partly explained by such actions being outside of the water utilities' charters of operations, as well as the lack of economic incentives.[15] Professor Fletcher outlined an alternative water management model that could encourage the greater utilisation of stormwater:

> If someone has a problem, because they now cannot discharge water, and someone has a demand for that water we have a marriage made in heaven.

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12 Mr Adam Lovell, Executive Director, Water Services Association of Australia (WSAA), *Proof Committee Hansard*, 26 August 2015, p. 5.

13 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 5.

14 Professor Tony Wong, Chief Executive Officer, CRC for Water Sensitive Cities, *Committee Hansard*, 18 May 2015, p. 25.

15 Professor Timothy Fletcher, Professor of Urban Ecohydrology, University of Melbourne, *Committee Hansard*, 18 May 2015, p. 34.

> How to create that incentive is the real challenge…we have tended to find that water authorities stick to their narrow remit, and yet a lot of the work that has been done…suggests that there are attractive business models in water authorities being integrated across all sources of water.
>
> Rather than just saying, 'I take water from a bulk water supplier who has a dam upstream of me; I take it and sell it to the punters,' a water authority could instead say, 'I manage a portfolio of water sources and I provide that to the community, including the services that facilitate those services.' For example, in a new development that is going to be constructed, a water authority might choose to be the provider of the water-tank system on individual houses and, with the very sophisticated telemetry systems that exist now—for example, telemetetric flood control so that when a big rain is coming those rainwater tanks can be dropped down to provide protection for the upcoming flood—we can really imagine those water authorities having a much more integrated portfolio. I would argue that in terms of business models that makes them more resilient, in the face of a change in climate.[16]

Resources available to local government for stormwater management

4.14 Local governments face direct costs associated with managing the runoff caused by impervious surfaces. Several submitters, however, questioned whether local governments have sufficient resources and are otherwise well-placed to manage stormwater effectively. Stormwater Australia, for example, noted that:

- local governments find it difficult to raise a sustainable revenue stream to support the management of stormwater; and
- many of the public good outcomes that could be achieved from better stormwater management are not within the mandate of local government to deliver, or are benefits that would be derived by 'a broader community outside the specific local government's area of responsibility'.[17]

4.15 The various priorities that local governments have, the limited funding available to them and the implications of this tension for stormwater infrastructure was highlighted. Local Government NSW stated that its councils have a stormwater drainage infrastructure renewal backlog of $633 million at 30 June 2012, which will 'continue to constrain local government's ability to renew existing and provide new infrastructure'.[18]

4.16 eWater submitted that often 'councils or other responsible authorities have no operational plans or funding to support the ongoing maintenance of stormwater infrastructure'. eWater added that where funding is available for infrastructure, it

16 Professor Timothy Fletcher, *Committee Hansard*, 18 May 2015, p. 34.

17 Stormwater Australia, *Submission 19*, p. 16.

18 Local Government NSW, *Submission 15*, p. 7.

'is also important to allocate sufficient funding to support the ongoing maintenance of stormwater infrastructures, not just to fund their capital costs'.[19]

4.17 Stormwater industry associations also noted asset management issues. In its submission, Stormwater Victoria advised that the estimated asset value of local government stormwater infrastructure is over $11 billion. Stormwater Victoria contended that, with a general trend for competitive contracting of maintenance services, 'only the absolute minimum of service as required by the contracts' occurs. Stormwater Victoria argued that this is unsustainable and that a new funding model is needed 'so that the costs of renewing and replacing drainage infrastructure are not unsustainably transferred to future generations'.[20]

Stormwater offsets and levies

4.18 The costs that local governments face can be recovered by stormwater levies, such as those used in New South Wales,[21] and offsets, such as the offset scheme used in Melbourne. A stormwater offset program allows developers to 'pay an offset where it is not technically or economically feasible to meet best practice stormwater management onsite'.[22] Stormwater Australia explained that the offset schemes involve the use of a 'proxy pollutant', such as nitrogen, to calculate contribution rates. The developer may either 'pay an offset or undertake water quality improvement works which achieve the desired regulatory outcome'. Stormwater Australia submitted that:

> These schemes are considered effective at managing a component of stormwater impact (eg nutrient pollution as opposed to stormwater volume), however, they are generally limited to new (greenfield) developments, are not universally applied and because of their focus on the development phase, are not set up to address longer term operational issues.[23]

4.19 The committee received evidence that demonstrated some of the limitations of existing levy and offset arrangements. Stormwater South Australia submitted that 'there is difficulty in establishing meaningful and legally enforceable cost-sharing provisions with developers for the upgrade of drainage systems which their development flows to but is not actually part of their development'.[24] Stormwater Victoria submitted that local governments need a mechanism to secure dedicated revenue for stormwater management. In Victoria, the water utility can levy a drainage charge, however, local councils cannot do so even though they control 'a significant

19 eWater, *Submission 9*, p. 5.

20 Stormwater Victoria, *Submission 20*, p. 7.

21 Local governments in New South Wales are permitted to impose a stormwater levy on ratepayers in relation to new stormwater management services, however, they are not able to impose a levy that relates to existing services. Local Government NSW, *Submission 15*, p. 6.

22 CSIRO, *Submission 42*, p. 4.

23 Stormwater Australia, *Submission 19*, p. 17.

24 Stormwater South Australia, *Submission 32*, p. 2.

proportion of the drainage network'. Instead, funding 'must be sourced from general rate revenue in competition with other services delivered by councils'.[25]

4.20 In Local Government NSW's view, the ability for NSW councils to impose a stormwater levy on rate payers for new stormwater infrastructure 'has not removed the stormwater infrastructure backlog'.[26]

4.21 SPEL Environmental was critical of stormwater offset schemes as it considers the introduction of stormwater offsets is not resulting in better management of stormwater. SPEL Environmental noted that Gladstone, Ipswich, Redlands, Logan, Toowoomba and Mackay councils started to collect offsets in 2012, however, none of these councils have implemented a treatment system. SPEL Environmental called on the Australian Government to:

> …ban the use of stormwater offset schemes by councils as it is very damaging to the stormwater industry economics and the environment because the treatment is not occurring![27]

Role of state governments in stormwater management

4.22 State governments can have clear policy and leadership roles with respect to improving stormwater management in their jurisdiction. For example, in 2009 the South Australian Government released its water security strategy, *Water For Good*. That strategy included a target that, by 2025, up to 35 gigalitres per annum of stormwater is to be harvested in urban South Australia for non-drinking purposes (where economically and technically feasible). This target increases to 60 gigalitres by 2050 for Greater Adelaide, and an additional 15 gigalitres per annum in regional areas.[28]

4.23 Evidence was received, however, which suggested that the effectiveness of state government efforts to improve stormwater management outcomes can be affected by jurisdictional arrangements within state public sectors and the relationship between state and local governments.

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25 Stormwater Victoria, *Submission 20*, p. 7. This evidence was supported by the evidence given by the City of Melbourne. The City of Melbourne advised that although small-scale projects can be funded from the rate base, the majority of its large-scale stormwater harvesting projects have been co-funded by Australian and state government grants. Further, if development is occurring in flood prone areas, the City does not 'have a mechanism to levy a fee for the works that are required in order to provide this development with a better level of flood protection'. The City noted that, as part of its Elizabeth Street Catchment Plan, it intends to explore various options for developer contributions or an offset. City of Melbourne, *Submission 43*, p. 5.

