Introduction

To set South Australia on the path to integrated urban water management we are developing an urban water directions statement to guide all stakeholders to deliver the integrated management of water, sewerage and stormwater services to contribute to the full suite of water security, public health, environmental and urban amenity outcomes that the community seeks.

The paper, *Setting our future urban water directions: Delivering integrated urban water management for the benefit of South Australia*, is the principal paper that contains key background information and a summary of key issues relating to the provision of water supply; drainage, flood mitigation and other stormwater management objectives, and opportunities for water to contribute to healthy, green and cool cities and towns.

This paper (*Support Paper 1: Water for the future – All options on the table*) is one of three support papers to *Setting our future urban water directions: Ideas for water reform*, that offer further detail and include questions to facilitate engagement and feedback. The three support papers are:

- *Support Paper 1: Water supply for the future – All options on the table* (this paper)
- *Support Paper 2: Drainage and flood management – Managing our rain for the next century*
- *Support Paper 3: Water for life – Water to support healthy and enjoyable urban living*

Support Paper 1: Water supply for the future – All options on the table invites your feedback about what future water management arrangements might be required to ensure South Australia's water supply investment decisions are robust in the face of our changing circumstances including climate change; while also delivering economically efficient, financially and environmentally sustainable outcomes, and ensuring our towns and cities are resilient to shocks of severe drought and other events that might impact on our water security.

> *"Town and city water security is meeting needs, over time and under changing supply and demand profiles, across the following dimensions: water quantity, quality (i.e. fit for purpose), affordability and access… and achieving this is done through investment and operations that are economically efficient, financially and environmentally sustainable, and resilient to shocks."* – Public report prepared for the Department of Agriculture, Water and Environment (Aither, 2021).

Water security for our cities and towns

Water security for our cities and towns means) ensuring that an acceptable quantity and quality of water for people, industry, and the environment is available now and into the future. Providing water security involves both managing demand for water and making sure water is available to meet demands. The health and wellbeing of South Australia's communities is dependent on access to safe and reliable water for drinking and basic human needs, as well as fit for purpose water to create green spaces, and water features such as lakes and wetlands, and for mitigating the impacts of urban heat, for an affordable cost. Many parts of the economy of our urban areas are also dependent on reliable water supplies that meet the needs of businesses.

This paper considers water security in South Australia's cities and towns by examining the predicted future water demands and all potential water supply options. The paper builds on the *Water Security Statement 2021 Water for Sustainable Growth* and the *Climate Projections for South Australia*.

Water security statement 2021. Water for Sustainable Growth

The statement provides the first state-wide snapshot of water security for more than a decade including:

- an overview of South Australia's water resources and how they are managed;
- information on Adelaide's current and future water security;
- a snapshot of water security for each region and large regional urban centres; and
- detail on how current and future state-wide water security priorities are being addressed.

With current use patterns, anticipated growth and accounting for a high emission related climate change, it is predicted that South Australia's urban water users will continue to have a high level of water security for the foreseeable future. South Australia has long recognised the short-and long-term risks our climate and geography pose to water security and the state has adapted well to manage these risks. Significant investment in water infrastructure and world leading sustainable water resource management continues to provide a high level of water security for most South Australian communities. We are well positioned to build on this long history as we face future challenges. The state government is responsible for sustainable management of South Australia's water resources and is committed to ensuring that water availability supports economic growth and employment. Responsibility for water security including the regulation, management, treatment, distribution and use of water is shared between regulators and public and private entities. Providing water security for our cities and towns as they grow and develop while maintaining resilience to the changing climate will require a dynamic water industry, focused research, and investment in infrastructure and innovative technologies.

Increasing populations, economic growth, and increased water use for heat mitigation and urban greening are challenges that water managers will need to face. The most significant challenge to water security in South Australia's urban centres is expected to come from changes to the climate, which is projected to become hotter and drier with more frequent and intense heatwaves and storm events. Projections indicate that rainfall will continue to decline in most parts of the state reducing water availability, while hotter conditions will likely lead to higher water demands to continue activities at current levels. Planning for the security of our urban water supplies will need to account for these changes to ensure that we continue to meet basic human needs, community expectations for quality of life and economic growth, while at the same time minimising environmental impacts. A comprehensive understanding of water demand predictions and supply options is needed to guide investments in water supply infrastructure.

Changes to water demand, such as increased demand for urban cooling and greening, could impact water security if additional water sources or water savings through demand management are not found.

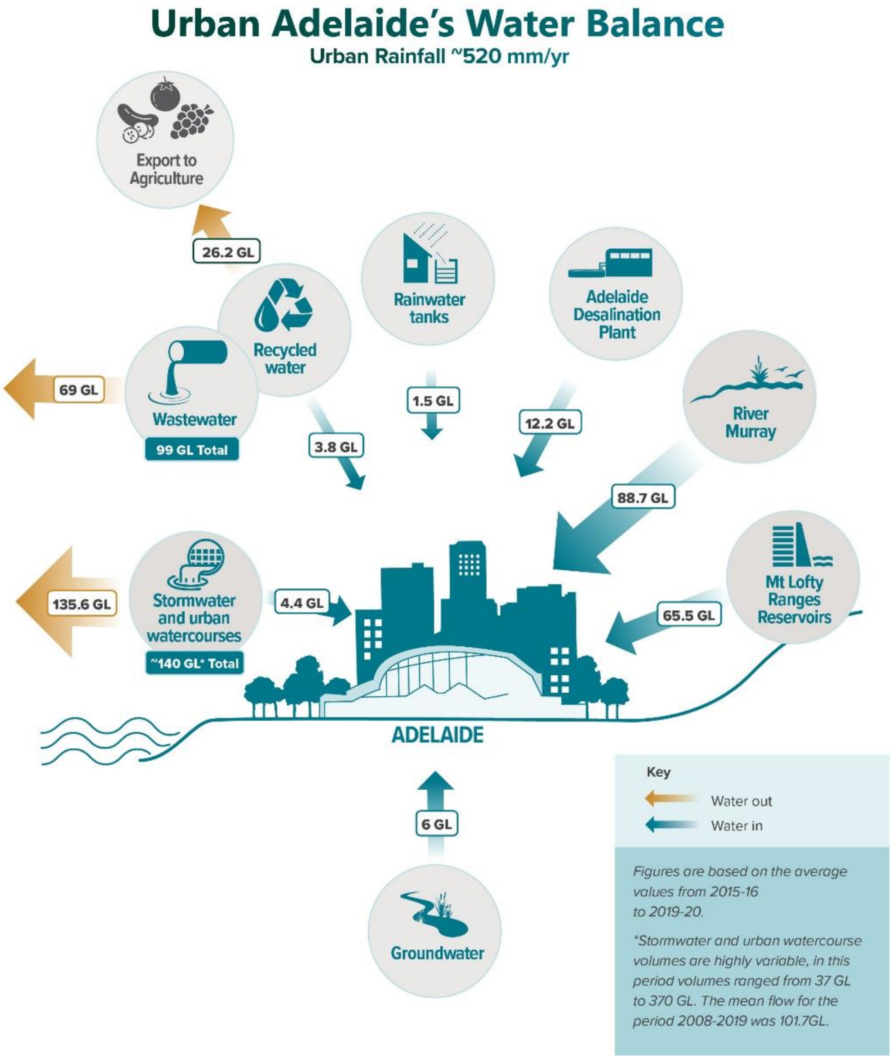
Issues relevant to urban greening and cooling are discussed in **Support Paper 3 Water for life**

Meeting additional demands requires water supply infrastructure investment that delivers water at the lowest cost and an acceptable (and agreed) level of reliability to meet demands for the long term. Acceptable trade-offs may need to be found between the reliability of supply, water quality needs and cost. These trade-offs may vary dependent on the water source and the needs of water users. For example lower reliability, lower cost water supplies may be sufficient to support urban greening.

