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.
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> 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]

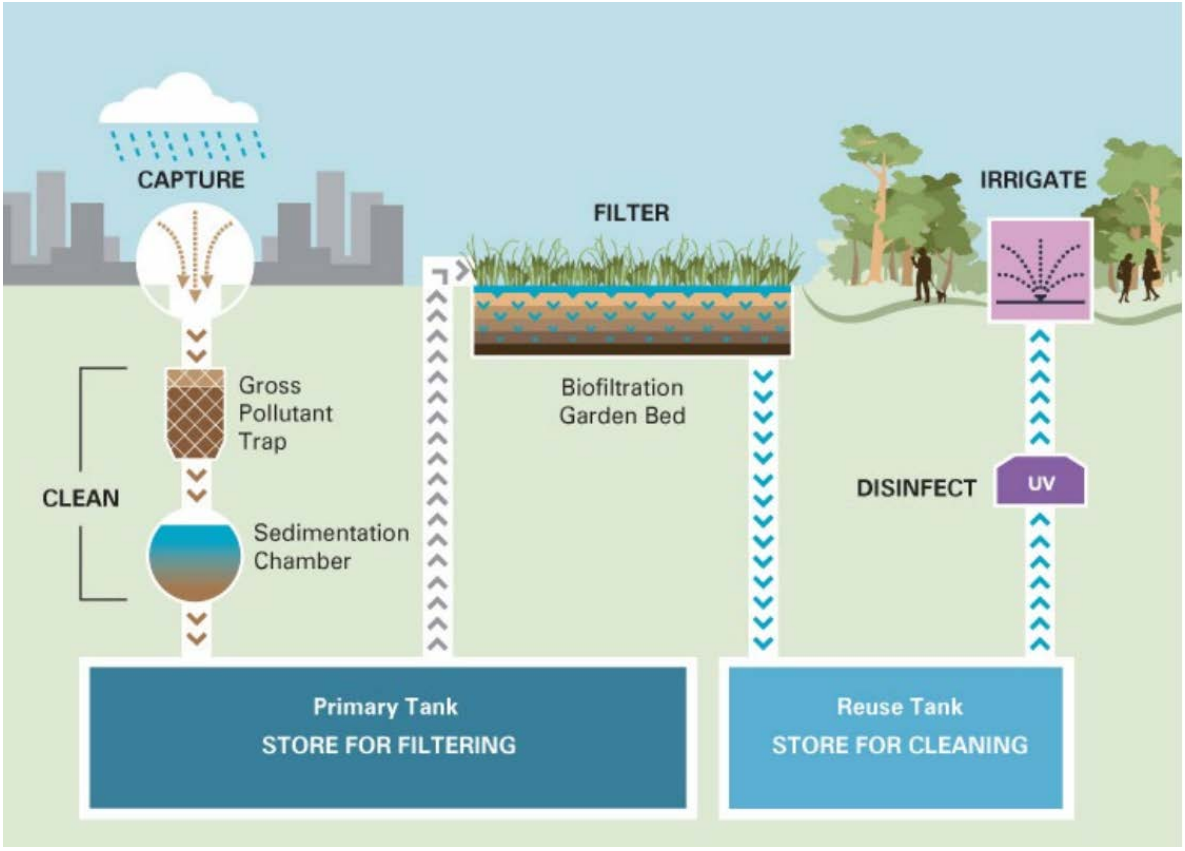
8 City of Melbourne, *Submission 43*, p. 3.

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.