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Welcome



State of Australian water reuse



Australian geography and climate

- The vast majority of Australia's climate varies from arid to semi-arid
- Australia is the world's driest inhabited continent and is only getting drier due to climate change
- Most of the population lives along the wetter coastal zones and near the capital cities
- Australia's population is expected to grow from 25 million people to 37 million people by 2050¹

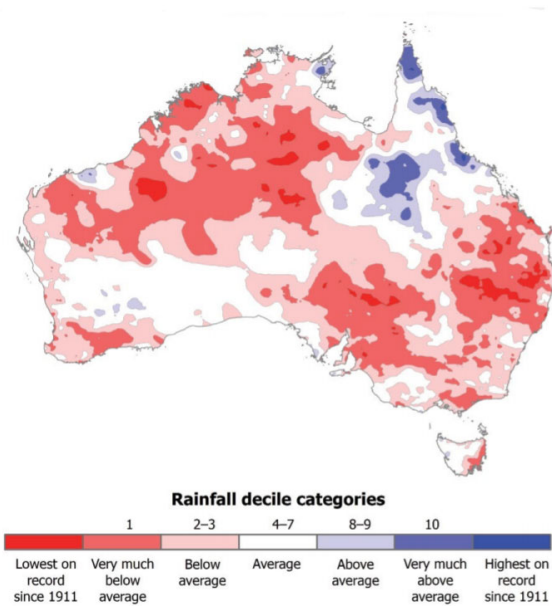


Figure I. Annual rainfall during 2018–19 compared with historical records (1911–2019)

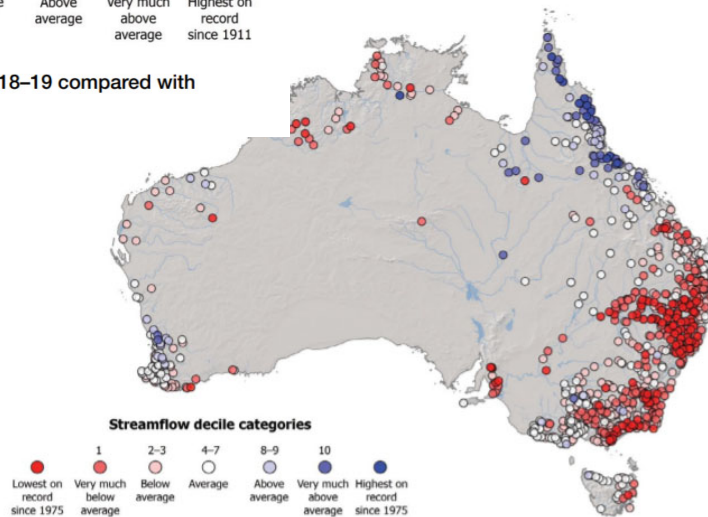


Figure II. Streamflows during 2018–19 compared with historical records (1975–2019)