26 Local Government NSW, *Submission 15*, p. 6.

27 SPEL Environmental, *Submission 12*, p. 3.

28 Government of South Australia, *Water for good: A plan to ensure our water future to 2050*, www.environment.sa.gov.au/files/sharedassets/public/water/water-for-good-full-plan.pdf (accessed 16 September 2015), p. 21.

4.24 Stormwater Australia suggested that the 'disparate responsibility arrangements' for stormwater at the state government level are a 'frustration', that results in attention being given 'to more familiar aspects of the water system…such as water supply and sewerage'.[29]

4.25 Dr Peter Dillon, a retired CSIRO researcher and co-chair of the International Association of Hydrogeologists Commission on Managed Aquifer Recharge (IAH-MAR), stated that in some states, the state and local governments 'are not sharing water infrastructure nor cooperating on integrated urban planning, water resources planning and management, which would benefit all'. Using the federation-era rail gauge issue as an analogy, Dr Dillon stated:

> …at this junction, it is not a problem of train tracks and different gauges. The gauges actually fit; we just have two different sets of assets that are run independently. If they were joined together, huge benefits could emerge, as long as the policies are appropriate.[30]

4.26 The Stormwater Industry Association WA submitted that state governments need to provide better support to local councils. It stated:

> Generally support for innovation is high within state government departments but unfortunately this rarely relates to practical assistance as a result of poor resourcing. There is a substantial need for increased investment in technical skills within State Government to provide support and guidance to local government and to assist the development and stormwater industries to develop and implement more innovative approaches to water management.[31]

4.27 Dr Darren Drapper suggested that there are other problems with the relationship between local and state government. To illustrate his concerns, he advised that when the Toowoomba Regional Council wanted to introduce rainwater tanks, it 'required a concerted effort, and significant additional reporting, to challenge the [Queensland] Public Works Minister'.[32]

4.28 It was also claimed that state governments could be reluctant to promote the utilisation of stormwater for financial reasons. Dr Drapper, for example, noted that the utilisation of stormwater is potentially a threat to the revenue streams of both state-owned and privatised water utilities.[33]

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29 Stormwater Australia, *Submission 19*, p. 16.

30 Dr Peter Dillon, *Proof Committee Hansard*, 26 August 2015, p. 17.

31 Stormwater Industry Association WA, *Submission 21*, p. 10.

32 Another example provided was in Hobart, where sufficient non-potable water could be supplied to several industrial uses, however, this 'struggled because there was no legislative vehicle permitting council to capture and sell this resource'. Dr Darren Drapper, *Submission 10*, p. 1.

33 Dr Darren Drapper, *Submission 10*, p. 1.

Regulation of water utilities

4.29 One area where state governments can significantly influence stormwater management is the regulation of water utilities. Several submitters argued that the regulation and limited mandates of water utilities presents challenges for efforts to improve stormwater management outcomes. An example of this argument is that provided by Mr Adam Lovell, Executive Director, WSAA. Mr Lovell stated that 'there is no innovation in the way we fund nor in the way that we regulate stormwater'. A reason given for this is as follows:

> Water utilities are regulated to death. One of the criticisms that I have seen in submissions and you will hear it in general is that water utilities have not done enough in this space. The fact is most water utilities operate off a very strict statement of obligations, operating licences or whatever you want to call them, which an economic regulator will look to in black-letter right down to the last cent. A water utility does not have licence to launch itself into stormwater, which it does not operate. Around the country, only Melbourne Water has a very strong legislative role in managing stormwater. Sydney Water operates about 10 per cent of stormwater assets in Sydney. In the rest of the country, zippo. Perth operates it from a drainage perspective.[34]

4.30 Mr Lovell advised that more desirable outcomes could be achieved if the water utility sector was able to 'work with customers to see what they want'. He provided the following example from the United Kingdom where a water utility had the opportunity to involve its customers in decisions about its priorities, which revealed a preference for improved stormwater management:

> …South West Water, over in the UK, has just gone through a price review. It is very similarly structured to Australia. The regulatory agency there said: 'We want to restore the primacy of the relationship between the customer and the water utility. We don't want to be the go-between. We don't want to be wagging our finger at the water utility, saying, "You must do this, you must do that, and this is the price you are going to charge." We want to say to the water utility, "Here is your price cap or here is your revenue cap. You work with your customers to understand what they would like to see from the local water system."' South West Water is a beautiful part of the coast down there in England. A lot of the customers said, 'We'd like to see stormwater management improved.' Just like in Australia, that water utility does not have control over the stormwater. Through that process, they went back to the regulator and said: 'Customers have asked for better stormwater management. They love their beaches and they want them to be clean as much as possible.' The regulators said: 'Fine, you go and work with the local councils. Here is the funding that the customers actually agreed to to go and do that.'[35]

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34 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 2.

35 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 6.

4.31 As water utilities generate significant revenue, Mr Lovell acknowledged that it could be considered that the money for stormwater management already 'is there'. In his view, 'it is about the way utilities are regulated'. Mr Lovell concluded that the water utilities need greater flexibility to identify and work to achieve the outcomes their customers and local governments want:

> I agree that taking a light-handed approach is like a piece of string, but we need to loosen that up. The utilities should be given a revenue or price cap—whatever suits the local circumstances. But they should be told, 'Go and work with your customers and the local councils to determine what sort of outcomes you would like to achieve and then go and achieve it.'[36]

4.32 Other stakeholders also recognised the difficulties that water utilities can face if they want to perform a greater role in stormwater. Dr Coombes suggested that it could take water utilities 'years of argument with all sorts of different state agencies with different opinions' to gain support for a stormwater project. Dr Coombes used the term 'exhaustion cost' to describe the situation:

> It is not the opportunity cost. I would call it the 'exhaustion cost': the cost of battling through all sorts of perceptions and different agendas in different departments and different rules that are set for them in their statement of obligation that get in the road of being able to efficiently deliver those solutions..[37]

4.33 Dr Coombes illustrated his concerns by referring to a project known as the Werribee Employment Precinct:

> We found the best option there in the west of Melbourne was to put stormwater in the aquifer, bring it back out and make it part of the water supply solution—therefore, making more water available to farmers downstream—approving the water quality and deferring some fairly substantial augmentation to get this new city running…When the water authority went to the Essential Services Commission to say, 'This is a great solution,' they said, 'No, we can't consider that because we do not consider stormwater to be water supply and it is outside of our jurisdiction. Go away and do a traditional solution.' They did not quite say that but that was the battle. That is why we need intervention at a higher level.[38]

36 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 7.

37 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 12.

38 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, pp. 12–13.

4.34 Dr Coombes also recognised that the water utilities handle significant revenue. Dr Coombes stated:

> I am not saying you take more money off our friends in the water monopolies; I am saying that we better target those funds so we get best use of public money because there is currently a substantial amount of money in environment levies and dividends that has been taken.[39]

Lack of economic incentives and private sector involvement

4.35 How state and local governments manage stormwater has implications for whether the private sector is able, or has adequate incentives, to develop solutions to stormwater challenges or to become involved in stormwater management.

4.36 Dr Peter Dillon told the committee that, although private sector investment exists for wastewater reuse, in established areas there is 'currently no private sector investment in stormwater management'. He argued that this is 'due to barriers to entry in urban water markets, monopoly positions of state owned water utilities, and the public-good nature of other benefits such as coastal water quality improvement and urban amenity space'. Dr Dillon outlined several developments that, in his view, would need to occur to promote greater private sector involvement in stormwater:

> Market mechanisms such as tradable discharge permits, scarcity pricing, water banking and water supply insurance, flood insurance underwriting, greenspace quotas and build-own-operate transfer contracting await development which would provide economic incentives for private investment in stormwater infrastructure and management.[40]

4.37 Mr Adam Lovell, Executive Director, WSAA, noted that the lack of overarching objectives for stormwater management affects the level of private sector investment. He explained:

> …each state, each city, each council has different objectives for the way they manage stormwater. That is fine in itself but what it does inhibit is private sector involvement. It inhibits innovation coming into the marketplace to deliver great new ways of managing stormwater.[41]

39 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 10.