Adelaide's water security

Adelaide has a high degree of water security as a result of its diverse portfolio of supply options; highly networked water distribution system; high proportion of climate independent water sources; highly capable water sector; and public awareness of the challenges of drought and need to carefully manage water. *The Water Security Statement 2021* (currently available as a draft for consultation) predicts that Adelaide's existing water sources are likely to be sufficient to 2050 without significant augmentation. This includes allowance for decreased rainfall and temperature increases consistent with a high greenhouse gas emissions scenario (RCP 8.5) and a mid-range population growth scenario that would see Adelaide's population increase to 1.85 million by 2050. The statement forecast that increased use of the 100 GL per year capacity Adelaide Desalination Plant will be needed to offset reduced availability of water from the Mount Lofty Ranges and River Murray.

Figure 1. Adelaide's average annual water balance

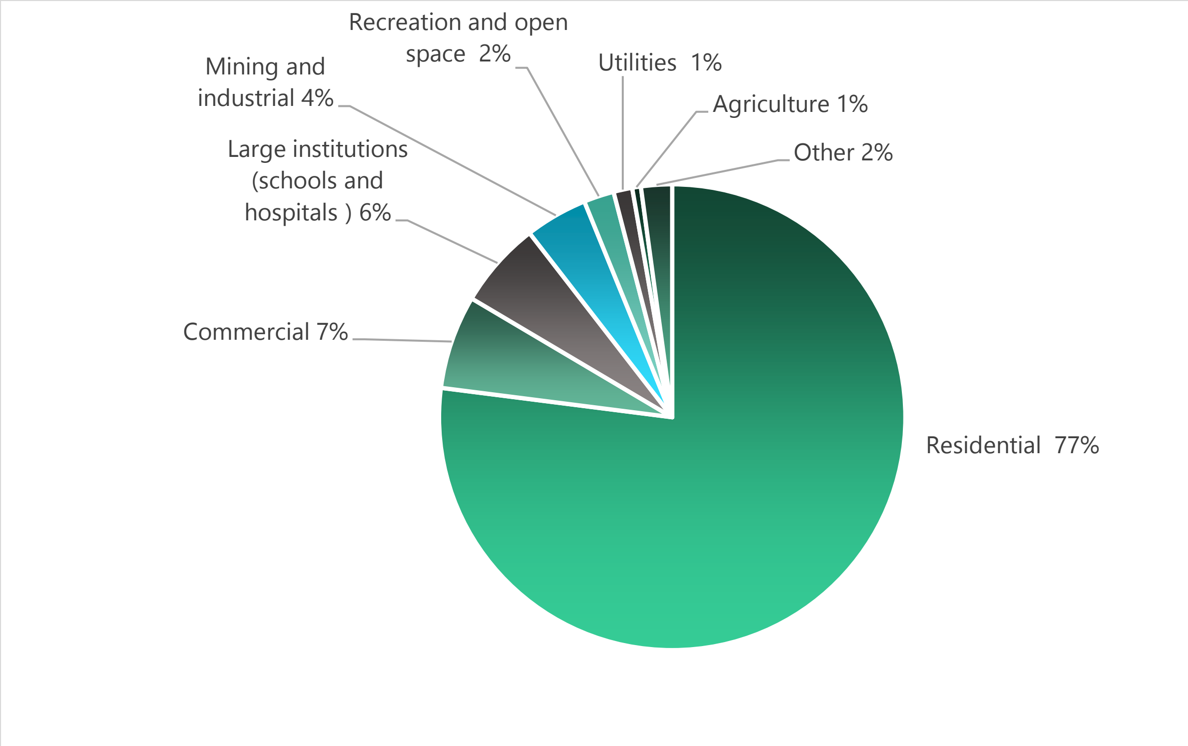


Adelaide's diverse portfolio of water sources include three large drinking water sources: the rivers of the Mount Lofty Ranges, the River Murray, and the Adelaide Desalination Plant. Smaller sources of non-drinking water (also known as non-potable water) include stormwater, wastewater and groundwater. Figure 1 displays Adelaide's average annual water balance including all water sources. The diversity of water sources provides flexibility for the water supply system, allowing water supply managers to use different water sources based on water available and relative costs of each water source. The proportion of Adelaide's water demand that can be met from the climate independent sources, seawater (desalination) and recycled water, is higher than other Australian capital cities; this is a major contributor to the city's high level of water security.

SA Water is Adelaide's major water retailer and the main supplier of drinking quality water for the vast majority of urban water users. Local councils, SA Water and a small number of private companies also supply non-potable water for irrigation of public space and to approximately 20,000 houses for toilet flushing and gardens.

Over the last five years the average annual drinking water use in urban Adelaide supplied by SA Water was approximately 166 GL with an estimated 10 GL of additional non-potable water used mainly for irrigating green space, and for some industrial uses. Residential use is the largest water use sector in the city accounting for 77% of the potable water supplied, with commercial businesses and large institutions making up the next largest use categories (Figure 2).

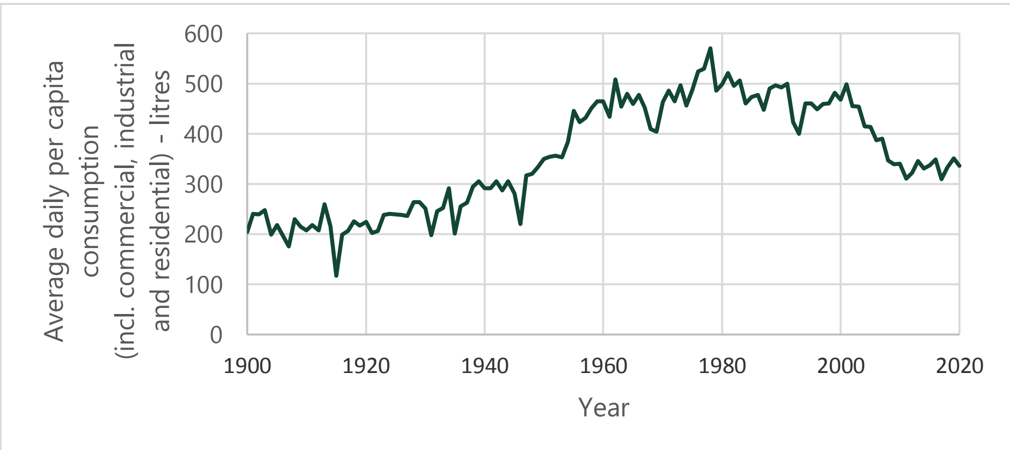
Figure 2. Potable water use in urban Adelaide by demand type



The primary influence on water demand in Adelaide is the weather, with demand being significantly higher in hot, dry summers compared to cooler, wet seasons.

Average daily per capita mains water consumption (including residential, industrial and commercial purposes) has declined significantly since reaching its peak levels during the 1970s and 1980s (Figure 3), with a large decline during the millennium drought, when the WaterCare education program and regulated water restrictions were in place. Water use has not increased significantly since the water restrictions were removed in 2010 and replaced with the Water Wise Measures applying for SA Water customers. Other water saving initiatives implemented during or since the Millennium Drought have included improved water supply system leak detection and repair, initiatives promoting the uptake of more water efficient appliances and devices (e.g. rebates and 'give-aways' for water efficient fixtures), and the provision of more timely and useful information on customer water bills. Average per capita water use is also likely to decrease as urban infill results in a more compact urban form, with more compact lot housing and apartment living and less private outdoor space needing water. Household appliances also continue to be upgraded to more water efficient appliances, facilitated by Australia's Water Efficiency Labelling and Standards legislation and the Smart Approved WaterMark scheme. Away from the residential sector, efficient irrigation practices have been introduced to schools, sporting fields and parks.

Figure 3. Average daily per capita mains water consumption in metropolitan Adelaide



The changing climate will impact different water sources differently. River flow and urban stormwater volumes are highly variable in response to rainfall and will be most impacted by a drying climate, with longer periods of low water availability being expected; while recycled water volumes are less variable and desalinated seawater is not climate dependent.

Climate independent sources such as seawater and recycled water will be increasingly important in dry years, when inflows to the River Murray and Mount Lofty Ranges reservoirs are reduced.

Additional water supplies will be needed if water use for liveability outcomes increases and to meet any additional economic demands such as the growth in demand from new industries. The selection of additional water supplies for the future will need to consider the reliability, cost effectiveness and impacts of all available water sources, accounting for changed availability that may occur in some sources as a result of climate change.

