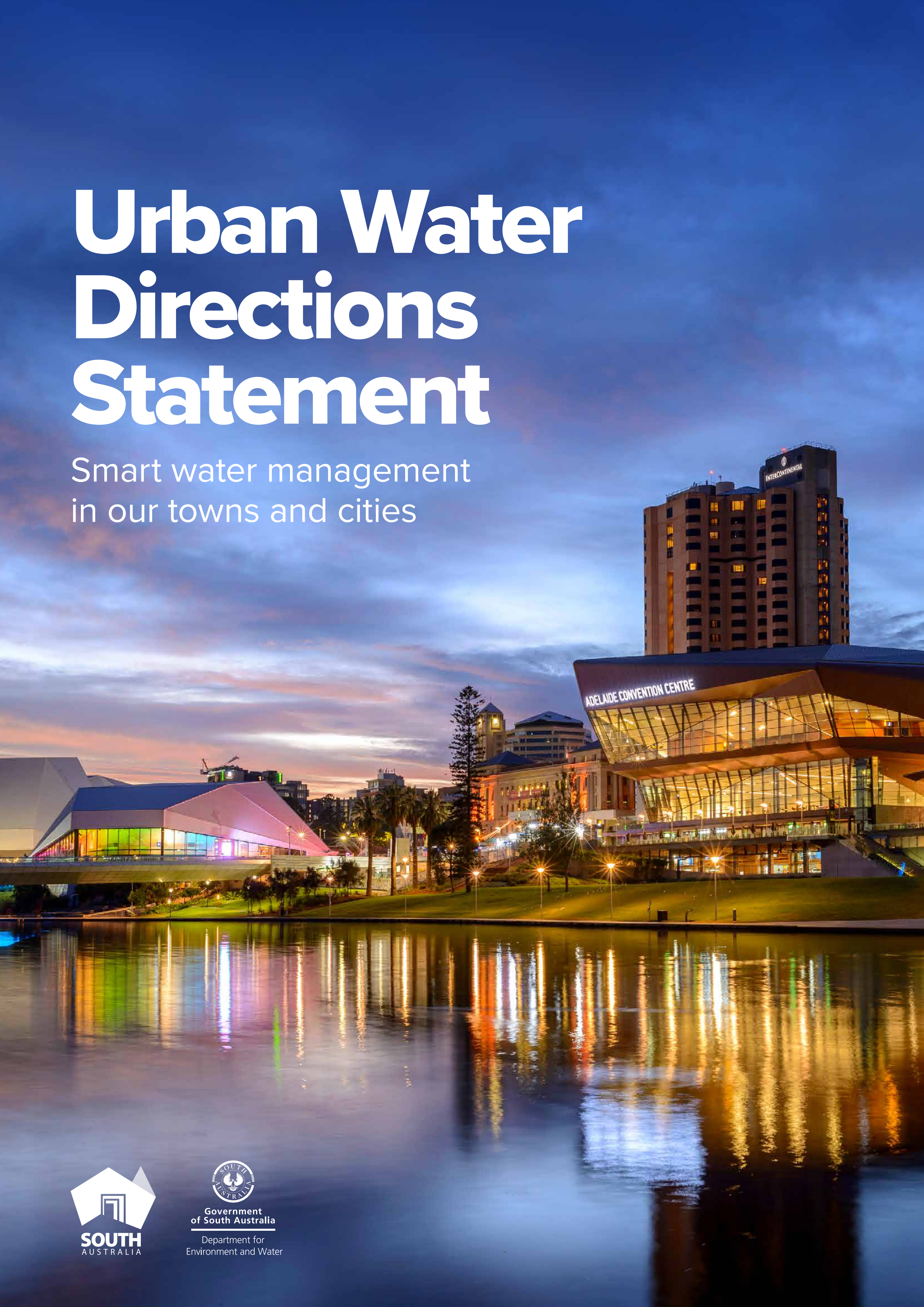
Urban Water Directions Statement

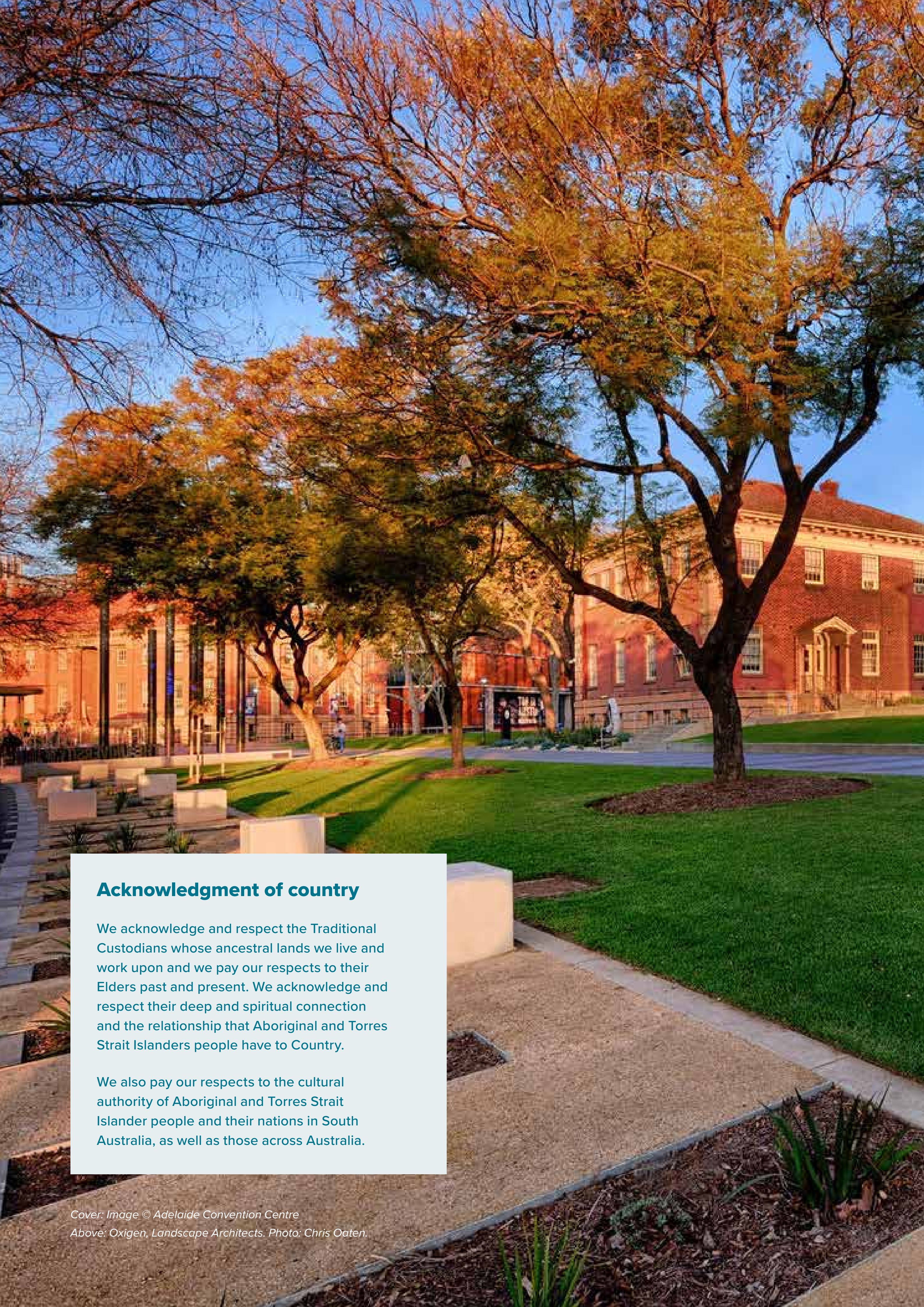
Smart water management in our towns and cities



SOUTH AUSTRALIA

Government of South Australia

Department for Environment and Water



Acknowledgment of country

We acknowledge and respect the Traditional Custodians whose ancestral lands we live and work upon and we pay our respects to their Elders past and present. We acknowledge and respect their deep and spiritual connection and the relationship that Aboriginal and Torres Strait Islanders people have to Country.