40 Dr Peter Dillon, *Submission 46*, p. 3.

41 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 2.

Chapter 5

Role of the Australian Government

5.1 In Australia, stormwater management is the responsibility of state and local governments. Despite this, it is clear that successive Australian governments have been involved in stormwater issues. For example, the Department of the Environment's submission noted that Australian governments have 'worked with other governments to improve urban water management including stormwater harvesting, through the implementation of the National Water Initiative'.[1] The Cooperative Research Centre (CRC) for Water Sensitive Cities, which was established in July 2012, is also an Australian government initiative.[2] Australian governments have also commissioned various reviews that examined matters related to stormwater.

5.2 Several submitters called for the Australian Government to play a greater role in stormwater. Among other things, it was considered that the Australian Government could play a leadership role and assist to address inconsistencies between jurisdictions that may impede the development and implementation of new stormwater management efforts.

5.3 This chapter considers the evidence received on these issues. The policies and programs related to stormwater that various Australian governments have developed or been involved in are outlined in the following paragraphs. The evidence received by the committee regarding how the Australian Government could facilitate improved stormwater management outcomes is then examined.

Commonwealth policies, programs and past reviews

5.4 This section outlines previous stormwater-related initiatives that the Commonwealth has been involved in, either directly or as part of the Council of Australian Governments (COAG).

National Water Imitative

5.5 The principal multi-jurisdictional water policy agreement in Australia is the National Water Initiative agreed to by COAG in 2004. The Initiative was developed:

> …in recognition of the continuing national imperative to increase the productivity and efficiency of Australia's water use, the need to service rural and urban communities, and to ensure the health of river and

1 Department of the Environment, *Submission 48*, p. 1.

2 Cooperative Research Centre (CRC) for Water Sensitive Cities, *Submission 44*, p. 2.

groundwater systems by establishing clear pathways to return all systems to environmentally sustainable levels of extraction.[3]

5.6 The Department of the Environment explained that the stormwater-related objectives and outcomes in the National Water Initiative are:

- clause 90—to 'encourage innovation in water supply sourcing, treatment storage and discharge'; and
- clause 92—agreed actions to promote 'innovation and capacity building to create water sensitive Australian cities'.[4]

5.7 Following the National Water Initiative, various guidelines for water recycling and planning were developed. These included the Australian Guidelines for Water Recycling, National Validation Framework for Water Recycling, National Urban Water Planning Principles and the National Urban Pricing Principles.[5] Further, various Australian governments have funded projects that have resulted in significant volumes of potable water being substituted by stormwater. A list of government programs that have funded stormwater projects is at Box 5.1.

Box 5.1: Australian government programs under the National Water Initiative

- National Urban Water and Desalination Plan (active since April 2008)—provides 'funding for urban water infrastructure and research that contributes significantly to improving the security of water supplies in Australia's larger cities without adding to greenhouse gas emissions'. Under the Plan, 36 projects have received funding totalling around $184 million and 10.1 gigalitres of potable water use per year has been replaced by stormwater.
- National Water Security Plan for Cities and Towns (active since 2007)—has 'the objective of improving water security to cities and towns with fewer than 50,000 people'. Five projects received funding of around $21.4 million from the Australian Government, with 6.9 gigalitres of potable water replaced by stormwater each year as a result of these projects.
- Water Smart Australia (active since 2004–05)—aims 'to accelerate the development and uptake of smart technologies and practices in water use across Australia, and to advance the implementation of the National Water Initiative'. Six stormwater projects received funding of $88.1 million from the Australian Government with almost 28.3 gigalitres of potable water replaced by stormwater per year as a result.
- Strengthening Basin Communities (completed program)—under this program, seven stormwater projects received funding totalling $12.3 million.

3 *Intergovernmental Agreement on a National Water Initiative*, June 2004, paragraph 5, http://nwc.gov.au/__data/assets/pdf_file/0008/24749/Intergovernmental-Agreement-on-a-national-water-initiative.pdf (accessed 8 May 2015).

4 Department of the Environment, *Submission 48*, p. 1.

5 Department of the Environment, *Submission 48*, pp. 3–4.

- Green Precincts Fund (completed program)—under this program, various project initiatives that encouraged water and energy savings measures at the community level were supported.
- National Rainwater and Greywater Initiative (completed program)—under this scheme, rebates (of up to $500) were provided to households and grants (of up to $10,000) were available to surf lifesaving clubs for rainwater or greywater tanks. A total of 14,625 rebates worth $7,017,200 were paid under the household program. Grants totalling $658,000 were provided to 86 surf lifesaving clubs across Australia.

Source: Department of the Environment, *Submission 48*, pp. 5–7.

Recent reviews

5.8 Another way that Australian governments have been involved in stormwater is by helping to build the knowledge base about approaches to stormwater management by initiating reviews or inquiries that examine this issue. For example, the key challenges associated with utilising stormwater were identified in a 2007 report of the Prime Minister's Science, Engineering and Innovation Council's working group: *Water for our cities: building resilience in a climate of uncertainty*.

5.9 Another relevant report is the Productivity Commission's 2011 report on urban water. In that report, the Commission reached the following conclusion:

> Integrated water cycle management initiatives are often driven by the assumption that it is always in the community's interest to increase water reuse and recycling, and to decrease reliance on centralised water supply systems. A preferred approach is to facilitate efficient recycling and reuse projects by removing barriers to integration (such as the absence of appropriate property rights for wastewater and stormwater and deficiencies in the analyses, and community awareness, of costs and benefits).[6]

5.10 Of relevance to stormwater, the Productivity Commission recommended that:

- to create the conditions necessary for institutions to operate effectively, governments should 'define property rights for environmental and consumptive use water, including stormwater and wastewater';[7] and
- with some possible exceptions, the Australian, state and territory governments should, in general, cease providing subsidies for stormwater (and other water) infrastructure.[8]

6 Productivity Commission (PC), *Australia's urban water sector*, report no. 55, vol. 1, August 2011, p. xlix [finding 5.1].

7 PC, *Australia's urban water sector*, vol. 1, p. xlvii [recommendation 4.1].

Calls for an increased role for the Australian Government

5.11 As noted in the introduction to this chapter, various submitters have argued that there would be significant benefits from the Australian Government undertaking a greater role in stormwater issues.

5.12 Although it was commonly recognised that stormwater issues are primarily matters for the states and local governments, it was suggested that this does not absolve the Australian Government from responsibility in stormwater matters. For example, Dr Peter Dillon noted that co-investment by the Australian Government in urban infrastructure such as roads, bridges and airports creates additional impervious areas that contribute to existing stormwater problems. Dr Dillon argued:

> Such investments should include engineered provisions for water harvesting and treatment, not just from the construction site but from surrounding urban areas where lack of open space limits options. They could also be made to depend on better integration of all water and energy utilities, urban catchment management plans being a fundamental basis for urban planning, and on continuing innovation.[9]

5.13 In justifying greater involvement by the Australian Government in stormwater management issues, precedents for Commonwealth involvement in other matters that are traditionally state responsibilities were also noted. Stormwater Australia, for example, argued that the Australian Government has a clear leadership role 'in setting the tone for planning and building controls', even though this is largely a state responsibility.[10]

5.14 It was also argued that stormwater management is a national issue warranting Commonwealth attention because the challenges faced by the states are similar. For example, Mr Andrew King from Stormwater South Australia told the committee that, as the challenges multiple states face are similar, 'it is critical to have stronger leadership and stronger importance of stormwater related infrastructure and the subject driven from a federal level'.[11] Dr Robin Allison, also from Stormwater South Australia, noted that although there is a 'reasonably consistent' approach to stormwater quality for greenfield development in the east-coast states, this consistency was

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8 PC, *Australia's urban water sector*, vol. 1, p. xlviii [recommendation 5.3]. The possible exceptions identified by the PC are where infrastructure investment 'is required due to changes in environmental standards that impose a significant cost on a defined group and/or infringe a well-defined "property right"'; or a 'formal and transparent process has identified that a regional community should not be required to recover costs fully through water charges'.