Challenges and opportunities for managing stormwater to achieve multi-objective outcomes are discussed in **Support Paper 2 – Flood and drainage management**

Water for liveability is discussed further in **Support Paper 3 – Water for life**

Water security in regional cities and towns

Water security within regional areas is critical to support existing water demands and to provide water for growth and employment. Each region has its own water security challenges, influenced by the availability of local water resources and water demands. The *Water Security Statement 2021* found that major regional centres have high levels of water security.

SA Water provides drinking water to the majority of regional South Australia. The largest water source for regional South Australian cities and towns is the River Murray, which is piped to many of the higher population areas of the state (https://www.sawater.com.au/water-and-the-environment/how-we-deliver-your-water-services/the-pipeline-network). With the length of SA Water's water mains exceeding 27,000 kilometres (more than any other Australian water utility) South Australia's ability to transport water via long distance water pipelines is nationally significant.

Other significant water sources for regional South Australia include local groundwater, most notably in Port Lincoln (and the southern Eyre Peninsula), Mount Gambier (and the lower south east) and in the far north. Other regional towns and their water supply include:

- Victor Harbor and the Fleurieu Peninsula are supplied from the Myponga Reservoir (and Myponga River), in the Mount Lofty Ranges.
- Kangaroo Island towns which are currently supplied by drinking water from one of two separate sources – the Middle River Reservoir or the Penneshaw Desalination Plant. (This is currently being augmented to include a new desalination plant at Penneshaw to supplement the existing desalination plant and the Middle River Reservoir, and distribution network upgrades)
- Rainwater (individual rainwater tanks) is used extensively across South Australia's regions.

SA Water is constructing new water supply infrastructure in some regions to enhance water security, this includes a new seawater desalination plant at Sleaford Bay on the Eyre Peninsula and a new desalination plant at Penneshaw on Kangaroo Island.

Water sources and water quality information is available for each SA Water supplied community on the SA Water website: https://www.sawater.com.au/water-and-the-environment/safe-and-clean-drinking-water/your-tap-waters-quality-and-testing/your-drinking-water-profile

Treated wastewater is used to irrigate ovals, parks, reserves and golf courses in many regional centres. This water is sourced from SA Water wastewater treatment plants or local government owned community wastewater management schemes (CWMS). There are currently 168 CWMS operating in regional council areas, understood to be collectively producing in the order of around 10 GL of effluent per year. A significant number of CWMS recycle some of the treated wastewater produced. There are also approximately 80 regional wastewater management schemes owned by other entities, associated with mining, agribusinesses and private developments. Recycled water is used for irrigation from a number of these schemes.

Changing water demands

Managing water demands is an important part of ensuring urban water security. Most South Australian cities and towns currently have high levels of water security. However, providing for future water security for South Australian cities and towns will be challenging as water demands grow in response to a range of pressures (Figure 4).

Water security planning for South Australia has already accounted for many of these challenges, but increased water demand for urban cooling and greening, and potential future additional demands for firefighting provisioning, has not yet been well quantified. The level of increased water demand for economic growth will also depend on the amount and type of industrial development. Industrial demand is only a minor component of current urban water use in South Australia, accounting for less than 5% of all water used in Adelaide, although this is greater in some regional towns (e.g. Whyalla). The proportion of water used for industry in major regional centres will depend on the nature of the local industry. Many industries have improved water use efficiencies in recent decades, but there will still be further gains that can be made in the sector.

Greening and cooling water demands are likely to vary significantly by locality, depending on the type of greening pursued (e.g. irrigated turf vs street trees) as well as climatic variations. There is some capacity within existing supply arrangements to meet these demands in the immediate term, but there is a likelihood that the demand could exceed supply in the future if broad scale greening, development of blue spaces and the use of water for cooling significantly increases demand. A first-order estimate suggests metropolitan Adelaide could potentially require 10% to 30% of additional water to provide for the target level of additional tree canopy cover in the 30-Year Plan for Greater Adelaide. The amount of water that will be required will depend on community expectations for the types and condition of tree they are willing to accept; importantly, it does not include the additional water that will be required to sustain other vegetation such as grasses and other plantings in open spaces as the climate heats and dries into the future. For example, there is some evidence to suggest that water needed to always maintain turf to the same quality during each year may be much more during drier years and during droughts.

For a discussion about water for urban greening see **Support Paper 3: Water for life**

Sustainable funding is needed for the long term provision of water to sustain urban greening and heat mitigation as these demands increase in the near future, and prior to the implementation of each on-ground initiative. Currently the water requirements are not being considered in detail in greening or cooling planning and this must become a primary component of assessing the feasibility for any urban cooling or greening initiative in South Australia's hot and dry climate.

Urban irrigation demand has already increased in response to climate changes, especially at peak use times. Future urban water security will need to focus not only on total water availability, but also on ensuring that adequate water is available where and when it is needed,

Figure 4. Drivers of increased future urban water demands

Population growth	• The populations of Adelaide and the state's major centres could increase by 25% by 2050 (moderate growth rates) • Increasing population drives increased water demand
Economic development	• Sustained economic growth requires stable water security to meet additional demands • Particularly if there are significant industrial demands which is currently minor (in Adelaide)
Climate change	• Water demand is tied to heat and dryness of summers • As the climate dries and heats the irrigation season will be extended and water volumes needed to sustain trees, gardens and parks is increasing
Urban greening	• Additional water will be needed to sustain increased greening in public open spaces and private gardens
Urban heat mitigation	• South Australia has already experienced average and extreme temperature increases and this is projected to increase • There are many ways water can be used to cool urban environments

whenever there is an extreme heat event or throughout extended dry periods, to effectively sustain vegetation and cool the environment.

Recycled water from the Glenelg to Adelaide pipeline now has very high summer demands and lower winter demand. Given that this supply is a constant year round supply, there is a need to find ways to store water over winter in order to maximise the use of this water during peak summer irrigation times.

To date water features have not been extensively considered in South Australia as an approach for cooling urban environments. However, cafes and restaurants have recently begun to take a lead with the adoption of misting systems and SA Water has begun promoting the benefits of water for cooling through the Cooling the Community campaign as well as offering cooling by portable misting at outdoor events.

Increasing water use for greening and cooling will need to be balanced through demand management in other areas to offset the increase in water use. This could include smart irrigation, indoor water efficiency through water smart appliances, water recycling and regulation of activities such as vehicle washing. This will require more nuanced communications about water use than have been required in the past as the increased water use for greening and cooling could appear wasteful in light of the accepted water conservation measures that have been in place since the millennium drought.

Minimising demand with smart water use

Minimising urban water demand will require innovative smart water management approaches (Figure 5).