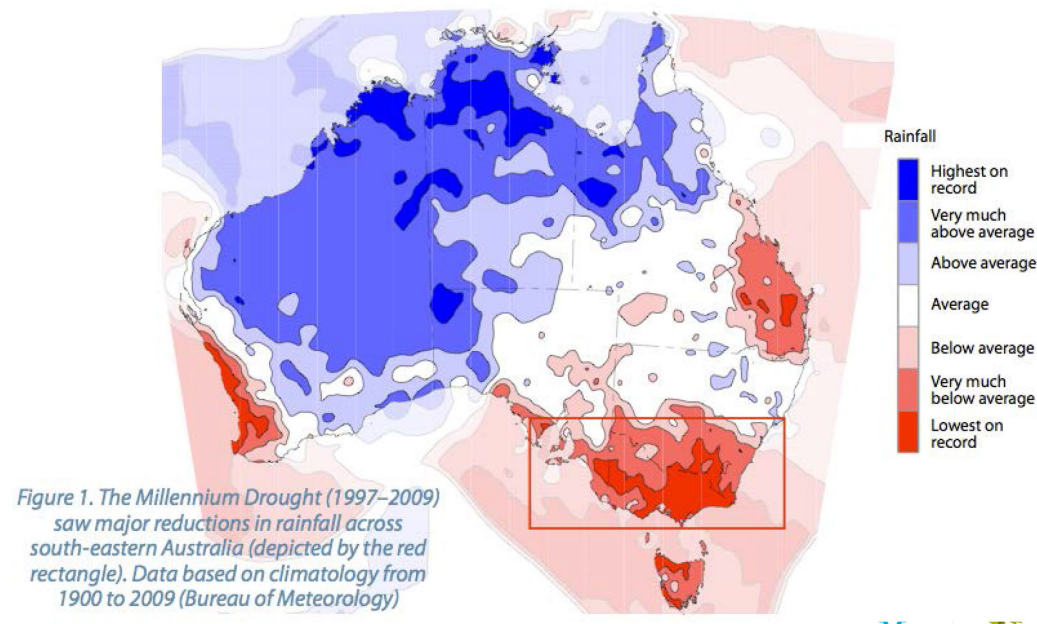
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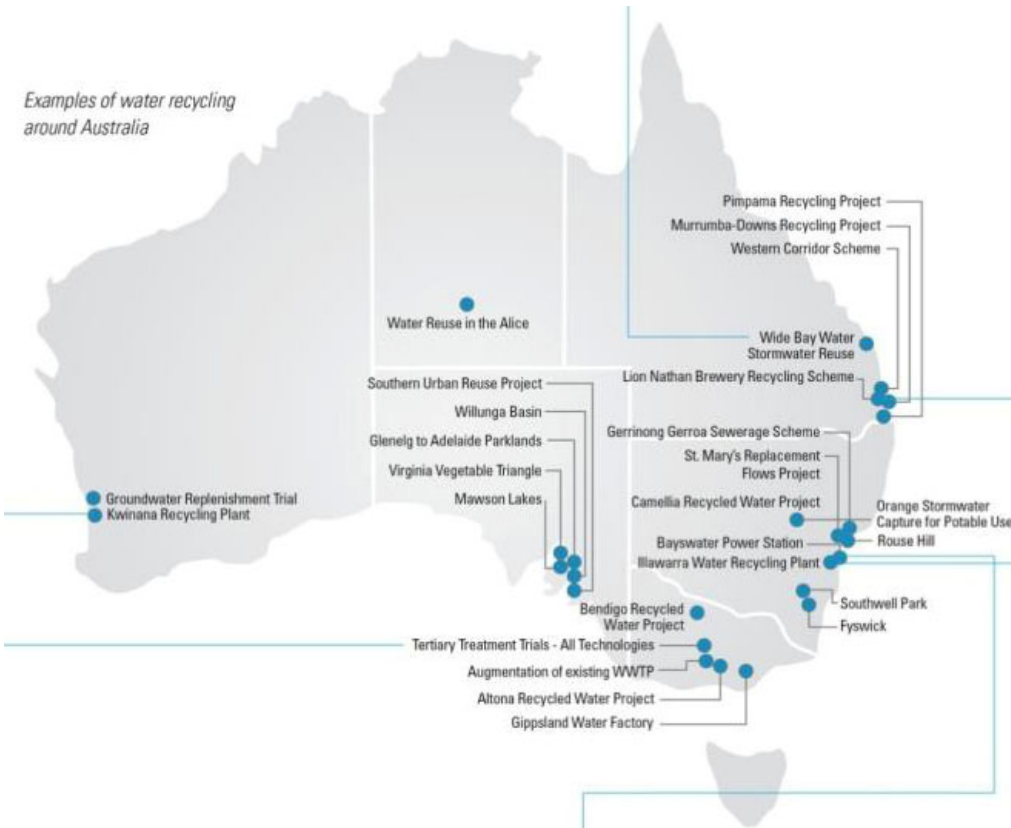


Millennium drought (2001-2009)