9 Dr Peter Dillon, *Submission 46*, p. 2.

10 Stormwater Australia, *Submission 19*, p. 19. Stormwater Australia referred to the Australian Building and Construction Commission and the 'overarching guidance for different building typologies around the nation and supports skills development to deliver the required outcomes'.

11 Mr Andrew King, Chair, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, p. 27.

'lacking a bit' in South Australia, Tasmania and the Northern Territory. As a result, Dr Allison argued that, in relation to greenfield development, 'there is certainly a space for federal leadership' to promote consistency.[12]

5.15 Other inconsistences between states were highlighted. Mr Andrew King, for example, noted that South Australia is, to his knowledge, 'the only state that does not have water quality targets in enforcement'. He added:

> South Australia released a water-sensitive urban design policy in October the year before last. Part of that policy was mandating water quality targets into development controls and government projects. That still has not occurred. There is some industry scepticism as to when that will occur, what the scale and extent will be and how softly that will be implemented.[13]

5.16 The inconsistent approaches may have implications for private sector investment. The committee was told that different objectives for stormwater management between different states inhibit private sector investment, thereby limiting the potential for innovation in ways to manage stormwater.[14]

5.17 As noted in Chapter 4, witnesses suggested that state governments may be reluctant to improve stormwater management outcomes because such action may have consequences for the revenue they receive from water utilities. To overcome this, it was argued that Commonwealth involvement or encouragement is needed. Dr Peter Dillon told the committee:

> Integrated urban water management that includes stormwater is rare and is dependent on Commonwealth grants because states…are defensive of their monopoly utility cash cows and do not have stormwater policies in place.[15]

5.18 In addition to an expectation that the states would not act to reduce the revenue received from water utility dividends, Dr Dillon stated that the states also 'are wanting to evade taking on other liabilities or responsibilities'. Dr Dillon stated that Commonwealth leadership could 'change the policy framework so that states will operate in a way that is giving most value for the whole of the state as opposed to just generating revenue'.[16]

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12 Dr Robin Allison, Committee Member, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, p. 28.

13 Mr Andrew King, Stormwater South Australia, *Proof Committee Hansard*, 26 August 2015, p. 28.

14 Mr Adam Lovell, Executive Director, Water Services Association of Australia (WSAA), *Proof Committee Hansard*, 26 August 2015, p. 2.

15 Dr Peter Dillon, *Proof Committee Hansard*, 26 August 2015, p. 17.

16 Dr Peter Dillon, *Proof Committee Hansard*, 26 August 2015, p. 20.

5.19 A final justification for the Commonwealth to be involved in stormwater management policies that was put to the committee is that the Commonwealth may become involved in the future anyway. To support this argument, the unique role of the Commonwealth in providing assistance for natural disasters was noted. It follows that the Australian Government may have an incentive to encourage stormwater projects that have the ability to alleviate the risk of damage from flooding. As the Managing Director of Urban Water Cycle Solutions and former Chief Scientist at the Office of Living Victoria, Dr Peter Coombes, remarked:

> When you get a big flood that is a large natural disaster, which level of government is called on to address the problem?[17]

5.20 Similarly, it was pointed out that the states may seek assistance from the Commonwealth when considering how to replace ageing stormwater infrastructure. Dr Peter Coombes told the committee:

> The stormwater infrastructure we have was built during the Great Depression and post war, and we are going to have to replace that soon. The states will probably have to go to the Commonwealth and say, 'We need more money to replace this.' That is an interesting problem also because it is local governments that are managing that asset. There is no real coordination of the national value—what it is costing us, how much it is worth, how old it is and what the nation together has to strategize for to ensure that the problems are solved and understood in the future.[18]

How the Australian Government could assist

5.21 Submitters identified various ways in which the Australian Government can encourage better outcomes. These included a leadership role, the provision of funding directly or ability to provide incentives for others to offer funding, and the Australian Government's ability to encourage innovation. The following paragraphs explore the evidence received on these matters.

Leadership and development of national policies

5.22 One area where there is a perceived role for greater involvement by the Australian Government in stormwater is policy coordination and leadership.

5.23 Suggestions for the Australian Government to work with the state and territory governments to set objectives for stormwater are not new; the Productivity Commission, for example, made the following recommendation in its 2011 report on the urban water sector:

> The Australian, State and Territory Governments should articulate a common objective for the urban water sector in relevant policy documents along the following lines:

17 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 14.

18 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 14.

> The primary objective of the urban water sector is to provide water, wastewater and stormwater services in an economically efficient manner so as to maximise net benefits to the community. This objective should be met by pursuing the following more specific objectives:
>
> - achieving water security and reliability at lowest expected cost
> - contributing to universal and affordable access to water and wastewater services
> - contributing to public health, flood mitigation and environmental protection.
>
> Economic efficiency should be defined broadly to include environmental, health and other costs and benefits that might not be priced in markets.[19]

5.24 The CSIRO noted that stormwater planning lacks coordination, and as a result there 'may be value in establishing a national approach to urban water management', with the view to increasing the level of adoption of stormwater harvesting practices.[20] Dr Peter Dillon argued that there is a role for the Commonwealth in setting the principles that state governments should implement in order to improve economic efficiency of urban water management.[21] Dr Dillon also suggested that the Commonwealth 'could play a facilitating role by establishing the principle that urban planning demonstrably address water issues holistically as a high priority'.[22]

5.25 Dr Dillon added that a national approach is also needed if greater private sector involvement in stormwater is an objective that governments want to achieve. He explained:

> If it is going to go down the private route, the policies really need to be tight and they need to be national so that we do not see competition between locations on the basis of the way in which water is being managed or poorly managed sites being able to make cheaper subdivisions because they are not taking into account the externalities. It needs to be a national approach—definitely.[23]

5.26 Dr Peter Coombes argued for the creation of a national stormwater initiative, which would lead to the development of 'a modern national stormwater policy'. Dr Coombes explained that within a national stormwater policy framework, policymakers would be:

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19 PC, *Australia's urban water sector*, vol. 1, p. xlvii [recommendation 3.1].

20 CSIRO, *Submission 42*, p. 3. Similarly, Stormwater Industry Association WA suggested the Australian government could facilitate better water management outcomes through the 'development of a coordinated approach to state regulatory frameworks'. Stormwater Industry Association WA, *Submission 21*, p. 10.