We also pay our respects to the cultural authority of Aboriginal and Torres Strait Islander people and their nations in South Australia, as well as those across Australia.

Cover: Image © Adelaide Convention Centre
Above: Oxigen, Landscape Architects. Photo: Chris Oaten.

Foreword

By setting state-wide directions for water management in our urban centres, we are preparing our towns and cities to be resilient in a warming and drying climate, while supporting continued economic growth.

Most South Australians live in our towns and cities. While Adelaide is our largest urban centre, other regional centres serve as vital community hubs, supporting tourism, agriculture, mining and other regional enterprises.

Water underpins our lives and livelihoods. Living in the driest state in Australia, smart water management has always been important for our towns and cities. The lifestyle we enjoy today benefits from a long history of water management and service delivery that has provided us with more secure water supplies, minimal flooding and lower environmental impacts.

In 2021, Adelaide was rated the third most liveable city according to the global liveability index—what we have always known is now being recognised internationally.

As outlined in this Urban Water Directions Statement, South Australia is committed to further enhancing the liveability of all of our towns and cities through increased greening, improved flood resilience and the optimised use of all of our available water sources. The resultant greening and liveability benefits will be an important part of realising the National Park City Vision for Adelaide, the second National Park City internationally after London.

While we currently have good levels of water security, a warming and drying climate — coupled with increased demands for greening and growth — means that we will need to be smarter about our future urban water use. Maximising the use of all available water sources, particularly those that are climate independent, will be increasingly important for building affordable, resilient and fit-for-purpose urban water supplies.

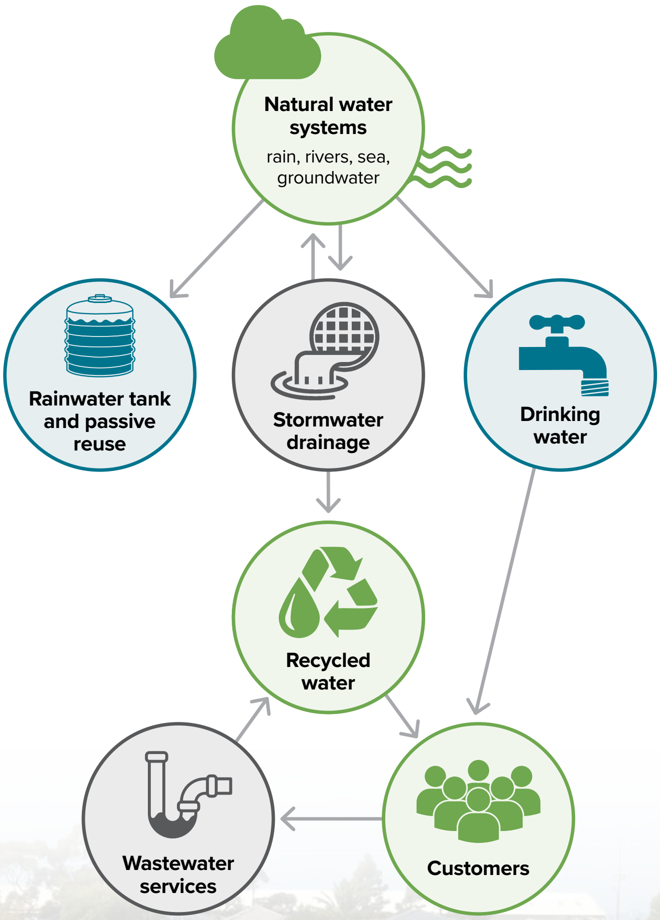
We know that healthy plant growth is a foundation for greener towns and cities and that healthy plants need water. Passive irrigation of trees and plants through the smart water-sensitive design is already a well-established practice. This and other water-sensitive design practices need to become 'business as usual' to support increased greening and reduce the likelihood of nuisance flooding in our streets.

The development of this Urban Water Directions Statement has been supported by a diverse range of stakeholders and experts and its release represents a key step towards more integrated urban water management in South Australia. Achieving this will require a collaborative approach and the South Australian Government looks forward to continuing to work with local government, the private sector and other stakeholders to implement the strategies outlined in this Statement.

David Speirs MP
Minister for Environment and Water

What is urban water?

Our urban water system includes five key elements: drinking water, wastewater services, stormwater drainage, recycled water and our natural water systems—rain, creeks and rivers, groundwater, and the sea.



Traditionally we have managed these elements separately, with different organisations responsible for each part.

While the level of collaboration between organisations has increased in recent years, there is still opportunity for a more strategic and formalised approach to the integrated management of all elements of the urban water system.

There is growing national and global acceptance that integrated management of the full urban water cycle is an effective way to maximise community buy-in and economic benefits, while minimising environmental impacts. This requires multi-sector institutional cooperation and an engaged and water literate community, as well as the application of new technologies.

Construction of infrastructure alone will not achieve integrated urban water management if institutional collaboration or public acceptance is lacking.

Integrated urban water management

Keeping rain where it falls through water-sensitive design will reduce pressure on the local stormwater system and support plant growth—potentially reducing irrigation demand and supporting liveability outcomes.

Using recycled water (stormwater and wastewater) also reduces the demand on drinking water supplies.

Setting the context

Almost 90% of South Australians live in cities and towns that have populations greater than 1000 people.

Just over three-quarters (77%) of the population is concentrated in Greater Adelaide, which extends from Gawler to Victor Harbor and from the sea to the hills.

Every city or town is unique and the approach to managing urban water in each case is influenced by population, water source availability, geography and climate.

Climate

South Australia's climate is a significant factor in how we manage urban water. Most of the state has a semi-arid climate with hot and dry summers, cooler and wetter winters, and generally low rainfall. Extreme heat days of 40°C or above are common in the summer months.

In a low rainfall climate, local water resources are often insufficient to meet all of our urban water needs. This has been a driver for the diversification of water supplies in Adelaide and other urban centres. Our urban water supply today includes a mix of water from creeks and rivers, groundwater, seawater desalination, recycled water and water transfers (water transported from remote sources, such as the River Murray).

Urban form

Traditionally South Australian towns and cities have been low density, dominated by detached houses on large allotments. In recent years the urban form has been changing, with a move to more medium and high-density living. In Adelaide, this often takes the form of small scale infill development, with single allotments being split into two or more dwellings.

In the natural landscape, and where development is low-density, rain can soak into the soils providing water for plant growth and replenishing our groundwater systems.

In highly developed areas, more rainfall runs off hard surfaces such as roofs, roads and paved areas. Our drainage systems have been constructed to remove this runoff, with many natural watercourses in urban areas being straightened and lined with concrete to quickly drain water away to reduce flooding.

As planned infill development continues, and the areas of hard surfaces increase, stormwater runoff is increasing beyond what existing stormwater systems were designed for.

Climate change predictions

Higher temperatures

Maximum, minimum and average temperatures will continue to rise with more frequent hot days and longer warm spells.

Drier with more times in drought

Autumn and spring rainfall has decreased by up to 20% in some agricultural areas. Further reductions and more time in drought are projected.

More intense heavy rainfall events

Heavy rainfall events will increase in intensity, increasing the risk of flooding.

Water is critical to create and maintain quality green space (St Clair)

Community

The benefits of community access to green spaces—areas of grass, trees and other vegetation—have been well documented. Increasingly the benefits of access to "blue spaces" such as coastal environments, wetlands, creeks and urban water features (e.g. fountains, splash pads) are also being recognised.