- Many major cities experienced severe water shortages including Perth, Adelaide, Canberra, Sydney, and Brisbane
- Groundwater reserves were being used up faster than they could be replenished
- Most major reuse and major desalination schemes in Australia were implemented during this period



Examples of water recycling around Australia



Desalination and water recycling projects built in response to drought

- 15 billion dollar program for potable water recycling and seawater desalination¹
- Construction of six desalination plants and several recycling facilities
 - Perth Desalination Plant
 - Southern Seawater Desalination Plant
 - Adelaide Desalination Plant
 - Victorian Desalination Plant
 - Gold Coast Desalination Plant
 - Sydney Desalination Plant

Regional case study: Brisbane

Western Corridor Project (2008)



Tarong Power Station: A power plant that uses recycled water from the Western Corridor Project

- Goal of the project was to secure the water supply of South East Queensland by reducing dependency on sources of water vulnerable to climate change and make purified recycled water available to power stations, industry, and agriculture for indirect potable reuse
- Comprised the construction of three new advanced treatment plants, drawing water from six wastewater treatment plants. Treatment process includes MF/RO and UV disinfection.
- Supply capacity: 230 ML/day (61 MGD)
- Largest water recycling project in Australia and the third largest recycled water scheme at the time
- Primary users are 2 power stations (20 ML/day [5.3 MGD])
- Drought Response Plan: Potential for recycled water to be input into the Seqwater dam supply if storage falls below 40%, requires authorization from water minister. More likely that additional customers would be identified.

Where are we now?

- Multiple indirect potable reuse projects have been implemented throughout Australia
- Direct Potable reuse remains prohibited. Since the millennium drought, there have been no government led policy on potable reuse or updates to any national water reuse guidelines or health act.
- Dual plumbing is currently installed in major cities
- Storage volumes of water decreasing in parts of southeastern Australia¹

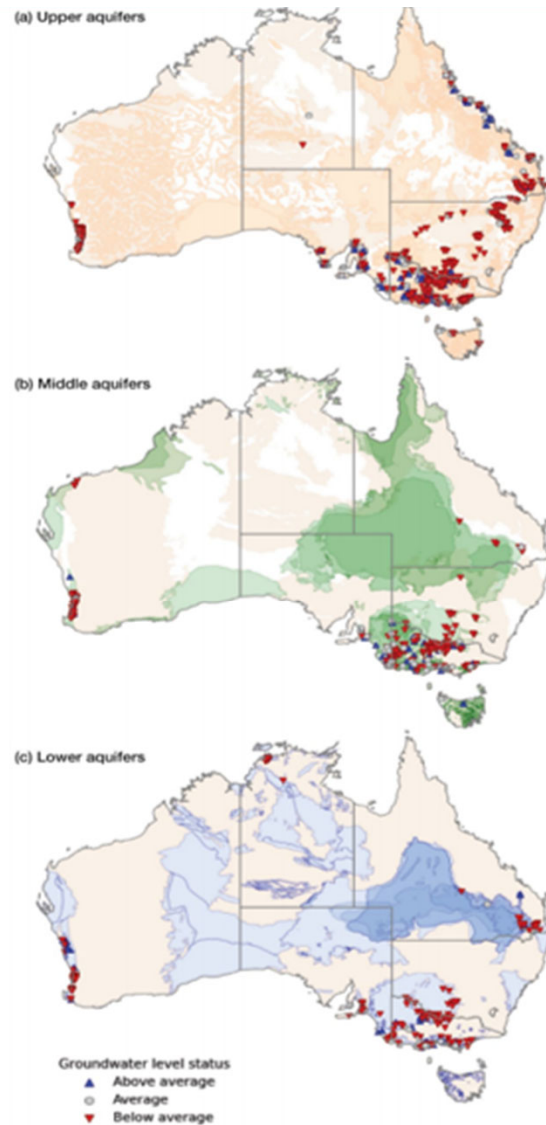
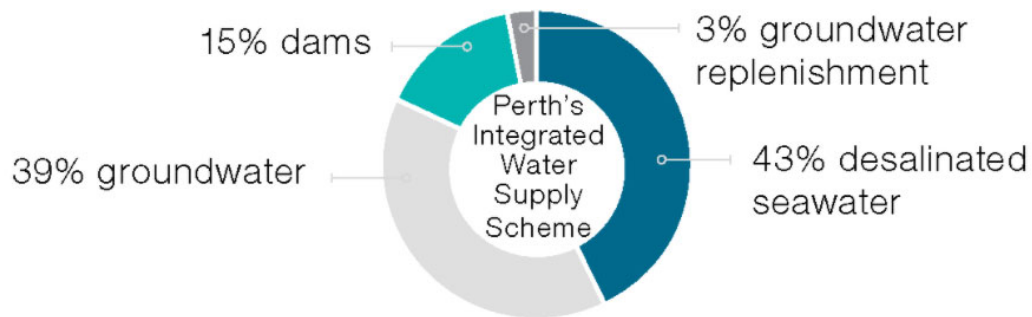