21 Dr Peter Dillon, *Submission 46*, p. 1.

22 Dr Peter Dillon, *Submission 46*, p. 2.

23 Dr Peter Dillon, *Proof Committee Hansard*, 26 August 2015, p. 20.

> …better able to go off and ask the Productivity Commission, the Bureau of Meteorology and the other agencies to answer…questions based on the wider challenge we are facing rather than whether we can make more money out of harvesting stormwater—because that is not the question here.[24]

5.27 In its submission, the Adelaide and Mount Lofty Ranges Natural Resources Management Board acknowledged that stormwater management is primarily the responsibility of state and local governments; however, it suggested that national standards for best practice stormwater management could work in concert with state and local government-based policies. The submission stated that the development of national standards would 'ensure consistent implementation nationwide'. The standards could also be linked to funding programs, which would promote the implementation of the standards 'and the resulting community and environmental benefits'.[25]

5.28 Dr Darren Drapper called for the Australian Government to set a policy direction that 'stormwater/rainwater harvesting is something every state and local authority should be implementing'.[26] Similarly, SPEL Environmental argued that the Australian Government should require all local governments to introduce pollutant reduction targets.[27] These submitters specifically called for the Australian Government to provide incentives for rainwater tanks to be installed on all new dwellings/developments nationally.[28]

5.29 The Water Services Association of Australia (WSAA) agreed that 'there is a role for the Commonwealth as a catalyst to better coordinate and provide leadership'. Notwithstanding this, the WSAA did not propose a specific model or objectives for this leadership; it suggested that the 'precise form' of the Commonwealth's involvement ' 'should evolve from further discussion with stakeholders'.[29] At the committee's Adelaide public hearing, however, the Executive Director of the WSAA expounded the WSAA's position by suggesting that stormwater should be

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24 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 9.

25 The submission stated: 'The development of national standards for best practice stormwater management could work in concert with state and local government based policy and guidelines to ensure consistent implementation nationwide. Any future funding programs could then be linked to the national standard to promote its implementation and the resulting community and environmental benefits'. Adelaide and Mount Lofty Ranges Natural Resources Management Board, *Submission 11*, p. 6.

26 Dr Darren Drapper, *Submission 10*, p. 3.

27 The targets advocated for are for the reduction of (a) gross pollutants by 90 per cent; (b) total suspended solids by 80 per cent; (c) total phosphorous by 60 per cent; and (d) total nitrogen by 45 per cent. SPEL Environmental, *Submission 12*, p. 2.

28 Dr Darren Drapper, *Submission 10*, p. 2; SPEL Environmental, *Submission 12*, p. 1.

29 WSAA, *Submission 49*, p. 2.

incorporated into the National Water Initiative, which would 'also bring in elements of climate change impacts, population growth, liveable cities'.[30]

5.30 Other matters noted included the advice that the Australian Government receives on water management issues and the particular agencies that could oversee the development of a national strategy. Multiple witnesses remarked that the recently-abolished National Water Commission[31] would have been well-placed to lead the development of a national stormwater initiative.[32] In the absence of the National Water Commission, Dr Coombes noted that the Department of the Environment could be the lead agency, and could 'challenge' the Bureau of Meteorology and the Productivity Commission to 'expand [their] thinking'. Dr Coombes concluded, however, that further advice could be sought about the specific bureaucratic arrangements.[33]

5.31 More general suggestions were put forward for particular organisations to receive greater attention from the Government. Dr Peter Coombes explained that, in his view, 'Stormwater Australia has now reached a level of maturity to be trusted in assisting the Australian Government to improve the future of water management and urban planning'. This would bring Stormwater Australia in line, in this respect, with the WSAA and the Australian Water Association, which Dr Coombes noted already directly advise the Australian Government on water management.[34]

5.32 Finally, a suggestion put to the committee was that there should be either a Commonwealth Minister for Cities or a departmental Major Cities Unit that 'incorporates water into the big infrastructure questions for Australia'.[35] Mr Lovell, who outlined this suggestion on behalf of the WSAA, provided the following reasoning for this recommendation:

> …80 per cent of our GDP comes from just 0.2 per cent of our landmass, which means our cities are important in getting the infrastructure challenges right and incorporated. I will give you an example of why water would be with transport. Think of all the water that comes through drainage off roads

30 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 2.

31 The *National Water Commission (Abolition) Act 2015* received the Royal Assent on 16 June 2015, formally abolishing the Commission (although the Commission effectively ceased operating from 1 January 2015).

32 For example, Dr Peter Dillion commented 'If the National Water Commission still existed, that would be the ideal way in which this…'. *Proof Committee Hansard*, 26 August 2015, p. 20. See also Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 10.

33 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 10.

34 Dr Peter Coombes, *Submission 60*, p. 3.

35 On 21 September 2015, the Hon Jamie Briggs MP was appointed Minister for Cities and the Built Environment.

> and how important that is. That is one simple example of why we need to integrate energy, waste, water, telecom and transport.[36]

Funding and financial incentives

5.33 In many areas of public policy that are not direct Commonwealth responsibilities, the Australian Government can nonetheless influence outcomes through the provision of funding. Successive Australian governments have fulfilled this function in relation to stormwater by providing significant funding for stormwater-related projects (see Box 5.1).

5.34 Mr Adam Lovell, the Executive Director of the WSAA, told the committee that the previous Commonwealth funding for stormwater (and desalination) was provided in response to drought. In response to a question about the previous funding, he stated:

> To give a very quick answer: it was in response to drought and trying to stimulate urban water security through diversity, and stormwater was seen to be part of that and so was desalination.[37]

5.35 Dr Peter Dillon outlined some of the benefits from the Commonwealth investment. He submitted:

> A substantial part of the $2 billion Australian Government Water Fund, announced in 2005, was spent on stormwater infrastructure projects in urban areas. This raised equivalent co-investment by local government, generated diverse innovative projects, helped states to approve them, and built capability within local government and the consulting and contracting industries.[38]

5.36 Ms Mellissa Bradley told the committee that the Commonwealth funding 'accelerated projects that probably would have taken them another 10 years to fund'.[39]

5.37 A suggestion for a new funding arrangement that was outlined to the committee is Commonwealth co-funding of state government stormwater funding. Dr Peter Coombes suggested that dividends and revenue earned by state governments from water utilities for environmental management should be tied to water environmental management, and the Commonwealth could co-fund the states' contributions.[40]

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36 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 2.

37 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 3.

38 Dr Peter Dillon, *Submission 46*, p. 3.

39 Ms Mellissa Bradley, Program Manager, Water Sensitive SA, *Proof Committee Hansard*, 26 August 2015, p. 24.

40 Dr Peter Coombes, *Proof Committee Hansard*, 26 August 2015, p. 9.

5.38 Mr Lovell argued that funding should be directed towards regional stormwater projects. He explained that a workshop that the WSAA held with its regional members in August 2015 revealed that they 'still struggle in terms of getting some of those projects up and running'. Mr Lovell remarked:

> The big cities, the Sydney Waters of the world, the Melbourne Waters of the world have got an economic rate of return and they can properly price those sorts of services. They cannot necessarily in the regional areas so there is potential funding there.[41]

5.39 Witnesses also provided suggestions for how Commonwealth grant schemes could be improved. Dr Dillon argued that grant-based schemes have 'been very successful in seeing implementation of water sensitive urban design, better use of stormwater, improved suburbs and increased greenery'. He observed that providing such grants on a competitive basis 'is an inducement for innovation'. Dr Dillon suggested, however, that the timeframe for projects based on grants is not ideal:

> One of the difficulties that we have with a lot of the current government subsidies is that you have to have the project over and done with within three years. Basically, they are paying large amounts for capital items but are not de-risking before the investment. What I am getting to is that we could end up with much better outcomes if the grants were over a longer period of time. It might delay the opening…but the value of the taxpayer investment in schemes could be significantly enhanced.[42]

5.40 In addition to direct funding, the potential for the Commonwealth to provide financial incentives, such as rebates for stormwater harvesting schemes, was also noted.[43] Dr Darren Drapper suggested that federal grants for such schemes 'should encourage collaborative and cooperative schemes that share the benefit with other water users, reduce demand on potable water supplies and enable possible "lease-back" arrangements'. Dr Drapper argued 'this would provide immediate community benefit with an ongoing income stream for the government'.[44]

5.41 Potential taxation incentives were also discussed. After it noted Singapore's 'far-sighted program to replace much of its post-war concrete lined floodways and drainage system with natural creeks and restored wetlands', the Australian Water Association stated that the Australian Government should ensure that investment decisions of this kind in Australia are not distorted by any taxation or fiscal measures.[45] Dr Drapper called for the Australian Government to provide incentives

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41 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 2.