With increasing urban densification, and a corresponding reduction in private open space, public open space is becoming more important in providing community access to green and blue spaces. Water underpins plant growth in quality green spaces and is the key feature in blue spaces. The improved liveability and amenity outcomes we seek for our communities cannot be achieved without water.

Environment

The way we manage water in our urban centres has an impact on our natural environment. In particular, stormwater runoff and wastewater treatment plant discharges can carry pollution (e.g. sediments, nutrients or microplastics) into creeks, rivers and the ocean. These environments make significant contributions to the economy as sites for tourism and recreation and as breeding grounds for economically important fish species. Increasingly people are expecting investments in urban water management to minimise impacts on the environment, particularly through the reduction of stormwater and wastewater flows to waterways and the coast.

Aquatic environments are important for tourism, recreation and food production (West Lakes)

Why do we need state-wide direction for urban water management?

A shared direction for the integrated management of urban water will set up our towns and cities for the future.

Water underpins our lives and livelihoods. Living in the driest state in Australia, smart water management has always been important for our towns and cities.

The lifestyle we enjoy today benefits from a long history of water management and service delivery that provides us with relatively secure water supplies, minimal flooding and lower environmental impacts. We can build on this history to deliver even more in the future—providing efficient and effective urban water services and delivering greener and more liveable cities and towns.

We continue to face a range of water management challenges that we need to be prepared to tackle now and into the future. Pressures on our water supplies are expected to come from a hotter and drier climate, a growing population, and a strong and thriving economy.

Higher density living and an associated increase in hard (impervious) surfaces, combined with increased rainfall intensity as a result of climate change, will strain our existing drainage systems.

We need to set clear priorities and management principles today so that our communities, businesses and environment can thrive in the future. With the right preparation and informed decision making, we can make the best choices regarding infrastructure delivery, policy settings and organisational arrangements for the most effective and efficient urban water management.

The options available to us from integrated urban water management will increase as our understanding, knowledge and capabilities develop. Some solutions will complement others, leading to more cost-efficient and effective outcomes, while poor decisions could have the opposite effect.

Given the long lifespan for much of our urban water infrastructure, we need to set a clear direction now that we can all work towards, to support our communities, businesses and environment into the future.

Integrated urban water management delivers:

- Greener and cooler urban centres that provide amenity and health benefits.
- Reduced flood risks, protecting people, property and infrastructure.
- Healthier local environments.
- Better use of all available water, potentially freeing up water for agriculture.
- New jobs and expertise that can be exported nationally and internationally.

We require a strategic, collaborative and transparent approach for the management of urban water that addresses the complex issues faced by the sector.

There is no single solution; rather a range of solutions that work together are required, including simple and already proven measures, alongside new and innovative ideas.

A shared direction will maximise sustainable urban water outcomes by guiding organisational arrangements and smart investment towards the most cost-effective long term solutions.

Our future urban water directions

The following strategies have been developed in consultation with key stakeholders involved in urban water management. They represent the priorities for action over the coming years. In addition to implementing these strategies, the South Australian government supports a national approach for a renewed National Water Initiative with a stronger focus on urban water and will be working with other jurisdictions to develop it.

The strategies have been grouped into four key areas, which are further described in the following sections:

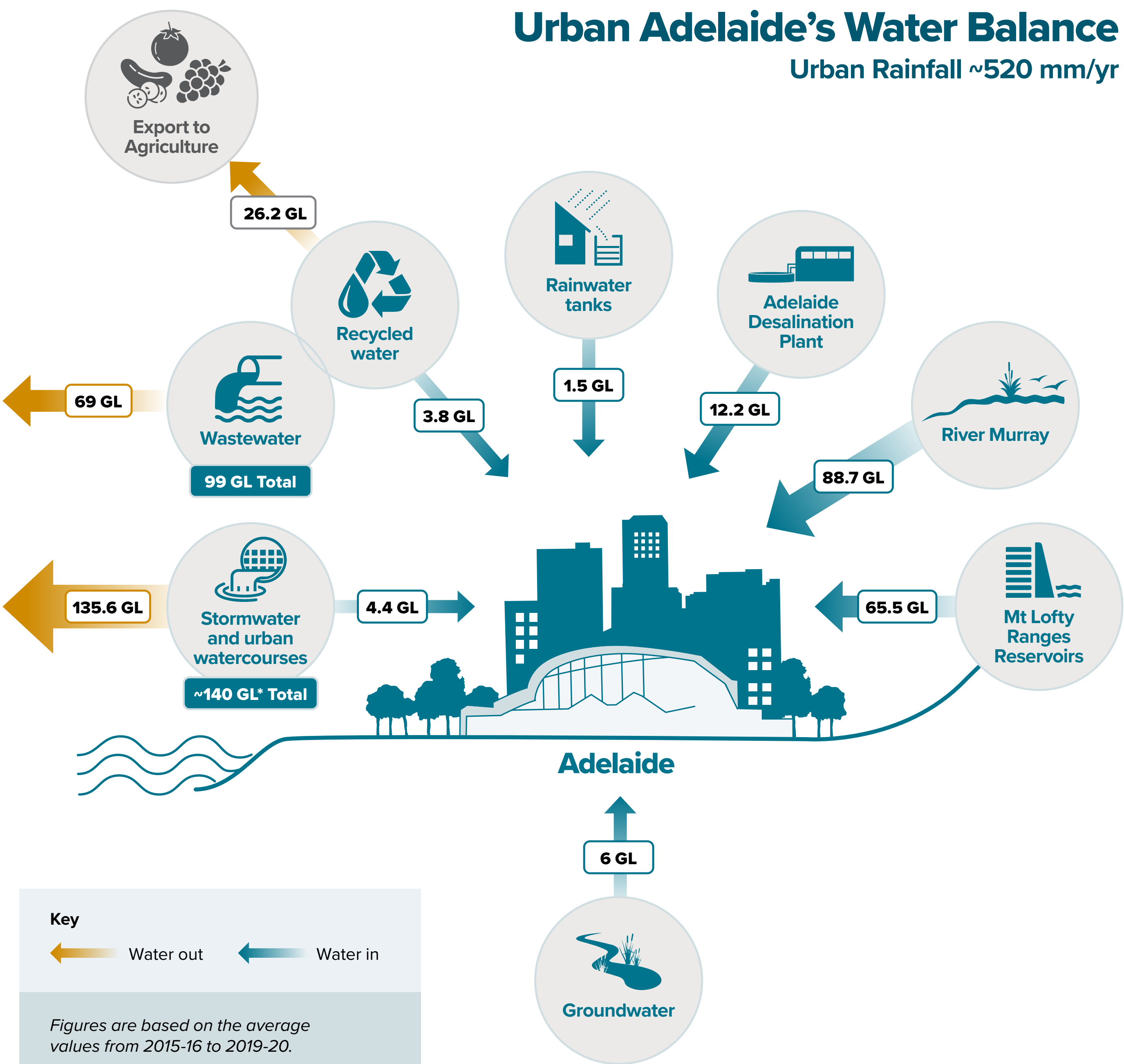
Securing our water supplies in a changing climate	Water in the landscape	Drainage for tomorrow	Our communities are part of the solution

Securing our water supplies in a changing climate

Water security for our urban centres is about ensuring an acceptable quantity and quality of water for people, industry and the environment—now and in the future. This is achieved by investment and operations that are efficient, financially and environmentally sustainable, and resilient to shocks.

Providing a secure water supply will become more challenging in the future, as our water demands grow, and our natural water sources become less reliable in a changing climate.

No single water supply option on its own is likely to meet all of the needs of an urban centre—rather combinations of water sources will be needed to create a resilient water supply. With decreased stream flows into creeks, rivers and dams, our reliance on rainfall dependent water sources is a potential long term risk to water security.



Figures are based on the average values from 2015-16 to 2019-20.