Figure 5. Approaches to minimise urban water demand

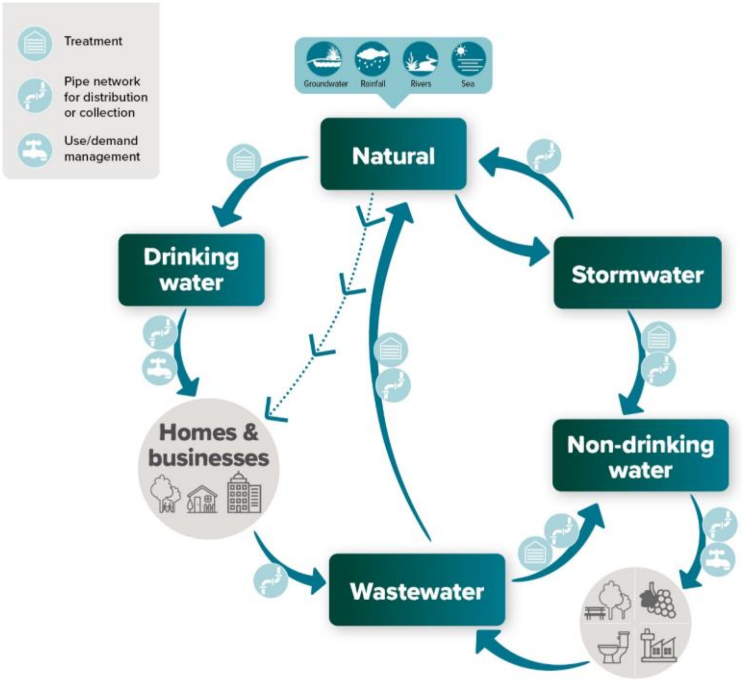
Water efficient technologies	• Water efficiency for homes, business, industry and irrigation will continue to be a cost-effective demand management approach. • The Water Efficiency Labelling and Standards (WELS) scheme is effective at communicating water appliance efficiency.
Water sensitive urban design	• Urban form and design are some of the most important contributors to minimising water demand by capturing rainfall and stormwater runoff and using recycled water to minimise demand for reticulated potable water.
Water wise behaviours	• Water wise initiatives are not as prominent as they were during the millennium drought when the Water Care campaign created behaviours that remain today • Water wise communication will be a priority as water use for livability increases.
Smart irrigation	• Climate change has already driven the uptake of smart technologies and practices for urban irrigation. • New practices and better communication applying knowledge from the horticulture industry (e.g. soil moisture monitoring) will be critical.
Passive irrigation	• The diversion of runoff and stormwater to green areas such as roadsides and parks is becoming more common. • Widespread adaption in combination with smart soil monitoring can reduce irrigation water demands.
Regulated water use controls	• Permanent water conservation measures apply in South Australian towns and cities. • During the millennium drought more severe restrictions were implemented. An appropriate level of regulated water use control can minimize demands.

Adelaide landmarks using smart demand management (e.g. water efficient appliances and irrigation) Adelaide Oval, Royal Adelaide Hospital, SAHMRI**,** SA Water House, Adelaide Airport, Marion Cultural Centre. For information on these and some other examples of smart water management in Adelaide see: https://www.environment.sa.gov.au/topics/water/water-in-urban-environments/urban-water-programs-initiatives#water-smart-adelaide

Sourcing and supplying urban water

Maintaining a high level of water security in the future will involve using the most appropriate portfolio of water supply options, protection of all water resources and linking fit-for-purpose water supplies with water demands. Figure 6 outlines the relationship between the different water sources, supply networks and uses.

Figure 6. Urban water cycle relationships



Historically urban water needs have been met from natural surface water and groundwater resources. In South Australia's dry climate this has depended on significant management to capture, store and move water from the resources to the urban areas where it is needed.

Protection of water resources

South Australia has a risk based system for the management of water resources where areas of high demands have higher levels of management. Water resources (surface water and groundwater) that require a higher level of management to provide security for all water users are prescribed under the *Landscape South Australia Act 2019*. Prescribed water resources are managed through water allocation plans that limit water use to a sustainable volume. Water for supply to urban centres is included in this planning alongside the requirements of the environment and other uses. Water for many of the state's cities and towns is provided from prescribed water resources. Water resources are not prescribed if there is insufficient demand for water to present a risk to the water resources.

More information on water allocation planning for prescribed water resources can be found athttps://www.environment.sa.gov.au/topics/water/planning/water-allocation-plans

Urban water sources

Surface water

Water in streams, rivers, lakes, dams and wetlands is replenished by rain or when groundwater discharges to the surface. In South Australia's dry climate, surface water systems are usually ephemeral, flowing only in response to rainfall events and remaining dry at other times. Some maintain permanent pools of water during dry periods because they are fed with groundwater. The exception is the River Murray which is controlled with dams, locks and weirs and is the largest source of surface water, supplying most South Australian cities and towns, including Adelaide. When it is dry in the Mount Lofty Ranges, Adelaide sources most of its water from the River Murray. The Mount Lofty Ranges reservoirs can store is enough water to supply Adelaide with drinking water for a year.

Much of the state relies on the Murray River as the sole potable water source. This includes major regional cities such as Mount Barker, which has a planned growth to reach a population of 60,000 in the medium term. Ensuring the reliable supply of water from the River Murray as the inflows to the basin decrease in the future will need to be managed.

Groundwater

Groundwater is an important water resource across much of South Australia. In some locations, including Mount Gambier, it is treated and used for drinking water. In many other cities and towns groundwater is used by industry and for irrigating public parks and gardens, sporting fields and school grounds. Groundwater is the main water source for some businesses, while for others it is particularly important during dry times, when rainfall and surface water availability is limited. Households with their own bores use groundwater for watering gardens.

In some remote communities desalination plants treat groundwater to remove salt and impurities for local communities including at Oodnadatta, Hawker, Leigh Creek, Indulkana, Mimili, Kaltjiti (Fregon), Yunyarinyi (Kenmore Park) on the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands, and at Yalata on the west coast. In some locations, such as the town of Meadows, groundwater is supplied by a reticulated supply for non-potable use.

Groundwater use in Adelaide is less than 3% of the total city water supply and there is scope for more groundwater to be used. This could include as part of the water supply for potable demands in a future drought, as it has in the past, most recently in 1968.

Groundwater for water supply in Adelaide

In response to water shortages in the twentieth century the Engineering and Water Supply Department drilled 113 groundwater supply wells throughout the Adelaide metropolitan area. Assessments of the groundwater resources of the Adelaide Plains in the 1950s raised the idea of Managed Aquifer Recharge for the first time.

During the severe 1914-15 drought wells were drilled to supply industry, public utilities, institutions and recreational groups in response to a Government proposal to "cut off supplies to large consumers of water unless rain fell to replenish the reservoirs".

Wartime industrial expansion in the 1940s resulted in a rapid increase in population and rising water demand. Despite Mt Bold Reservoir being completed in the 1930s, drought conditions necessitated the imposition of severe water restrictions in the late 1940s and early 1950s and groundwater supplies were again utilised.

The 1967-68 drought was the last time that groundwater was used for reticulated water supply in Adelaide. A network of about 40 wells supplied 10 000 ML during that period. During and after this drought supply wells were drilled at 38 schools for the irrigation of ovals and playing fields.

Seawater desalination

Seawater desalination plants remove salt and impurities from seawater, providing a climate independent source of safe clean drinking water, which serves as an important option for the provision of water security in South Australia's hot and dry climate. SA Water operates two major seawater desalination plants in South Australia, one in Adelaide and one on Kangaroo Island. There are also a number of smaller plants operated by local councils or the private sector. New desalination plants and associated distribution infrastructure have been approved for construction on Kangaroo Island and the Eyre Peninsula.

South Australia's total desalination plant capacity includes the 100 GL per year Adelaide Desalination Plant and smaller plants with combined capacity of 10 GL per year. The volume used is well below this capacity (approximately 5.3 GL per year between 2015-16 and 2018-19) as it is the most expensive potable water source, so is typically only used when other alternatives are not available. The water security provided by the Adelaide Desalination Plant will enable Adelaide to reduce its reliance on the River Murray in dry years. The unused capacity of this climate independent water source is one of the key contributors to water security for Adelaide.

Wastewater

Wastewater from toilets, showers and sinks in homes and other buildings is delivered to treatment plants by the sewerage system. Once treated, some of this water is recycled for non-potable purposes. Water that is not recycled is discharged to rivers or coasts. The use of recycled water has been steadily increasing and today SA Water recycles approximately 30% of treated wastewater from its Adelaide wastewater treatment plants. The majority of this is exported to neighbouring horticultural areas with smaller volumes used in the urban area for irrigation and other non-potable uses. Many regional local governments also use recycled water from their community wastewater management systems, predominately for open space irrigation of parks and sports fields.

Recycled water is a climate independent water source, with relatively consistent and predictable availability and quality. There are challenges in using wastewater over winter when agricultural and urban irrigation demands are low. This means that significant increases in recycled water use for irrigation will often require investment in over winter storage, to maximise the annual use and match peak demand periods in summer.

Recycled water and stormwater provides an additional water source in many parts of the state including underpinning peri-urban horticultural industries. This has been so successful in the McLaren Vale region that recycled water now meets over half of the region's agricultural water demand. As urban demands increase for water for greening and heat mitigation there is a potential conflict between these urban and rural non potable demands that need to be resolved to provide security for the existing users as well as providing water for new demands such as urban greening and other demands for water that would enhance urban liveability.