42 Dr Peter Dillon, *Proof Committee Hansard*, 26 August 2015, pp. 20–21.

43 SPEL Environmental, *Submission 12*, p. 1.

44 Dr Darren Drapper, *Submission 10*, p. 3.

45 Australian Water Association, *Submission 47*, p. 5.

for such projects, such as a 'green/stormwater/blue tax credit' to businesses that would be similar to the research and development tax incentive.[46]

Involving the private sector

5.42 The Australian Water Association submitted that the private sector's investment in water has been limited to outsourcing arrangements with water utilities for certain treatment facilities. According to the Association, the reforms 'required to create a water sector that accommodates private actors have been identified, but as yet governments have not decided to implement them'. The main barriers to greater private sector involvement in water are considered to be:

- existing regulatory frameworks 'that do not adequately provide for potential private ownership of water storage, treatment and distribution network assets';
- 'a lack of competitively-neutral regulatory structures';
- state-based economic regulators 'that are not sufficiently independent and are constrained by government policy of the day'; and
- state government-controlled pricing frameworks that 'do not enable operators to recover the full cost of supply'.[47]

5.43 Stormwater Australia suggested that the Australian Government could develop a program that encourages co-investment across different levels of government and with the private sector. Stormwater Australia added that the program should be focused over the long-term.[48]

5.44 Dr Peter Dillon argued, however, that for efforts to encourage private sector involvement to be effective, 'the policies really need to be tight and they need to be national'. Dr Dillon explained that a national policy would prevent competition between different locations:

> …on the basis of the way in which water is being managed or poorly managed sites being able to make cheaper subdivisions because they are not taking into account the externalities.[49]

46 Dr Darren Drapper, *Submission 10*, pp. 2–3.

47 Australian Water Association, *Submission 47*, p. 5.

48 Stormwater Australia, *Submission 19*, p. 17.

49 Dr Peter Dillon, *Proof Committee Hansard*, 26 August 2015, p. 20.

Research and innovation

5.45 The Australian Government's role in supporting research and innovation pathways through the CSIRO, cooperative research centres and other programs, was noted.[50]

5.46 The CSIRO's past work received significant recognition. For example, Mr Bruce Naumann from the City of Salisbury told the committee:

> We really have pushed ahead with this focus on stormwater harvesting. But I must emphasise that it is not us. Peter Dillon has been incredible for us—the CSIRO and their research. We are not just going out there and doing this. All three of the universities here are involved in the research. The CSIRO has done a lot of the work. There are consultants. There are engineering firms. There are a lot of people who have been involved in putting these schemes together. People often say, 'You people must really know what you're doing,' but we don't. We just know who to talk to and we know how to pull projects together, and that has been our success—getting the right people getting these projects rolling.[51]

5.47 Mr Naumann added that as the CSIRO 'really does underpin a lot of what we have done', more stable funding for the CSIRO would be beneficial.[52] He explained:

> Moving forward, we really do need that constancy of research. There is still a lot more to do. Managed aquifer recharge is still in its infancy. There is still a lot of work that needs to be done to see the full potential of managed aquifer recharge. I think it is incredibly important for water security in Australia, not just for Adelaide but for a lot of our cities.[53]

5.48 Cuts in CSIRO programs were viewed as a retrograde development. Mr Naumann noted that the CSIRO team they worked with 'just got cut overnight', with only two junior employees retained.[54] Dr Dillon, who was one of the CSIRO employees made redundant, told the committee:

> CSIRO urban research capacity is withering without Commonwealth impetus for improved integration and capture of R&D benefits worth billions of dollars in Australia. Other centres are closed or in decline and the CRC for water sensitive cities does not have capacity for integrative matters of this nature. So it is time for reinvestment in the urban domain. I can say that now as a former CSIRO employee, made redundant in September last year when there was a 15 per cent cut across the board in the CSIRO. The urban water research was particularly singled out for

50 Stormwater Australia, *Submission 19*, p. 26.

51 Mr Bruce Naumann, Manager, Salisbury Water, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 37.

52 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 40.

53 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 37.

54 Mr Bruce Naumann, City of Salisbury, *Proof Committee Hansard*, 26 August 2015, p. 41.

> reduction—particularly for my colleagues in Melbourne. They had a capacity which was of the nature that would feed into the discussions that we are having today.[55]

5.49 Despite the recent cuts, witnesses proposed ways that the Australian Government could promote innovation in stormwater. For example, it was considered that innovation and good water management practices could also be directly supported by making grants and rewards available for 'demonstration projects and innovations in stormwater design and construction'.[56] Mr Lovell from the WSAA, however, warned that the Commonwealth should be careful with the funding it provides. Mr Lovell argued that innovation funding should only be provided for 'leading edge projects' to avoid sending 'the wrong pricing signals'.[57]

55 Dr Peter Dillon, *Proof Committee Hansard*, 26 August 2015, p. 17.

56 Stormwater Industry Association WA, *Submission 21*, p. 10.

57 Mr Adam Lovell, WSAA, *Proof Committee Hansard*, 26 August 2015, p. 2.

Chapter 6

Committee view

6.1 As Dorothea Mackellar observed in her timeless poem *My Country*, Australia is a land of droughts and flooding rains. When considering the management of stormwater, both of these features of Australia's climate are relevant. In Australia's urban environments, rain events generate significant volumes of runoff that must be removed from the streets. Yet the overwhelming majority of this water is not utilised; rather, the stormwater is discharged out of the city as quickly as possible via an extensive drainage network. In a country that has a history of acute water shortages, the under-utilisation of stormwater is, on the face of it, surprising.

6.2 Stormwater can also cause significant environmental damage. The traditional method for stormwater management relies on drainage networks that convey stormwater out of urban areas as quickly as possible. The pollutants and waste from city streets and other urban surfaces carried by the runoff are transferred into waterways. Both the pollutants and the quantity of the inflow degrade the health of the bodies of water that receive the runoff. Further urbanisation will increase the amount of impervious area in Australia's cities and, therefore, the volume of stormwater that cities will generate. The effect that climate change may have on rain events also needs to be considered, particularly as climate change could potentially result in worsening stormwater-related flooding in Australia's urban areas.

6.3 Stormwater appears to be a problem that will be of increasing importance to address. As stakeholders repeatedly told the committee, however, stormwater is unlike most other environmental challenges in that addressing the problem also presents opportunities. Finding ways to harvest more stormwater will help preserve other water supplies and, for non-potable uses of stormwater, result in less water being treated to drinking quality standard when this degree of treatment is not required. There are several other potential benefits from stormwater, such as the ability for stormwater to help improve the liveability of Australia's cities through the use of green infrastructure. Additional uses for stormwater and rainwater may also make cities more resistant to flooding, while also potentially reducing the need to increase the capacity of existing stormwater infrastructure. With ageing stormwater infrastructure in many of Australia's major cities, it is timely to consider new and improved solutions to stormwater management.