**Stormwater and urban watercourse volumes are highly variable, in this period volumes ranged from 37 GL to 370 GL. The mean flow for the period 2008-2019 was 101.7GL.*

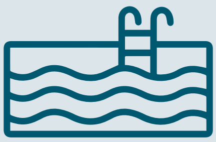
Most South Australian urban centres have high levels of water security.

The South Australian government has prepared a water security statement that provides up to date state-wide information on South Australia's water security.

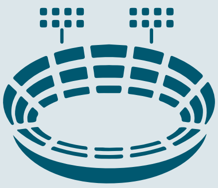
This Urban Water Directions Statement will complement the water security statement.

During the severe 1914-1915 drought wells were drilled in Adelaide to contribute to the water supply.

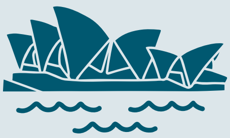
The 1967-68 drought was the last time that groundwater was used for reticulated water supply in Adelaide—40 wells supplied 10,000 ML.



An Olympic size swimming pool contains 2.5 ML



Adelaide Oval filled to the top of the stand would hold 2.5 GL



Sydney Harbour contains 500 GL

1 Megalitre (ML) = 1 million litres
1 Gigalitre (GL) = 1000 million litres

When considering the broad range of potential water sources that could contribute to a diverse water supply portfolio, it is important to factor in the full range of economic, social and environmental benefits that would be delivered by a mix of supply options. These include:

- improved resilience in water supplies by reducing dependence on rainfall (climate dependent water sources)
- living with less water where it offers a similar or better outcome (by using water more efficiently)
- avoided infrastructure costs
- improved liveability from water that supports green and blue spaces
- improved water quality and environment for urban waterways and the coast
- avoided urban heat impacts
- health benefits associated with improved liveability and reduced urban heat impacts.

As changing climate and growing demands continue to put pressure on water resources, it will become increasingly important for South Australia to plan for long-term urban water security. Future water supply augmentation decisions will need to consider all parts of the urban water system—balancing supply with demand management and smart water use. Our water supplies in the future will need to be diverse, flexible and resilient to enable us to adapt quickly to future changes and as new information becomes available.

The strategies in Table 1 collectively will help us to deliver diversified and resilient water supplies to support our lifestyles and livelihoods.

Table 1: Securing our water supplies in a changing climate

All options on the table	S.1	Review SA Water's statutory authorisations to broaden the scope to provide for the full range of commercial, social and environmental costs and benefits for all options to be part of water supply augmentation decisions.
	S.2	Ensure that the Essential Services Commission of SA (as the economic regulator) considers the full range of commercial, social and environmental costs and benefits for all options in water supply augmentation decisions.
Efficient regulation to support diverse water supplies	S.3	Ensure water policy and regulation supports stormwater harvesting and managed aquifer recharge.
	S.4	Provide for access arrangements that support efficient use of all water infrastructure (owned and operated by all water industry entities) without impacting on existing customers.
Build it in from the start	S.5	Require new development (including through appropriate rezoning policies) to have adequate and environmentally sustainable water supplies and reticulated sewerage systems, particularly in consideration of a changing climate.

What does it mean?

Economic regulation accounts for avoided costs (e.g. avoided infrastructure upgrades), flood damage, and potential environmental impacts (e.g. benefits from reducing polluted water discharges). **S.1, S.2, S.3**

Adequate water supplies need to be built into new development from the start to avoid future retrofitting at a higher cost, particularly as rainwater tanks become less reliable in a changing climate. **S.5**

Fit-for-purpose water use is encouraged and fully accounts for all costs, including avoided costs and any additional costs that may be required for dual reticulation networks. **S.1, S.2, S.3**

Recognise that the most prudent and efficient option to meet basic service standards may not be a reticulated supply system in some communities. **S.1, S.2, S.3**

Maximise the use of existing infrastructure before building new infrastructure. **S.4**

Mechanisms are in place to account for the benefits that occur from water use (e.g. amenity, cooling, reduced environmental harm). **S.1, S.2, S.3**

A reticulated sewerage system provides better environmental and public health outcomes (compared with on-site disposal) and provides a coordinated collection system for easier water recycling. **S.5**

Support efficient regulation through clearly defined water security standards. **S.1, S.2, S.3**

Purified recycled water
San Diego

San Diego is a coastal city with a population of around 1.4 million people. About 85% of its water is imported (long distances) from sources that are increasingly at risk due to climate change. Recognising the growing risk to its water security, San Diego is taking steps to diversify its water sources, including through a scheme that will provide highly purified recycled water to meet more than 40% of the city's water needs by the end of 2035.

The Pure Water San Diego Program uses well-proven water purification technologies to clean recycled water to produce safe, high-quality drinking water. Purified water sourced from municipal wastewater is seen as being a cost-effective investment to meet San Diego's water needs, providing a reliable, sustainable water supply while also reducing wastewater discharges to the natural environment.

San Diego's Pure Water demonstration facility helped community members to understand the water treatment processes involved in producing purified recycled water

Sewer mining
Port Augusta

A major challenge with water recycling is often the need and cost of having to transport water from wastewater treatment plants to where recycled water can be used. Sewer mining largely avoids the need for major pipe networks.

Sewer mining involves tapping into a sewer line to divert or extract wastewater, which is then extensively treated to produce high quality water that can be used locally.

Advances in sewer mining and sewage treatment technologies mean that sewer mining is becoming an increasingly efficient and potentially more cost-effective way of supplying water suitable for irrigation of local parks, sports fields and golf courses.

The City of Port Augusta is a proven leader in water reuse, driven by its desire to provide the best parks and gardens it can for the community. The Council began investigating the possibilities of water reuse in the late 1990s and in 2006 opened its wastewater treatment plant at Central Oval, which uses a sewer mining process accessing untreated wastewater from the nearby SA Water sewage pump station. Once treated, the water is available for irrigating green spaces such as its Central Oval, foreshore, and other parks and gardens.

Despite being located in a dry environment, Port Augusta has been able to keep many open spaces greener, cooler and more attractive for locals and visitors through sewer mining

Water in the landscape

Infrastructure in urban area has historically been designed to move rain and runoff out of cities and towns, and away from buildings and roads, as quickly as possible. Over the last few decades, there has been a shift away from this purely drainage focus and towards multi-objective stormwater management that aims to achieve a broader range of outcomes.

> Multi objective stormwater management aims to minimise flood risks and the impact of stormwater on the environment, while maximising benefits like greening and cooling through recycled water use.

The future prosperity and liveability of South Australia will depend on how effectively we can build our towns and cities to make them more liveable in a hotter drier future. Green and blue spaces are an important component of our urban lifestyle—providing a place for social interactions, recreation and relaxation.

In recent years there has been an increased focus on improving the amenity of our towns and cities for the liveability, health and well-being benefits that greener neighbourhoods can provide.

The way we manage our urban water is a core contributor to creating and maintaining climate resilient towns and cities. Many of our urban landscapes are already watered well above the natural rainfall. This can be seen in summer where irrigated parks and playing fields are easily distinguished from un-irrigated areas.

Estimating irrigation demands for our urban areas is difficult because of the wide variety of vegetation types, soils and planting densities that occur in our towns and cities. For example, native vegetation adapted to the state's semi-arid climate can grow without additional water, but irrigation is required for other vegetation (including lawns). Additional water is particularly needed for plants to survive extreme heat events in summer at the end of an extended dry period.

Providing more water to plants in hot conditions improves their condition and their vegetation cooling performance through denser tree canopies that provide darker shade and increased evapotranspiration.

Many of the state's regional cities and towns have cleverly used local recycled water supplies, such as wastewater from community wastewater management schemes, in order to keep parks, sports fields and other open space green and comfortable year-round, for local residents and visitors to enjoy.

Additional water can be provided to plants through active irrigation, but irrigation water demands can also be reduced by capturing and retaining water runoff in the landscape, and directing it to increase soil moisture levels for plant growth through passive irrigation. The redirection of this runoff also reduces discharge to waterways and the coast and can help to reduce nuisance level flooding.