Reuse of residential (and commercial) greywater (water from the laundry, bathroom taps and shower) along with industrial greywater (slightly polluted water which can be reused in manufacturing) can save significant quantities of drinking quality water and reduce the volume of wastewater conveyance for downstream treatment. While greywater generation is a relatively regular seasonal supply, sites where it is used may need to be capable of accommodating the annual greywater load.

Sewer mining is another option to recycle treated wastewater at a more local scale than that provided by a municipal wastewater treatment plant. Sewer mining involves tapping into a wastewater system and extracting some of the wastewater stream for treatment and use as recycled water. This may reduce the length of the pipe network to supply recycled water as treatment and distribution can occur closer to the end use. This could also potentially reduce costs as there are significant costs in distribution networks. Suitable locations have an appropriate end use nearby such as a park area, golf course or a building or development complex. Potential applications for sewer mining could include commercial high rise developments, where other potential water sources are limited (such as rainwater harvesting which is limited by the available roof catchment and storage space, and greywater where the volumes of greywater generated are more likely to be quite limited). Thus the sewer provides a consistent water resource and sewer mining can be a suitable treatment technology.

While it has not been actively explored by state government to date, purified recycled water for potable use could be a potential future water source to reduce South Australia's reliance on climate dependent surface water from the Mt Lofty Ranges and River Murray. While not currently part of South Australia's drinking water supply mix, the use of highly treated purified recycled water is becoming more commonplace around the world (Figure 7).

Groundwater replenishment for indirect potable supply in Perth, Western Australia

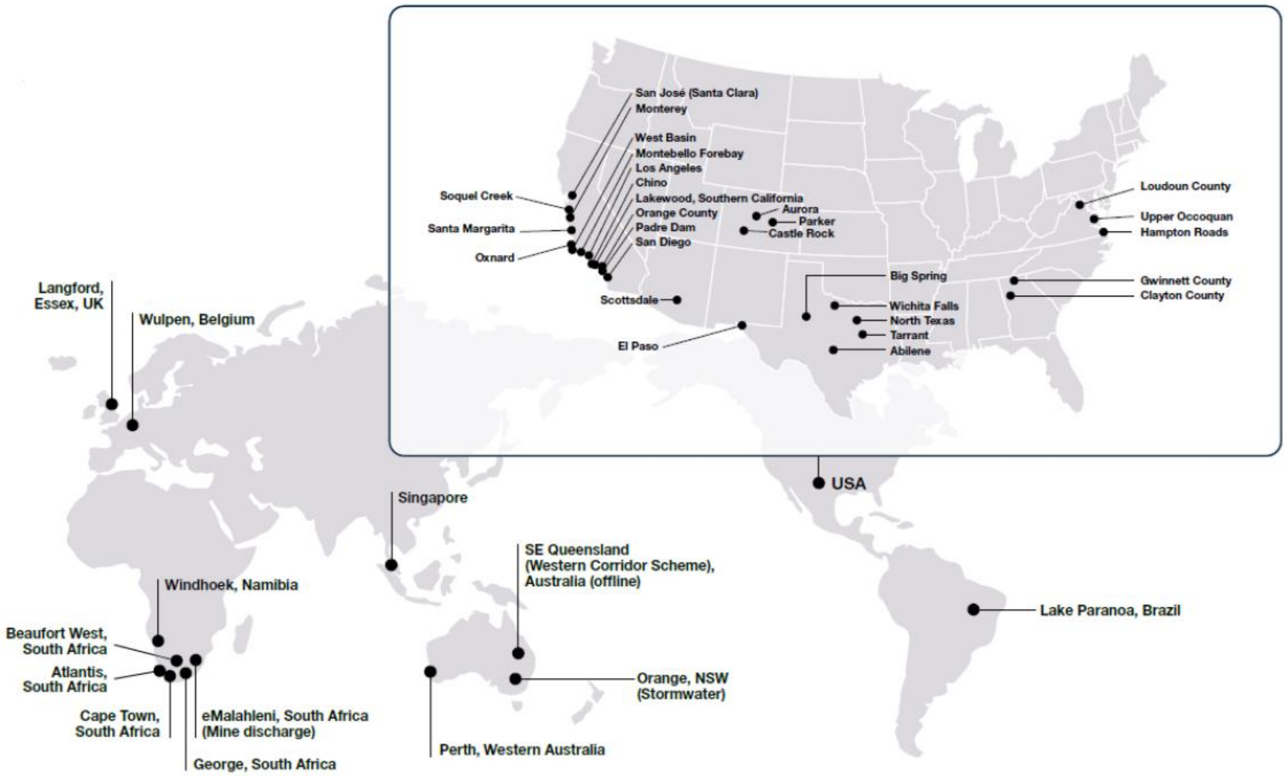
In 2017 Australia's first full-scale Groundwater Replenishment Scheme started recharging recycled water to Perth's deep aquifers. Today groundwater replenishment makes up 3% of the Western Australia Integrated Water Supply Scheme.

Wastewater is initially treated at the Beenyup Wastewater Treatment Plant, before further advanced treatment processes at the Advanced Water Recycling Plant including ultrafiltration, reverse osmosis and ultraviolet disinfection. This removes chemicals and micro-organisms to meet Australian guidelines for drinking water.

This was the outcome of 15 years of development by the Western Australian government which began exploring opportunities for recycling wastewater in 2002 and by 2012 a successful 3-year groundwater replenishment trial had been completed.

As an example, "Pure Water San Diego" is the City of San Diego's phased, multi-year program that will provide purified recycled water as more than 40% of San Diego's water supply by the end of 2035. The Pure Water San Diego Program will use proven water purification technology to clean recycled water to produce safe, high-quality drinking water. The Program offers a cost-effective investment for San Diego's water needs and will provide a reliable, sustainable water supply. Further information available here:
https://www.sandiego.gov/public-utilities/sustainability/pure-water-sd#:~:text=Pure%20Water%20San%20Diego%20is,%2C%20high%2Dquality%20drinking%20water)

Figure 7. Locations using purified recycled water 2020 (source Water Services Association of Australia



Stormwater

Stormwater is water from rain events that enters the urban drainage network. Stormwater use involves capturing, treating and storing stormwater for use when required. In South Australia this often involves treatment in wetlands, storage in an aquifer and pumping the water out of the aquifer to irrigate parks and gardens.

> Challenges and opportunities for managing stormwater to achieve multi-objective outcomes are discussed in **Support Paper 2 – Flood and drainage management**

Large scale stormwater harvesting began in the north of Adelaide in the early 1990s and has increased over the past 30 years. Today approximately 3% of water used in Adelaide comes from treated stormwater. Although a minor part of the total city water supply, stormwater is a valued source of water where it is able to be accessed. After a rapid growth period, harvested volumes have stabilised at approximately 5 GL per year (since 2015) except for 8.4 GL in the high rainfall year of 2016. The harvested volume of these schemes has not reached the originally estimated capacity, of the order of 20 GL per year for a range of reasons including source water quality variation, supply and demand alignment, lower than average rainfall, treatment wetland efficacy and aquifer performance. Operators of stormwater harvesting schemes have identified modifications that could increase the capacity by up to 2 GL per year. While most stormwater harvest schemes in Adelaide use ‘managed aquifer recharge’ (MAR) for temporary storage of the water prior to its extraction from wells for use, some direct extractions from urban rivers also occurs. The average annual take from urban reaches of the River Torrens is in the order of 0.4 GL per year and is typically used for summer irrigation.

It is not expected that the rate of development of new schemes will be as rapid as in recent decades. It was previously estimated that Adelaide's total harvestable stormwater volume was 60 GL per year. This has recently been revised down to approximately 23.5 GL with the new estimate taking into account scheme performance, operational restrictions, rainfall reduction and the development of open space preventing the construction of treatment wetlands. There is a possibility of improving the increasing stormwater harvest volumes and reliability of supply through technological developments for efficient treatment and harvesting; integrating stormwater, wastewater and natural groundwater use in common networks; reducing aquifer pressures; and any creation of open space from urban consolidation that allows for treatment wetlands to be established.