6.4 The committee is cognisant of the Commonwealth's limited role in urban water management. Stormwater is a municipal issue that is the responsibility of individual state and local governments. This has some advantages: state and local governments across the country have the flexibility to develop policies and projects that best suit them. Stormwater management challenges also vary between cities because of geological differences—the best practice approach to managing stormwater in Perth, for example, will differ to the approach needed in Melbourne.

This may allow different techniques to be developed and tested, with demonstrated successes replicated elsewhere and less effective projects not repeated.

6.5 Nevertheless, the current approach to stormwater management has various apparent weaknesses. The primary responsibility for stormwater often falls to local governments, which are limited in their ability to make decisions that are outside their immediate area of responsibility and can be affected by actions, or inaction, in neighbouring local government areas. Evidence received by the committee during this inquiry also suggested that the regulation of water monopolies by state governments prevents those entities from considering how better stormwater management outcomes could be achieved. It was put to the committee that improved stormwater management outcomes potentially could be realised if water monopolies had broader objectives that allow them to become more involved in best practice stormwater management.

6.6 Increased attention to, and investment in, stormwater management across all levels of government could result in considerable environmental and economic benefits. Responding to the threats of flooding, climate change and ecosystem degradation should be priorities for all levels of government. The costs of inadequate stormwater planning are borne by the nation as a whole, with direct costs including those related to flood clean-up and recovery, higher insurance premiums, and riparian management. Proactive planning and well-targeted investment is needed to account for these threats.

6.7 The Australian Government is uniquely placed to promote the advantages of improved stormwater management. The committee received evidence demonstrating several examples where Commonwealth funding for projects and Commonwealth-backed research enabled stormwater projects to be undertaken. Given that infrastructure projects and responses to major flooding disasters often require Commonwealth assistance, the minimisation of the long-term costs associated with stormwater through better stormwater management also appears to be in the best interests of the Australian Government.

6.8 The Australian Government can make a significant contribution by providing national leadership in stormwater policy. State governments should still try different stormwater solutions and pursue those that best suit them; however, if the Australian Government can facilitate coordination between the states and the sharing of lessons learnt from stormwater policies and projects, this will help achieve the best outcomes nationwide. A consistent, national approach to stormwater could also assist private firms to have leading edge technologies they develop adopted throughout the country. In addition, this has the potential to assist these firms to focus on export opportunities, rather than understanding and overcoming domestic regulatory differences.

6.9 The committee considers that the Australian, state and territory governments should develop a National Stormwater Initiative, which would establish a national policy framework for stormwater management. The Initiative will provide a mandatory national agenda for stormwater management that seeks to realise economic and environmental benefits from the increased utilisation of stormwater and which

incorporates whole-of-water-cycle principles. The Initiative will also outline the structure for funding, co-funding, conditions for funding, incentives, policy setting (using agencies like the Productivity Commission, Bureau of Meteorology and the Australian Bureau of Statistics) and data collection.

6.10 The development of a National Stormwater Initiative would enable various funding models and financing issues to be considered, including co-investment models and impediments to greater private sector investment. Best practice stormwater management policies across a wide range of matters, including the state government regulation of water monopolies, would also be identified and refined. Throughout the development of the National Stormwater Initiative, consideration should also be given to the contribution that stormwater management can make to future national prosperity as we adapt to the challenges of urbanism, climate variability, and population pressures.

6.11 Although the Australian Government should promote the adoption of best practice regulatory frameworks, funding arrangements and policies for stormwater, the committee envisages that the main ongoing role for the Australian Government in stormwater management is to support research and encourage innovation. Research and innovation in stormwater management and other water-related matters is in the national interest. This research supports evidence-based policy development and provides the greatest opportunity for stormwater projects to improve outcomes and to be cost-effective. The National Stormwater Initiative should outline the objectives of research and innovation support, and consider how all levels of government can facilitate innovation in stormwater management.

Recommendation 1

6.12 The committee recommends that the Australian Government work with the state and territory governments to develop and implement a national policy framework for stormwater management (a National Stormwater Initiative).

Recommendation 2

6.13 To inform the development of the policy and regulatory framework under the National Stormwater Initiative, the committee recommends immediate audits to:

- **establish the scope of stormwater opportunities, taking into account water security, environmental issues and economic benefits; and**
- **collate stormwater knowledge into a central repository to aid future decision-making processes.**

6.14 The committee further recommends that the audits:

- **be conducted by a balanced, independent expert panel with input from relevant agencies, peak bodies and scientific representatives;**
- **give due consideration to industry practice, science and innovation; and**

- **use whole-of-community, whole-of-life-cycle and system analysis methodologies when assessing and prioritising potential stormwater projects and policy reforms.**

Recommendation 3

6.15 The committee recommends that the Australian Government place water policy on the agenda of an upcoming meeting of the Council of Australian Governments (COAG) and that COAG recognise the benefits that improved stormwater management can provide.

Recommendation 4

6.16 As part of the development of the National Stormwater Initiative, the committee recommends that the Australian, state and territory governments consider new funding models and financial incentives that would facilitate improved stormwater management outcomes in an economically efficient way.

Recommendation 5

6.17 The committee recommends that the Australian Government restore funding for stormwater research. As part of the development of the National Stormwater Initiative, consideration should also be given to how the overall level of research and development can be increased by attracting co-investment from other levels of government and the private sector to support and expand research activities that receive funding from the Australian Government.

Senator Anne Urquhart
Chair

Additional Comments by Senator Xenophon

1.1 All levels of government have a duty to manage water in a responsible way. It is our most critical resource. Likewise, there are considerable advantages to national prosperity from increased investments in stormwater management across all levels of government.

1.2 I commend the Chair and the entire Committee for acknowledging the important role the Australian Government can play in coordinating a national policy, a National Stormwater Initiative (NSI), to assist state and local governments and industry stakeholders with a regulatory framework aimed at achieving economic and environmental benefits through the increased utilisation of stormwater.

1.3 It is vital that the NSI provides ample authority and incentive for state and local governments to comply with the policy and regulatory framework.

1.4 The dominance of state-owned water monopolies, with a focus on water supply and sanitation can and do act to distort policy settings and lead to inefficient investments in the medium and long term. Furthermore, and as highlighted by Dr Peter Dillion, 'monopoly positions of state owned water utilities' act as barriers to entry for private sector investment in stormwater management.[1]

1.5 The costs of failed and inadequate stormwater planning and resourcing for it, are borne by the nation as a whole via the direct costs of flood recovery, clean-up, higher insurance premiums, riparian management, and of course water security. Climate change poses a number of growing threats which are best managed through pro-active planning and co-investment. Stormwater needs to play a key role in the water security of Australia, and with it deliver a whole range of other benefits. In addition to the Committee's recommendations, other recommendations need to be considered as follows:

Recommendation 1

1.6 As part of the development of the National Stormwater Initiative, the Australian, state and territory governments consider new funding models and financial incentives that would facilitate improved stormwater management outcomes in an economically efficient way.

1.7 The funding model should include:

- **appropriate amounts of funding from state government resources to establish the National Stormwater Initiative, including but not limited to funding from water utilities and state-owned water corporations;**
- **adequate contributions from dividends and environmental charges collected from state water utilities to sustain the National Stormwater**

1 Dr Peter Dillon, *Submission 46*, p. 3.

Initiative and provide funding for future stormwater infrastructure and planning; and

- **mechanisms to ensure that 'cost shifting' and the transfer of responsibility between agencies is avoided.**

1.8 Australia has an enviable reputation internationally for its extensive experience and leading edge technologies used to manage stormwater. A national approach will assist export potential in markets such as China, which has a multi-billion dollar program to manage runoff as part of its sponge city program. A national approach to support the export of technology and knowhow will create growth and employment opportunities for Australia.