> **Water is vital for tree health, and tree survival in droughts.**
>
> Australian and international research has shown that tree deaths during droughts and heatwaves occur by 'hydraulic failure'—preventing trees using water.
>
> As a tree becomes more water stressed the xylem (tubes that carry water from the roots up the tree) form small air pockets that block water transport to the leaves.

Average annual irrigation to maintain turf at a suitable quality in Adelaide for the same area (IPOS Code of Practice)

Elite sports	Premier sports	Local sports	Passive recreation
• Adelaide Oval, Veal Gardens, Victoria Square • 1098 mm/yr	• A-grade cricket ground, Glenelg foreshore, premier league soccer • 611 mm/yr	• local sports ground, community park • 490 mm/yr	• local park, local picnic area • 368 mm/yr

Adelaide has recently become the second National Park City after London – improving liveability through a better connection between people and nature.

The National Park City concept is based on re-thinking the traditional nature and purpose of a 'National Park' and how it can be applied in the context of urban landscapes. The concept recognises the unique ecology of cities, and the many health, wellbeing, biodiversity and economic outcomes that can be experienced through promoting a better connection between people and nature.

The National Park City area will cover all of Greater Adelaide. Maintaining sufficient quantities of fit-for-purpose water to support urban greening and cooling will be an important part of realising this National Park City vision.

A range of additional benefits can be realised through the incorporation of small scale infrastructure at a local street scale that keeps the rain where it falls, for example:

- the passive watering of urban trees, e.g. through kerbside inlets and infiltration techniques
- improved water quality and amenity, e.g. through installing and maintaining raingardens
- stormwater infiltration through pervious paving and footpaths that can reduce runoff and increase soil moisture to support plant growth
- using harvested stormwater for open space irrigation to displace or supplement drinking water use.

Selecting suitable street trees species to deliver desired benefits (such as aesthetically pleasing form, shade, urban cooling, and habitat benefits) should also take water availability into account, including making water available through passive watering techniques. By providing the right amount of water (not too little, or too much) we can: maximise the opportunity for trees to thrive over a full range of climate conditions; minimise tree deaths due to drought and heatwaves; and maximise the broader benefits of healthy trees.

People can also take action on their own property (allotment scale). Rainwater tanks can be used to capture water for use in houses or for watering gardens, or permeable areas can be increased, allowing water to soak into the soil and provide passive irrigation benefits.

The importance of increased green and blue spaces in improving our liveability in a changing climate has also been well recognised. However, this will require additional water use, which will come at additional cost. Economic regulation guides the price of water based primarily on fully recovering operational costs, asset replacement and meeting regulatory obligations. It does not currently recognise and price for the broader community benefits that can be attributed to increased water use for greening.

The greatest benefits of additional greening are likely to occur in the lowest socio-economic neighbourhoods, where communities are least able to afford additional water use. There is therefore a need to consider how additional water costs to support greening are paid for and how the diverse range of benefits, including those that are difficult to quantify, can be factored into water pricing decisions.

The strategies in Table 2 collectively will help us to maintain water in the landscape to achieve improved greening, amenity and local environments.

Table 2: Water in the landscape

Build it in from the start	W.1	Promote integrated planning for green and blue spaces, ensuring that new greening has water available to support its healthy growth.
	W.2	Develop policy options that provide for the planning system to facilitate quality new development that includes water-sensitive design elements to support greening and amenity outcomes.
	W.3	Develop policy options for the planning system (including building codes) that set the framework for flood resilient building design and development.
	W.4	Develop options for a concessions scheme ("green tariff") that better support the use of all water supplies for the establishment and maintenance of new greening – reflecting the full range of relevant economic, social and environmental and community wellbeing costs and benefits.
	W.5	Build flood protection functions into new infrastructure design.
Use what we have	W.6	Maximise the amenity, recreational, environmental and cultural value of watercourses and regional drainage infrastructure.
Keep it green (and blue)	W.7	Encourage local and street level water-sensitive design features as a business as usual approach to all streetscape upgrades.
	W.8	Improve our understanding of the impact of stormwater on waterway and marine environments including seagrass health.

What does it mean?

Healthy greening that provides a cooling and amenity benefit requires water to thrive. **W.1, W.4**

Planning policy directs high quality design that maintains water in the landscape to support greening, cooling and amenity outcomes on private and public land. **W.2, W.7**

Planning policies that guide site layout to provide for overland flow paths to reduce flood impact. **W.3**

Retaining water in the landscape. Examples include rainwater tanks and permeable paving (allotment scale); rain gardens, permeable paving and treenet inlets (street scale); and detention basins and stormwater harvesting (regional scale). **W.2, W.7**

It is cheaper to build it in at the start than to retrofit it later. **W.5**

Building structures and fit outs that provide resilience to flood, e.g. building materials that can wet and dry without being damaged. **W.3**

There are many ways to achieve benefits—this is more than just naturalising waterways. **W.6**

We need targeted monitoring to better understand the main sources of fine sediment discharges that impact on the marine environment so that we can reduce their impact. **W.8**

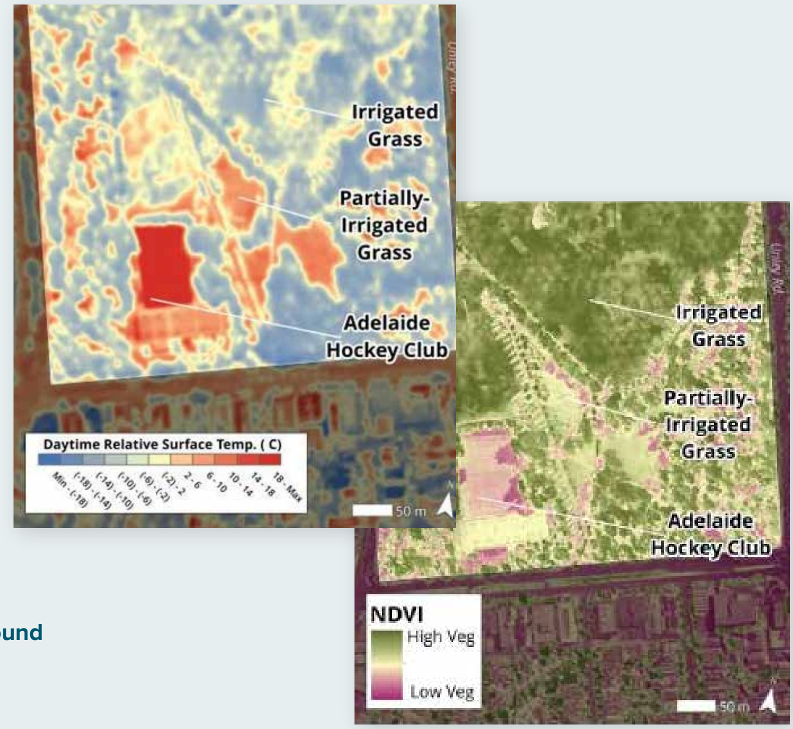
Irrigated and non-irrigated turf in summer 2020

Water and urban cooling

Greener, more extensively watered grass is likely to be cooler than less well irrigated or unwatered grass. These pictures show the difference in daytime surface temperature between irrigated, partially irrigated and artificial turf in metropolitan Adelaide.

Urban heat mapping in Western Adelaide during a hot weather event in 2017 found that supplementary irrigation created about 1.7°C of cooling compared with non-irrigated spaces.

- **Irrigated grass can reduce surface temperature by up to 20°C compared to dry grass**
- **Irrigating shade trees can cool the ground by more than 2-3°C during the day and 4-5°C at night**
- **Every 10% increase in tree cover can reduce ground temperature by between 0.5°C and 1°C**



Flood Resilient Building Design: Learning to live with floods

Recognising that it is impossible to completely mitigate against all natural hazards, there is a push towards growing the resilience of communities and infrastructure to withstand the damaging effects of natural disasters when they occur.