Managed Aquifer Recharge

South Australia has earned global recognition for managed aquifer recharge (MAR), from research to successful implementation.

South Australian companies have built expertise and global recognition and MAR is currently being used across a range of scales for urban and rural irrigation as well as for industrial purposes.

MAR provides a way to capture water when it is available and treat and store water in an aquifer. This water can then be pumped back out from the aquifer when required. The source water can be varied, but two common sources are treated wastewater or stormwater where the pattern or supply of water does not fit the pattern of demand and so storage is necessary.

The quantity and quality of stormwater runoff can vary significantly, impacting the ability to effectively harvest and treat stormwater. Increased tree canopies over roadways and other paved areas may lead to additional sediment and nutrient load in the stormwater, reducing the volume that can be treated to a standard required for aquifer storage or adding to the complexity and potentially to the cost of treatment.

Similar to wastewater, purifying stormwater for potable use has not been fully explored by the state government to date, although significant research has been undertaken. This option could form part of a future water mix potentially increasing the harvested volume as the purified water could be fed directly into the potable supply without storage before use.

Rainwater tanks

Roof rainwater is a popular and often important local source of roof rainwater for many South Australians. In Adelaide, it is believed that around 44% of dwellings have a rainwater tank. In regional towns and cities rainwater tank ownership is typically higher than it is in metropolitan Adelaide Domestic rainwater use is not metered but the average use in Adelaide is indicatively estimated to be about 1 to 2 GL per year, representing a minor component of the city's water supply mix. In other parts of the state rainwater tank ownership levels are generally greater than in Adelaide, and rainwater is more likely to form a greater proportion of domestic water use. Actual rainwater usage varies from year to year depending on the amount and timing of rainfall, the amount of roof area connected to the tank, how often and how much rainwater is used, and the size of the rainwater tank.

Rainwater tanks remain a practical way that households and some businesses can reduce their consumption of mains water, especially when they are plumbed into a building (e.g. to toilets, laundry cold water outlets, or hot water systems which allows for more regular rainwater use whenever it is available). Rainwater use is generally limited to the site where it was captured, but there may be an opportunity to develop precinct scale rainwater use by linking the rooves of adjacent buildings, such as in a commercial area, and using the captured rainwater for irrigating shared green space.

Other potential sources

Other water supply augmentation options for South Australia have been considered and found not to be viable including increasing reservoir capacity, large scale long distance water supply schemes, towing icebergs and cloud seeding among others. Extensive consideration of these options was undertaken in the preparation of the Water Proofing Adelaide Strategy (2005), and the Water for Good strategy (2009). These and other studies have continuously found the proposals not to be viable.

Water supply systems

Water is supplied for use through systems that treat and distribute the water to points of demand. Separate supply systems are in place for potable and non-potable water throughout our cities and towns. The sewage and stormwater drainage systems are additional separate systems. Water quality is a critical consideration for potable water supply and potable water is required to meet the requirements of the *Safe Drinking Water Act 2011*. Other consumer protections are provided by the *Water Industry Act 2012*, which governs all water industry retailers. The Essential Services Commission of

South Australia (ESCOSA) is the economic regulator under the Water Industry Act and licences water and sewerage service retailers, sets minimum operational standards, and ensure customers pay a fair and reasonable price for the services. The Office of the Technical Regulator also has a regulatory role under the Water Industry Act, to ensure that infrastructure is safe and reliable and adequately maintained.

Supplying Drinking water

Most of the water supplied to cities and towns is treated to a quality that is safe for drinking, known as potable water. Potable water is used for a wide range of indoor and outdoor activities, including drinking and cooking, commercial, industry, and irrigation of public open space (parks and playing fields).

There are a wide range of challenges on the horizon for urban water supply in South Australia, most significantly finding cost effective ways to meet additional water demands of a larger population. Inflows to Adelaide's water supply reservoirs and the Murray-Darling Basin are projected to decrease. Significant volumes of water may be required to achieve and sustain the State's urban greening targets and this may draw on the potable as well as non-potable supplies. Infrastructure system maintenance costs will increase for the water supply and sewerage systems that were predominately developed in the second half of the twentieth century.

The combination of reduced inflows to the traditional supply systems and increased water demands will lead to a greater dependency on water sources that are climate independent. The two climate independent water sources in the state are desalinated seawater (currently used for supplementing potable supplies) and recycled water (currently only treated to a quality suitable for non-potable uses). Assessments of many other water supply options have been undertaken over the past 20 years, but none have yet been found to be feasible.

Reliability of water supply is critical and currently, supply systems such as the Adelaide Desalination Plant do not allow for the storage of large volumes of treated water, with distribution direct from the treatment plant to the distribution network. This would become an issue in providing a reliable supply if there is no or very limited water available from the Mount Lofty Ranges and River Murray and the desalination plant needs to be taken off line for a short period of time. Ensuring resilience in the water supply system is a key component of maintaining a reliable water supply.

In some situations, either restricting supplies, or carting of potable water, is important for supplying water when other water supplies have failed or are unable to meet the demand. This can be for an individual property that is not connected to a reticulated supply whose rainwater tanks have emptied, or a community water supply that has failed during severe dry periods. The reliability that the River Murray and associated water pipelines and other infrastructure provides to regional South Australia means that this occurs less frequently for South Australian communities connected to that water source, compared to some towns in other states that have experienced severe drought conditions in recent years.

Supplying non drinking water sources

Non-potable water is treated to a lower standard than drinking water and is reserved for non-drinking uses; sources include treated stormwater, recycled water, and groundwater. The use of water from these sources reduces the demand on drinking water supplies, as well as reducing sediment and nutrient discharges to the marine environment. Public health and environmental regulations ensure water is treated to the level required for its intended use, known as a 'fit-for-purpose' standard.

The supply and use of non-potable water has been introduced at different scales and for different purposes in urban areas. Most commonly, non-potable water is used close to where it is collected and stored and the most successful application has been the irrigation of public open space by locally sourced stormwater, recycled water and groundwater. Sometimes it is piped to other parts of the town or city or exported to other regions. See Case Example – Oaklands stormwater harvesting and use project, Marion. Supply for residential uses such as garden uses and toilet flushing via a third pipe supply has been less successful to date and operations have struggled to be cost effective due to the small volumes used by each customer, additional upfront plumbing costs, and ongoing costs for managing the risk of inadvertent cross-contamination of the public water supply. Demand for water for garden irrigation and toilet flushing, which are those most suited to non-drinking quality water, has also diminished in recent decades. This has arisen as a result of a significant trend to more compact housing with small gardens, which have very little garden watering needs. Likewise, modern dual flush toilets use about half as much water as toilet models available in the late 1980s.

Case Example - Oaklands stormwater harvesting and use project

Oaklands wetland is a 2.2 hectare constructed wetland located in Marion. Completed in 2013, the wetland and adjacent park landscaping have transformed the disused former driver training centre site into functional stormwater harvesting and use scheme, combined with a beautiful habitat where people can appreciate the year-round open water and connect directly with nature.

Annual benefits include:

- Use of up to 200 million litres of stormwater per year for irrigation of 31 council reserves replacing mains or groundwater use, or creating new irrigation areas.
- Expected total treatment of 400-500 million litres of stormwater per year.

Source: Water Sensitive SA

(See also: *Oaklands Park wetlands – a multi-functional success,* in Support Paper 3: Water for Life)

Non-potable water currently accounts for approximately 10% of water used in Adelaide. Additionally, about 26 GL out of the 99 GL of wastewater generated is recycled and exported to peri-urban horticultural areas such as the McLaren Vale and northern Adelaide plains (Figure 1). Non-potable water is supplied in many cities and towns for watering gardens and parks, flushing toilets, industry and other non-contact uses. In Adelaide approximately 20,000 houses at Mawson Lakes, Bowden and Seaford are supplied non-potable water for toilets and garden use. Across Adelaide and the neighbouring horticultural areas about 750-1,000 km of non-potable water supply networks have been installed over the past 30 years. Roof rainwater stored in tanks is also used in many homes for toilet flushing and garden use.