Recommendation 2

1.9 That the Australian Government work with industry and other stakeholders to develop pathways to local and export markets for a range of intellectual and physical stormwater-related products.

Senator Nick Xenophon
Independent Senator for South Australia

Appendix 1

Submissions, tabled documents, additional information and answers to questions taken on notice

Submissions

1 Dr Peter Freewater
2 IECA Australasia
3 DesignFlow
4 Institute of Public Works Engineering Australasia
5 E2Designlab
6 Mr Simon Brink
7 Bankstown City Council
8 Townsville City Council
9 eWater Limited
10 Dr Darren Drapper
11 Adelaide and Mount Lofty Ranges Natural Resources Management Board, Government of South Australia
12 SPEL Environmental
13 Municipal Association of Victoria
14 Institute of Public Works Engineering Australia Victoria
15 Local Government NSW
16 Central West Councils Salinity & Water Quality Alliance
17 Waterway Ecosystem Research Group, The University of Melbourne
18 City of Greater Geelong
19 Stormwater Australia
20 Stormwater Victoria
21 Stormwater Industry Association WA
22 Mr Jack Mullaly
23 Moreton Bay Regional Council
24 Mackay Regional Council
25 Australian Institute of Landscape Architects
26 Eastern Metropolitan Regional Council
27 Surfrider Foundation Australia
28 City West Water
29 Ipswich City Council
30 Healthy Waterways
31 Local Government Association of South Australia
32 Stormwater South Australia
33 Burnett Mary Regional Group

34 Cooks River Alliance
35 Water Sensitive SA
36 Sydney Water
37 City of Monash
38 Institute of Public Works Engineering Australasia (NSW Division)
39 Centre for Water Management & Reuse, University of South Australia
40 Great Lakes Council
41 Urban Water Cycle Solutions
42 CSIRO
43 City of Melbourne
44 CRC for Water Sensitive Cities
45 Georges River Combined Councils' Committee Inc
46 Mr Peter Dillon
47 Australian Water Association
48 Department of the Environment
49 Water Services Association of Australia
50 Engineers Australia
51 Australian Academy of Technological Sciences and Engineering
52 Parramatta River Catchment Group
53 Local Government Association of Queensland
54 Western Suburbs Regional Organisation of Councils
55 Floodplain Management Association
56 Mr Justin Crick
57 Mr Peter Q Newland
58 Mr Richard Clark
59 Clouston Associates
60 Dr Peter Coombes
61 Networked Infrastructure National Architecture Pty Ltd
62 Templug International Pty Ltd
63 Earth Environmental
64 Government of South Australia

Tabled documents

Stormwater Australia – Hearing notes (public hearing, Melbourne, 18 May 2015)

Stormwater Australia – List of suggested actions (public hearing, Melbourne, 18 May 2015)

Stormwater Australia – Water recycling (public hearing, Melbourne, 18 May 2015)

Stormwater Victoria – Hearing statement (public hearing, Melbourne, 18 May 2015)

City of Melbourne – *Total Watermark—City as a Catchment: Update 2014* (public hearing, Melbourne, 18 May 2015)

City of Melbourne – *Urban Forest Strategy: Making a Great City Greener 2012–2032* (public hearing, Melbourne, 18 May 2015)

City of Melbourne – Opening statement (public hearing, Melbourne, 18 May 2015)

City of Melbourne – Stormwater diagram (public hearing, Melbourne, 18 May 2015)

City of Melbourne – *Summary Report 2012* (public hearing, Melbourne, 18 May 2015)

City of Melbourne – *Outcomes Report 2012* (public hearing, Melbourne, 18 May 2015)

Australian Academy of Technological Sciences and Engineering – Harnessing the Potential of Stormwater (public hearing, Melbourne, 18 May 2015)

Australian Academy of Technological Sciences and Engineering – Integrated water management can boost 'liveability' in cities (public hearing, Melbourne, 18 May 2015)

Dr Peter Coombes – Overview of submissions 41 and 60 (public hearing, Adelaide, 26 August 2015)

Dr Peter Dillon – Key points (public hearing, Adelaide, 26 August 2015)

Dr Peter Dillon – *Australian Progress in Managed Aquifer Recharge and the Water Banking Frontier* (public hearing, Adelaide, 26 August 2015)

Dr Peter Dillon – *Reliability of water supply from stormwater harvesting and managed aquifer recharge with a brackish aquifer in an urbanising catchment and changing climate* (public hearing, Adelaide, 26 August 2015)

Dr Peter Dillon – *Refinding Yabbies* (public hearing, Adelaide, 26 August 2015)

Dr Peter Dillon – *Assessment of treatment options of recycling urban stormwater recycling via aquifers to produce drinking water quality* (public hearing, Adelaide, 26 August 2015)

Additional information

Dr Peter Coombes – Coombes, P and Barry M (2008), 'The relative efficiency of water supply catchments and rainwater tanks in cities subject to variable climate and the potential for climate change', *Australian Journal of Water Resources*, vol. 12, no. 2

Dr Peter Coombes – Living Melbourne, Living Victoria: Greater Melbourne Systems Model – Modelling in support of Living Victoria Ministerial Advisory Council

Dr Peter Coombes – Coombes, P and Barry M (2014), *Systems analysis of water cycle systems: Economic analysis of options and scenarios for the Living Ballarat project*, Urban Water Cycle Solutions

Dr Peter Coombes – Victorian Government, *Melbourne's water future*

Dr Peter Coombes – Coombes, P, Smit, M and MacDonald, G (2015), *A Case Study: Resolving Boundary Conditions in Economic Analysis of Distributed Solutions for Water Cycle Management*

Dr Peter Coombes – Coombes, P, Smit, M and MacDonald, G (2015), *A Case Study: Resolving Boundary Conditions in Economic Analysis of Distributed Solutions for Water Cycle Management* (final paper)

Answers to questions taken on notice

Stormwater Australia – Answers to questions taken on notice (public hearing, Melbourne, 18 May 2015)

Appendix 2

Public hearings

Monday, 18 May 2015 – Melbourne

Stormwater Australia

Mr Andrew Allan, National President

Stormwater Victoria

Mr Ralf Pfleiderer, President
Mr Chris Beardshaw, Secretary

City of Melbourne

Mr Ralf Pfleiderer, Water Sensitive Urban Design Co-ordinator

Australian Academy of Technological Sciences and Engineering

Professor Ana Deletic, Deputy Chair, Water Forum
Dr Matt Wenham, Executive Manager, Policy and Projects

CRC for Water Sensitive Cities

Professor Tony Wong, Chief Executive Officer
Mr Chris Chesterfield, Director, Strategic Engagement

Waterway Ecosystem Research Group, University of Melbourne

Professor Tim Fletcher
Associate Professor Chris Walsh

Wednesday, 26 August 2015 – Adelaide

Water Services Association of Australia

Mr Adam Lovell, Executive Director

Dr Peter Coombes (private capacity)

Dr Peter Dillon (private capacity)

Water Sensitive SA

Ms Mellissa Bradley, Program Manager

Stormwater South Australia

Mr Andrew King, Chair
Dr Robin Allison, Committee Member

City of Salisbury

Mr Bruce Naumann, Manager