Flood resilient building design is one tool to limit the cost of property damage caused by floods; this is taking on a greater prominence in Queensland. Creating more flood resilient buildings involves a combination of techniques such as:

- siting and orientation of the building on the allotment
- setting finished floor levels
- 'wet proofing' the building by selecting water-resistant and easy to clean construction materials like concrete, hardwood and closed cell insulation materials
- 'dry proofing' the building by preventing floodwater from entering with permanent or temporary barriers.

Resilient building design can significantly reduce the effort, cost and time to return people to their homes and workplaces following a flood. The adoption of flood resilient building techniques in Queensland has resulted in savings for homeowners, lower insurance premiums, and less environmental impact in terms of waste to landfill after flood clean ups.

An example of water-resistant internal building materials.
Image: Courtesy of the Queensland Government publication Flood Resilient Building Guidance for Queensland Homes published by the Queensland Reconstruction Authority at https://www.qra.qld.gov.au/resilient-homes.

The average time taken to recover the initial cost to make a more resilient home varies between one and twelve years, depending on the building type, treatment adopted and likely frequency of flooding. While flooding in South Australia tends not to be as severe as that in south-east Queensland, many of the design elements adopted in flood resilient buildings could still provide benefits for dwellings and other buildings constructed near creeks and rivers and on floodplains.

Brown Hill Creek
Everard Park

In urban environments it is not always practical to restore watercourses to a natural state. Urban watercourses carry higher flows and greater runoff from impervious areas and development often encroaches on their banks, leaving little space to recreate natural creeks. However, even in such highly constrained locations, good design can deliver solutions that manage flooding, as well as provide amenity, recreation and environmental value.

Brown Hill Creek in Everard Park was typical of a highly degraded urban watercourse. The channel was concrete lined, in poor condition, and overgrown with exotic tree species and weeds. Although the creek was in private ownership, it was inaccessible and offered little amenity for property owners or neighbours.

The capacity of the channel was also inadequate to carry the flows that it needed to. So, when the time came to upgrade the channel as part of the Brown Hill Keswick Creek Stormwater Project, the designers looked for an innovative solution that would avoid having to widen the creek, acquire more private property, and remove significant trees.

Above: Before - Brown Hill Creek at Everard Park
Top: After - covered culvert and shared use path

The solution was a covered culvert overtopped with a shared-use path and landscaping. The underground culvert safely conveys stormwater flows up to the '1 in 100 chance' annual exceedance probability flood, and the shared-use path provides a safe and visually attractive connection for pedestrians and cyclists to public transport and services along nearby Anzac Highway.

Water-sensitive design to support street trees

A range of water-sensitive design techniques can be used to retain water runoff in the local landscape where it can be used by street trees; some examples include Treenet inlets and permeable paving.

Research by Flinders University found that Treenet inlets installed at Highgate provided about 21% more water for each tree to transpire during the dry season. They were also found to have significant benefits to white cedar trees, resulting in a 50% increase in tree height and a 25% increase in diameter over three years compared to similar trees without inlets.

In Burnside the value of kerbside water inlets to boost the health and canopy cover in large mature trees is being demonstrated. For some years, a mature tree ailed in health during the summer's hot and dry conditions. Its leaves yellowed and leaf density declined. This led to its aesthetic, shading and cooling value declining at the time it was needed the most.

In early 2018 two tree water inlets were installed at the edge of the root zone to enable runoff to be diverted for sub-soil watering. This corresponded with a rapid improvement in the health of the tree. Its leaf density over the summer 2018-19 was observed to be about 80% compared to 30% in similar periods in previous years, while its leaves became greener and lusher.

A Treenet kerbside water inlet, and the mature tree in Burnside before and after the installation of the Treenet inlet

Drainage for tomorrow

Historically in South Australia rain and runoff in urban areas has been managed to limit the inconvenience of water ponding on roads and property, and to minimise the likelihood of land and buildings being frequently flooded (including from flooded creeks or rivers).

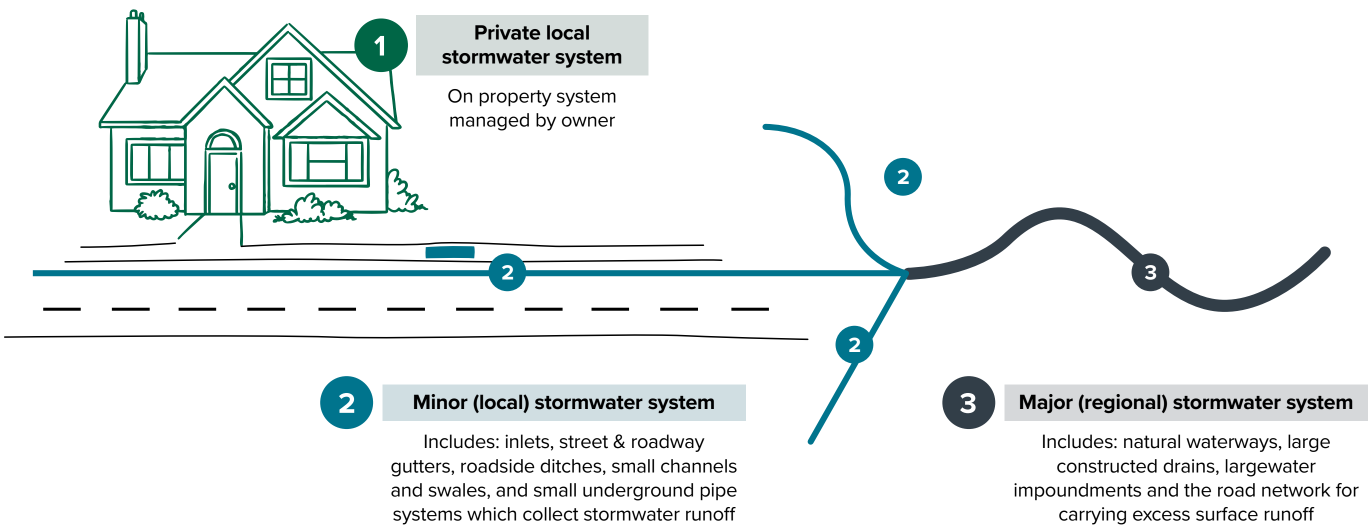
As towns and cities expanded, there was a need to manage increasing amounts of runoff from hard surfaces, such as roads and houses, and protect new development from flooding. Networks of stormwater pipes and drains were constructed to carry water to creeks, rivers, and the ocean. Many sections of natural watercourses were straightened, diverted into large pipes, or reshaped and lined with concrete to improve their ability to move flood waters away quickly. We now have extensive drainage and flood mitigation infrastructure including pits, pipes, drains and constructed channels, levee banks and detention basins. Kerbed roads, and in some places open spaces, are also designed to safely carry the runoff from 'major' rain events.

Since the mid-1950s our 'minor-major' approach to urban drainage has prevented Adelaide and other cities and towns from experiencing frequent major floods; it is also the reason why urban assets such as roads are able to operate effectively for the vast majority of times that it rains.

Between 2014/15 and 2018/19 metropolitan councils collectively spent an average of more than $100 million per year on stormwater management.

Regional councils spent an average of $30 million per year on stormwater management.

The replacement cost of flood mitigation and drainage infrastructure in Adelaide is estimated at more than $4.2 billion ($2018).



While our existing systems have protected us in the past, we face a number of significant challenges that will result in increased vulnerability to flooding and higher flood damage costs over the coming decades if they are not adequately managed. These include:

- ageing infrastructure – most drainage infrastructure was built decades ago and will soon require replacement
- climate change – increased storm severity and increased sea level rise
- urban development – infill development places greater demand on stormwater infrastructure, with more runoff coming from more hard surfaces.