South Australia has a range of suppliers of non-potable water including local councils, SA Water and private suppliers. Councils collect, treat, store and supply non-potable water for irrigating parks and gardens and some industrial users. SA Water supplies recycled water for irrigating parks, to some homes and to horticultural areas. Unlike SA Water's drinking water supply, the different non-potable water supply networks have been developed and are managed separately. In Adelaide there are 15 independent networks, operated by 12 entities, with each having been developed independently to service local needs. Although small disconnected systems can be advantaged by their inherent flexibility and ability to service the needs of specific consumers, there are a number of potential drawbacks. Compared with larger centralised water networks servicing and recovering costs from a large customer base, small local water suppliers can face additional challenges, such as the necessity for them to recover costs from a small customer base, managing risks associated with the potential loss of one or several major water consumers (such as a large business), and the prospect of them also needing to provide another backup water supply in case their local water resource goes offline. While investment and operational decisions related to these systems are made independently, in recent years the operators have come together to consider how linking nearby schemes and collaborating on management can improve reliability and efficiency.

Adelaide landmarks using non-potable water

Coopers Brewery, Adelaide Oval, Adelaide Airport, Royal Adelaide Hospital, Adelaide Parklands, SAHMRI, SA Water House, Wayville Showgrounds, Mawson Lakes, many schools, Adelaide Botanic Gardens and the Marion Cultural Centre.

Making decisions for water security

As changing climate and increasing demand continues to put pressure on water resources and the ecosystems they support, it will become increasingly important for South Australia to plan for long-term urban water security. Future water supply augmentation decisions will need to drive the development of the most appropriate portfolio of water supply options to meet the water security needs of each city or town in the face of climate change and drought. These decisions will need to be made in consideration of all parts of the urban water system. There will be a need to balance additional supply with demand management options, as well as consideration of all potential water supply options, including those that may deliver additional benefits through their use. In the past water supply, sewage services and stormwater investments were made separately, but it is now considered that a broad range of liveability and water cycle management benefits can be achieved through integrated decision making. Some examples of how managing urban water in an integrated way provides benefits:

- Increasing stormwater harvesting and wastewater recycling for non-potable reuse reduces the need for harvesting from natural sources and the volume of water that needs to be treated to drinking water quality.
- Managing urban planning and stormwater systems to retain rainwater and runoff in the urban landscape reduces the volume of water and amount of pollutants that flow to natural environments. The retained water can in some circumstances also soak into the soil, reducing the volume of water needed to irrigate trees and other vegetation.
- Reduced water use in homes leads to less wastewater discharge needing treatment and management for reuse or discharge to the environment.

No water supply option on its own is likely to meet all the needs of a city or regional town and combinations of options will need to be considered. Water security decision making will need to be informed by current and accurate information and consider many criteria for flexible responses to future changes and as new information becomes available. In Table 1 the supply costs, environmental impacts and social impacts associated with a range of urban water management options have been collated. The costs presented in the table are adapted from *All options on the table: urban water supply options for Australia, WSAA 2020* which collated the latest available data from existing and newly planned projects across Australia estimating national median levelised costs for each water supply option. These values may not align with specific South Australian operations, but are provided here as the most contemporary and consistent information for comparing options. The environmental and social impacts describe expected impacts from effective delivery of each supply option. These do not include any impacts that may be occur with system failure of poor implementation of the approach.

Water security decision making often factors in the need to provide secure water supplies for particular purposes, based on a hierarchy of needs. For example should water supplies decline and restrictions be required, maintaining water for critical human needs is considered the most important. During the millennium drought water use was limited through mandatory enforceable restrictions that limited the irrigation of public green spaces and private gardens. This also led to significant long-term legacy issues as a result of some irrigation systems that were switched off during the drought being no longer functional following several years of disuse. In the decade since the drought ended the critical role green infrastructure plays in community health and wellbeing has become more widely understood and the use of water for urban heat mitigation is now being recognised. At the same time, high water use landscape features such as green walls and water cooled spaces such as splash pads and other blue spaces have become more common in urban development and landscaping. The benefits that greening and cooling provide and the community expectation for the maintenance of the increasingly vegetated urban area has combined to increase the priority of water use for sustaining greenery and for heat mitigation, so that it is now a higher priority water use than it once was. This change is reflected in the SA Water Cooling the Community campaign. The continuation of water conservation measures (or 'water wise measures') that replaced mandated water restrictions after the end of the millennium drought reflects the needs to continue other water efficient practices as these new water uses increase. In providing secure water supplies in the future it is also important to develop decision making frameworks for restrictions in times of drought.

For further details about water for urban greening see **Support Paper 3: Water for life**

Climate dependent water sources that have historically formed a key part of our urban water supply are projected to become less reliable with climate changes. The protection of these sources will remain a key part of urban water security to ensure that their use is maximised. This protection includes planning for the management of key water resources through resource prescription and water allocation planning, catchment management and reservoir watershed protection.

Supply augmentation will be needed to meet additional demands. Supplies will need to include a combination of available water sources including the expansion of recycled water and stormwater use, increasing local groundwater use and expanded desalination. There are additional costs in maintaining separate potable and non-potable supply networks. The alternative option of treating all water to a potable standard would allow the maintenance of only one supply network, but this also has costs such as those associated with treating variable quality water to reliably meet public health and safety standards and for providing sufficient community assurances concerning the safety of the water supply, that need to be considered. Another option that has been developed interstate and internationally is purified recycled water for drinking, but this has not been actively explored by the South Australian government to date.

Water supply augmentation options are not a one size fits all. It is likely that there will be a range of options that contribute to a secure water supply in the future, operating at varying scales, all contributing to improved water security in the long term. Table 2 presents different consideration for developing water security actions at different scales, including local, precinct and town / city-wide scales.

Table 1 Urban Water management option costs and environmental and social impacts
Costs adapted from All options on the table: urban water supply options for Australia, WSAA 2020

Possible future water supply options and their estimated costs and benefits *(adapted from Water Services Association Australia)*					
Management action	**Cost $/KL 2019-20**	**Reliability added to water supply**	**Environmental impact**	**Social impact**	**Notes**
Water use efficiency measures	0.41	Water efficiency measures that reduce demand can maintain water supplies and delay or defer the need for investment in new water supplies.	Efficient water use can reduce environmental impacts – e.g. reduced energy use.	Can provide a social benefit through reduced water bills as a result of reduced water use.	Cost effective for achieving small water savings. Projects include water efficient appliances and demand management programs.
Surface water (rivers)	1.08	Important part of existing water supply portfolio, however likely to be a high risk investment in the future as it is rainfall reliant and less resilient to climate change than other options.	Dams impact on the environment through inundation of surrounding land and changed flows to downstream river ecosystems.	Potential impact on Aboriginal cultural heritage by inundating important sites and impacting access to ancestral lands.	Relatively large upfront cost due to scale of infrastructure required, but ongoing costs to operate a dam are relatively low if the dam is located near the community receiving the supply.
Groundwater	1.20	Can offer a reliable supply even in times of drought. Resilience to drought is dependent on the type of aquifer and how long it takes to refill from rainfall (recharge).	Low impact if extraction is within sustainable limits. Can be at risk of over-extraction and salt water intrusion. Over use may not be detected for several decades because of slow renewal and movement of the resource.		Costs can vary significantly dependent on the infrastructure required, including if desalination is needed.
Water sharing between regions (e.g. River Murray supply in Adelaide)	1.33	Generally pipeline interconnectors increase the reliability of a community's water supply- but this can be dependent on the rainfall distribution across the regions.	There can be environmental impacts from construction of pipelines including impacts on flora and fauna, waterways and land. Energy demands are variable dependent on pumping requirements.	Sharing water between regions can maintain the economic and social outcomes in those regions, and particularly in the region receiving water. However community views on sharing water between regions are not always positive and should be considered in options analysis.	Costs to construct can be moderately high depending on the distances involved between regions, length of pipework, terrain, the method of construction and the associated storage requirements.