Flooding will remain an ever-present threat in many urban areas. The cost to upgrade flood protection and drainage infrastructure in existing built-up and flood prone areas can be considerable. In some densely populated areas there can already be too much other infrastructure (such as water pipes, gas pipes and phone lines) to fit larger stormwater drains. We therefore need to think differently about how we manage our stormwater systems to keep the costs of stormwater management as low as possible, while providing our communities with the appropriate level of flood resilience.

Watercourses in urban areas, both natural and constructed, serve many functions including drainage and flood management, supporting recreation and social connection, and supporting aquatic ecosystems.

Legislation provides the overarching framework that governs how we manage our stormwater and urban watercourses. A notable feature of the current legislative scheme is that there is no dedicated legislation for multi-objective stormwater and urban watercourse management that addresses the varying responsibilities for: flood mitigation, preparedness, response and recovery; receiving water quality and environmental protection; and stormwater use.

One outcome of the layered legislative framework that governs stormwater and urban watercourse management is the proliferation of organisations with various interests in this area.

The diversity of functions associated with urban watercourses presents a challenge when trying to deal with the complexity of issues that arise and the diversity of stakeholders with a broad range of interests and perspectives.

Increased areas of hard surfaces increases peak stormwater flows and the frequency and volume of runoff.

A catchment near Glenelg designed in the late 1960s is likely to have achieved its ‘designed for’ minor drainage performance (annual exceedance probability of 20% or ‘1 in 5’ chance) in the early 1980s.

As a result of development it has reduced to providing in the order of a 50% (or 1 in 2) annual exceedance probability.

This is a significant reduction in the level of protection from nuisance flooding.

Further complexities occur when significant portions of watercourses are contained within privately owned land—this is particularly the case when the watercourse forms an important part of a regional drainage system. Private ownership can lead to substantial difficulties in access by public authorities, who may have responsibilities associated with the drainage function of the watercourse. This also adds to the confusion regarding roles and responsibilities for watercourse and drainage management.

The strategies outlined in Table 3 collectively will help us manage our rain and runoff in the future.

Table 3: Drainage for tomorrow

One network – three parts	D.1	Convene an expert panel to recommend clear responsibilities for each part of the drainage system—private local, public local and regional (major) drainage.
	D.2	Convene an expert panel to recommend funding options for drainage management that recognises multiple benefits and beneficiaries.
	D.3	Investigate opportunities for legislative reform to better manage urban watercourses and regional (major) drainage systems.
Share the space	D.4	Work with stakeholders to maintain open space for retention/ detention and flood conveyance functions in a way that complements existing and other compatible uses.
	D.5	Encourage planning for underground services (e.g. telecommunications, water pipes, gas pipes, sewers) that provides for underground space for street trees and drainage infrastructure.

What does it mean?

An expert panel can provide independent advice to government on the future management of stormwater. **D.1, D.2**

Clear legislation can set the framework for multi-objective stormwater management. **D.3**

Recognise that many urban watercourses are a key part of the regional (major) drainage system and need to maintain their core drainage function. **D.3**

Access to private land to maintain drainage functions of urban watercourses can be difficult without appropriate legislative tools (e.g. authorised Water Industry Officers under the Water Industry Act can access private land for maintenance and repair). **D.3**

Make space available to detain infrequent major floods to reduce flood damage, as part of the overall flood management strategy. **D.4**

Ability to construct new drainage infrastructure and to plant street trees is often limited by available space under footpaths and roads—with a wide range of services already taking up that space. To provide space for new greening and stormwater drainage, we need to be smarter about how we use underground space. **D.5**

Drainage and open space working together, Medika Boulevard, Mansfield Park

Limestone Park
Ipswich

Low lying parts of Ipswich are now better protected from flash flooding after localised heavy rainfall. A detention basin stores stormwater runoff for a limited time and then releases it slowly over several hours through a small outflow at the lowest point.

The storage capacity of the detention basin constructed at Limestone Park is 25.2 ML.

An irrigated multi-purpose sports field forms the floor of the detention basin. The sports field is surrounded by a low bund that detains the water.

Cooks River and George River

Economics researchers from Charles Sturt University looked at home sales as part of investigating the value people place on the quality of waterways and adjacent landscapes in south-western Sydney.

This research found that property values correlate closely with nearby stream characteristics, after discounting for other factors that affect house values.

Compared against VRC scenario 1 (see opposite):

- homebuyers are willing to pay nearly 5% more for houses close to VRC2 characteristics
- homebuyers placed a premium of almost 6% more for characteristics of VRC3
- the premium value for a house in areas with the highest stream vegetation condition was 9.3% or the equivalent of approximately $53,000.

Aerial imagery shows examples of different stream vegetation and riparian condition (VRC), from VRC 1 (absence of virtually any vegetation and riparian characteristics) to VRC 6 (well vegetated, natural-looking riparian corridor).The research highlighted that willingness to pay relates to the quality of riparian corridors being maintained in a healthy and attractive condition.

Communities are part of the solution

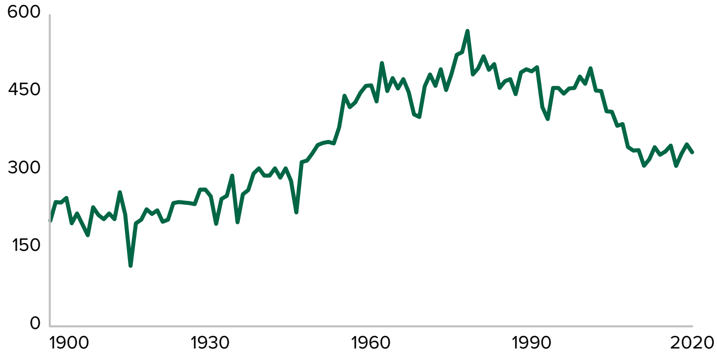
The delivery of integrated urban water management requires more than infrastructure—it also requires an engaged and active community participating in and supporting urban water management.

The community contributes directly through the action it takes in smart water use and in response to flood warnings and risk. This is done through the building and design of properties to include water-sensitive design and through the support provided to all stakeholders who manage parts of the urban water system.

People are key contributers to demand management. Average daily per capita mains water use (including residential, industrial and commercial purposes) has declined significantly since reaching its peak levels during the 1970s and 1980s, with a large decline during the millennium drought when the WaterCare education program and water restrictions were in place. Despite the easing of water restrictions, water use has not increased significantly since that time.

Other water saving initiatives implemented during or since the millennium drought have included rebates for water efficient appliances and timely information on customer water bills to inform customer decisions.

As we look to increase water use to support the development and maintenance of quality green and blue spaces, we will need an evolution in community attitudes. This means moving away from a minimalist approach to water use and towards a smarter water use mindset — one that encompasses water efficient technologies and a higher use of water from diverse and fit-for-purpose water sources to support greener neighbourhoods.



Average daily per capita mains water consumption (litres/day) in metropolitan Adelaide

For a future that makes the best use of all of our available water sources, we will need to work with the community to build support for an ‘all options on the table’ approach to water supply and smart water use to manage future demands. As we build new infrastructure and develop supporting policy frameworks to facilitate action, we will also engage with our communities to build support, understanding and commitment to a sustainable urban water future.

The strategies outlined in Table 4 will help an informed and engaged community be part of the solution for better urban water management in the future.

Table 4: Communities are part of the solution		
Smart water	C.1	Build the capacity of communities to make informed and smart water choices.
Build resilience	C.2	Provide effective flood warning systems and ensure that the community is prepared to respond to warnings.
All options on the table	C.3	Build community confidence in an 'all options on the table' approach, including purified recycled water where it forms a safe and cost-effective part of the water supply system.

What does it mean?

New technologies support efficient and reduced water use in homes and industry. **C.1**

Smart water use is about using water efficiently and effectively; sometimes that means using more water to support greening. **C.1**

Demand management is part of the solution. **C.1**

Community readiness to respond to flood warnings is an important part of managing flood risk. **C.2**

The use of demonstration sites has been shown to be effective nationally and internationally in increasing community understanding and acceptance of purified recycled water. **C.3**

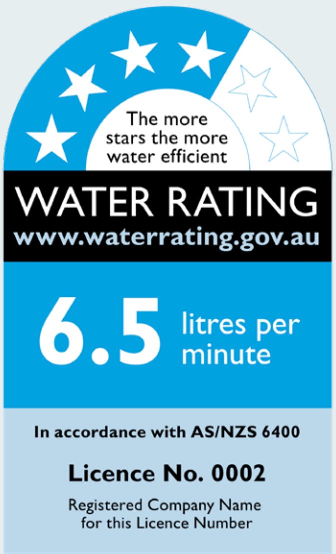
Case studies

Water Efficiency Labelling and Standards Scheme

The Water Efficiency Labelling and Standards (WELS) scheme is a joint initiative of the Commonwealth, state and territory governments. It requires some common water-using products, including showerheads, taps, washing machines, dishwashers, and lavatory equipment, to be registered and labelled with their water efficiency. The WELS scheme also requires some products, such as toilets, to achieve a minimum water efficiency requirement.

South Australia has been a strong supporter of the WELS scheme since it commenced in 2005. Since introduction the scheme is estimated to have saved South Australian water consumers almost 90 GL of water in total. It has also reduced energy consumption, primarily through reducing hot water consumption, as well as by reducing energy associated with pumping and treating water.

Nationally, the WELS scheme is estimated to have already delivered more than $5 billion of benefits to Australian urban water consumers.



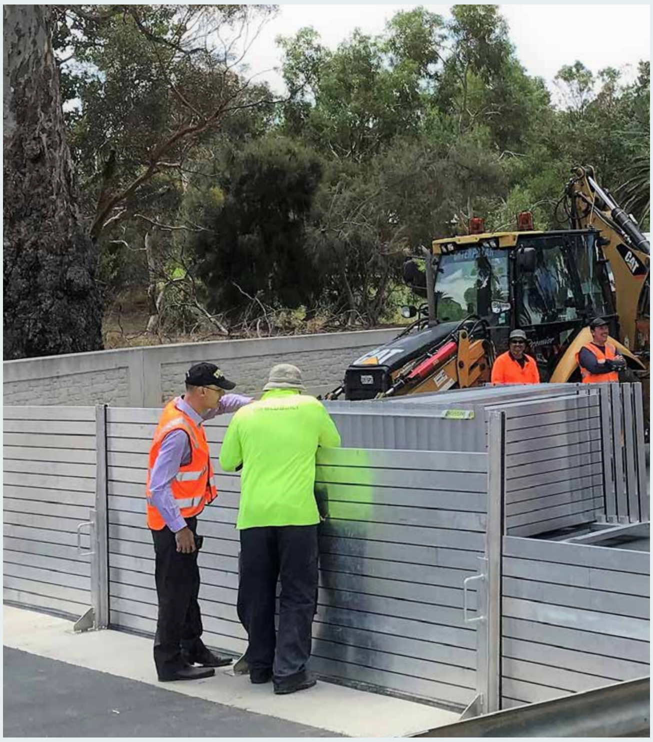
Nuriootpa flood preparedness

The town of Nuriootpa is built on the banks of the North Para River approximately 60 km north east of Adelaide. The town lies upstream of existing flood defences (such as the Bruce Eastick Dam). Flood warning, and being prepared, are therefore key to preventing loss of life and property.

The town receives flood warnings via the Bureau of Meteorology, with warning locations in the town itself and four locations upstream.

The warning service means that the town of more than 6,300 residents has time to prepare and allows the Barossa Council to install specially made temporary flood barriers at five key locations within the town. The temporary barriers are lightweight, but strong, and easy to install.

The community at Nuriootpa is well-prepared for flooding, and the actions of its residents and local council will undoubtedly continue to prevent unnecessary flood damage.



AWMA Water Control Solutions

Smart irrigation in Adelaide

With the growing impacts of climate change, one of SA Water's goals is to promote healthy communities by creating and maintaining cool, green open spaces with sustainable water use. In December 2019, SA Water implemented the Smart Irrigation Project to assist in reaching this goal. The project uses real-time data from an integrated system of soil moisture probes, daily weather forecasts and smart water meters to provide users with a weekly irrigation schedule online to optimise their water efficiency.

Smart irrigation systems are currently installed in 22 public spaces and playgrounds around Adelaide and five regional locations. Local councils who manage these areas use the data to determine the right amount of water to use, at the right time.

When compared to non-irrigated spaces, a smart irrigation system reduces ambient temperature by up to 5°C, and even more during heat waves.

To demonstrate these cooling benefits, SA Water has installed more than 200 air temperature sensors in council parks and playgrounds across Adelaide, from Gawler to Onkaparinga, with temperatures displayed live on the SA Water website.

Smart Irrigation is used to create and maintain green, cool public open spaces with sustainable water usage

Where to from here?

This Directions Statement seeks to provide an initial but comprehensive state government response to recommendations on integrated urban water management in the State Infrastructure Strategy and Climate Change Action Plan and forms one of ten high-level strategic priorities in the government's recent Water Security Statement.

The development of this Urban Water Directions Statement has been informed by input from a diverse range of stakeholders and experts and its release represents a first key step towards embedding an integrated urban water management agenda across South Australia.

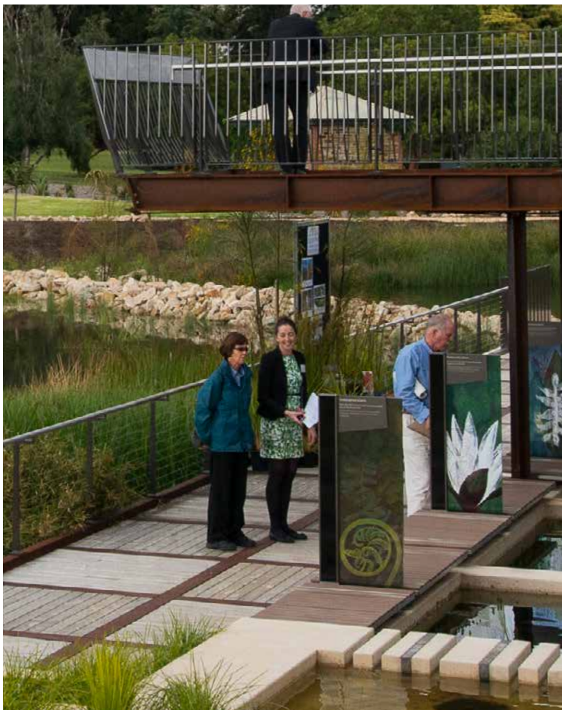
The implementation of this agenda will require an ongoing commitment to strong collaboration between state government, local government, the planning sector, community organisations and the private sector.

In addition to progressing the specific actions in this Directions Statement, the Department for Environment and Water will continue to work across state government and with external partners on a more detailed implementation action plan – one that captures and reflects the interests of all urban water management stakeholders across South Australia.

While some of the specific actions in this Directions Statement will be delivered within a shorter timeframe, the next phase of comprehensive implementation planning with external partners is expected to take approximately 12 months from the release of this Statement. A report on progress against the actions in the Statement will also be provided at that time and will be repeated annually.

The state government's work with external partners on urban water is also expected to inform the state's approach to negotiations over a revised National Water Initiative, which are expected to take place over a longer timeframe.

Finally, a comprehensive review of the effectiveness of the actions in this Directions Statement will be undertaken as an input to the next update of the state-wide Water Security Statement. Following statutory consultation, the next substantive update will be in mid-2024, to coincide with the start of SA Water's next regulatory business period.



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