Possible future water supply options and their estimated costs and benefits *(adapted from Water Services Association Australia)*					
Management action	**Cost $/KL 2019-20**	**Reliability added to water supply**	**Environmental impact**	**Social impact**	**Notes**
Purified recycled water for drinking	2.34	Generally a relatively reliable water supply option which provides diversification to the water supply portfolio increasing water security.	Reduces nutrient and other pollutants that would otherwise be discharged to waterways and the sea.	There could be competition for water supplies with other types of water users (e.g. irrigation use of recycled water).	Community support can be a particular challenge for purified recycled water, more because of the "yuck" factor than any technical aspects. Community education and engagement has evolved in recent years, and public acceptance is improving in many parts of the world.
Seawater desalination	2.74	Provides a rainfall independent source of water and is an effective way to secure supply.	High energy use, which can be lowered with renewable energy. Can be impacts from hypersaline brine discharge to receiving environments if not managed.	Higher cost than other sources.	High upfront costs related to membrane treatment and energy infrastructure. Ongoing operational costs are also relatively high due to high energy use.
Rainwater tanks	10.17	Highly rainfall dependent. Supply is often at a different time of year than demand and there is relatively limited opportunity for large storages in urban areas.	Low impact of rainwater capture	High upfront costs to install a rainwater tank can reduce accessibility to low income households. Rainwater tanks provide an opportunity to reduce water bills, and allow customers to use water during drought and restrictions which can help maintain green areas and achieve liveability benefits.	Reliability and cost/benefit will both increase with use of larger tanks.
Stormwater supplied for non-drinking use	3.29 precinct 9.24 site-scale	Highly rainfall dependent and can be out of sync with seasonal demands, dependent on the storage system	Reduces nutrient and sediment discharge to the receiving environment.	Can provide multiple benefits to communities, including improved public amenity and health benefits associated with green and blue spaces. Can be relatively high cost but may be able to achieve economies of scale with decentralised stormwater harvesting	WSAA did not include managed aquifer recharge (MAR) in the supply of stormwater. In SA MAR is a key part of stormwater use that would increase infrastructure costs, but also improve reliability as it provides effective water storage across seasons and years to better balance supply and demand.

Possible future water supply options and their estimated costs and benefits
(adapted from Water Services Association Australia)

Management action	Cost $/KL 2019-20	Reliability added to water supply	Environmental impact	Social impact	Notes
Recycled water for non-drinking use (including sewer mining)	4.35	Relatively reliable water supply option and provides increased water security. Can reduce peak and overall demand in an urban water system, potentially delaying or deferring higher capital cost water supply investments.	Reduces nutrient discharge to the receiving environment.	Provides an opportunity to deliver water enabled green and blue spaces for liveability outcomes even in times of drought. Opportunities to increase agricultural production and to create local food bowl regions with a secure water supply.	Relatively high cost as a water supply option, but when other benefits are considered can be a viable option in a water supply portfolio
Water carting	20.22	Generally a last resort option – relatively small volumes are transported as a short term supply option	High energy use. Renewable energy can offset the impact.		Can in some instances be the most cost effective option for small, generally more remote communities where the development of an alternative source has a high unit cost.

Table 2. Applicability of urban water sources at different scales[2]

Water source	**Site scale** Water that is harvested and used within one site.	**Precinct scale** Water supplied through minor networks to multiple sites.	**Town or city scale** Water supplied to a whole town (either potable or non-potable use)	**Interbasin transfer** Water exported from one basin or catchment for use in another
Roof rainwater	Captured roof rainwater is used for some industry and domestic activities. **Statewide** Roof rainwater capture will remain a viable source of water.	Captured roof rainwater is not used at the precinct scale, but this could be viable in commercial precincts or others by linking roofs to shared rainwater tanks for greening and other uses.	Captured roof rainwater is not used at town / city wide scale or transferred between basins and it is not considered that this would be viable.	
Diverted rain and stormwater runoff	Passive irrigation by diverting runoff is becoming increasingly common (e.g. Treenet inlets). **Statewide** There is an opportunity for widespread application of passive irrigation.	Diverted rain and stormwater runoff use is a site based activity as it irrigates the immediate location where it is diverted (e.g. the localised Treenet inlet watering). The exception is where volumes are diverted that recharge aquifers for use off site.		
Harvested urban stormwater	Stormwater is captured treated and stored for use at many locations, often with aquifer storage. **Adelaide** Opportunities for further development are likely to exist, but there are none currently in development.	Harvested stormwater is supplied at a precinct scale for irrigation and other non-potable uses. **Northern suburbs of metropolitan Adelaide** Future establishment of non-potable supply networks may be viable in some locations.	Harvested stormwater is not used at town / city wide scale or transferred between basins. Town / city wide use could be viable if stormwater was recycled for potable use or if extensive non-potable networks are viable. Interbasin transfer may be viable stormwater was 'shandied' with wastewater.	
River flows	River water is harvested for on-site irrigation or commercial use at some urban locations. **River Torrens, Adelaide** The low reliability of flows in South Australia's ephemeral rivers makes it unlikely that further development would be viable compared to other water source options.	Water is pumped from River Torrens flows for open space irrigation. **River Torrens, Adelaide** The low reliability of flows in South Australia's ephemeral rivers make it unlikely that further development would be viable compared to other water source options.	River Murray towns use water extracted locally. **River Murray** The low reliability of flows in South Australia's ephemeral rivers make it unlikely that further development would be viable compared to other water source options.	Water captured in reservoirs is transferred to cities and towns in other regions. River Murray water is transferred to many parts of the state. **Mount Lofty Ranges and Kangaroo Island, many parts of the state** Further development of these supply networks would need to be determined on a case-by case basis.
Groundwater	Groundwater is extracted for industry, open space irrigation and domestic use from on-site wells. **Statewide** Site scale use from groundwater resources where spare capacity exists would be a viable future urban water supply option.	There are no precinct scale urban groundwater supplies. Precinct scale use from groundwater resources with spare capacity may be a viable future urban water supply option.	Groundwater supplies is extracted to supply many cities and towns. **Mount Gambier, and towns in the south, north and west of the state.** Further town /city scale use from groundwater may be viable where spare capacity exists.	Groundwater is exported outside of basins for town supply. **Port Lincoln, Coober Pedy.** Further transfers from groundwater resources where spare capacity exists would be a viable future urban water supply option.

Water source	**Site scale** Water that is harvested and used within one site.	**Precinct scale** Water supplied through minor networks to multiple sites.	**Town or city scale** Water supplied to a whole town (either potable or non-potable use)	**Interbasin transfer** Water exported from one basin or catchment for use in another
Seawater desalination	Seawater is desalinated for horticultural use on site. **Sundrop Farms, Port Augusta.** As a climate independent water source combined with renewable energy, it is likely that seawater desalination will become an increasingly important water source.	Small seawater desalination plants supply selected township activities. **Marion Bay** As a climate independent water source combined with renewable energy, it is likely that seawater desalination will become an increasingly important water source.	Seawater is a key potable water source in Adelaide some other towns. **Adelaide, Penneshaw** As a climate independent water source combined with renewable energy, it is likely that seawater desalination will become an increasingly important water source.	Desalinated seawater is not transferred between basins. As a climate independent water source combined with renewable energy, the transfer of desalinated seawater to inland urban centres could be viable.
Recycled treated wastewater	Treated greywater is used in residential applications and treated wastewater reuse occurs in unsewered areas with on-site aerobic treatment. **Statewide** On-site use of recycled wastewater will continue to be a viable option at sites with appropriate on site treatment.	Treated wastewater is supplied to approximately 20,000 homes across Adelaide for non-potable use. The Glenelg to Adelaide pipeline supplies treated wastewater for open space irrigation and other non-potable uses. Community Wastewater Management Systems supply recycled wastewater for open space irrigation in regional centres. Mawson Lakes, Seaford Meadows, Seaford Heights, Bowden Precinct scale use of recycled treated wastewater will become an increasingly important water source.	Recycled treated wastewater is not used town /citywide in South Australia. It's unlikely that available wastewater volumes would be sufficient for meeting demands at town/city scale.	Treated urban wastewater is transferred to agricultural areas, but not currently for urban reuse. **McLaren Vale and Virginia** It may be feasible for treated wastewater to be transferred to regional centres as an additional urban water supply.

2 Each entry considers the current status and South Australian examples as well as consideration of viability for the future (examples are indicated in italics).