Figure 18. Groundwater level status in 2018–19 compared to the historical record (1997–2019) for (a) upper, (b) middle and (c) lower aquifers

Regional case study: Perth

- Integrated Water Supply Scheme (IWSS) delivers 298 billion liters (242,000 AFY) of water each year to the population of Perth. Made up of the following sources:
 - Desalinated Seawater
 - Groundwater
 - Dams
 - Groundwater replenishment started in 2017 using RW



- Climate-independent water sources, including desalination and groundwater replenishment currently make up approximately half of Perth's water supply¹
- Plans for further expansion of groundwater replenishment system and a goal to recycle 30% of wastewater by 2030 resulting in an additional 70-100 billion liters (57,000 – 81,000 AFY) per year of climate independent water²
- Recycled water produced at Advanced Water Recycling Plant: UF/RO system and disinfected with UV
- Recycled water uses: Irrigation (parks, golf courses, non-food crops, trees, industrial processing (1,215 MG), construction, toilets, washing machines, gardens (Brighton 3rd pipe), groundwater recharge

Regional case study: Sydney

Replacement flows project (2007)

St Mary's Advanced Water Recycling Plant



- Warrangamba Dam is a main drinking water supply for Sydney. Some of this water must be released into Hawkesbury-Nepean River as environmental flows for habitat/wildlife.
- Replacement Flows Project – produces 50 ML/day (13 MG/day) recycled water to replace the environmental flows released from the dam.
- Treatment process: receives tertiary effluent from 3 WWTP's > strainer > UF > RO > dissolved CO₂ removal, pH balance, disinfection > discharge to river. RO concentrate sent to WWTP.
- Greatly reduces volume of nutrients, (e.g. nitrogen and phosphorous) discharged to the river. Improves water quality downstream of the Penrith Weir and helps reduce the growth of algae and water weeds

Domestic Water Reuse & Dual Plumbing

- Australia's largest residential recycling scheme in northwest sector of Sydney
- Third pipe scheme that produces recycled water for non-potable uses (garden irrigation, clothes washing, toilets) across the development area
- Recycled water supplied: 2 billion liters/year (528 MG/year). Excess RW discharges to wetlands.
- Supplies 32,000 homes at the Rouse Hill development (buildout is 300,000 people)
- Disinfected tertiary treated effluent is further treated with UV to produce RW
- RW use approved on fruits and vegetables in 2012

Regional case study: Sydney

Rouse Hill Recycled Water Scheme (2001)





Victoria's Waste Management Hierarchy (from Victorian guideline for water recycling)

Regional case study: Victoria

- Currently studying methods of augmenting existing water supplies and upgrading WWTP to accommodate the demand from a growing population including:
 - Desalination
 - Recycled Water through a staged IPR scheme
 - Stage 1 - Supply lake bed for recently decommissioned coal mine (add RO)
 - Stage 2/3 – Groundwater aquifer recharge (add advanced oxidation)
 - Recycled Water for Streamflow augmentation may also occur at Stage 3
- Victoria current water policy does not entertain direct potable reuse as a permissible use of recycled water

Brine management: Desalination

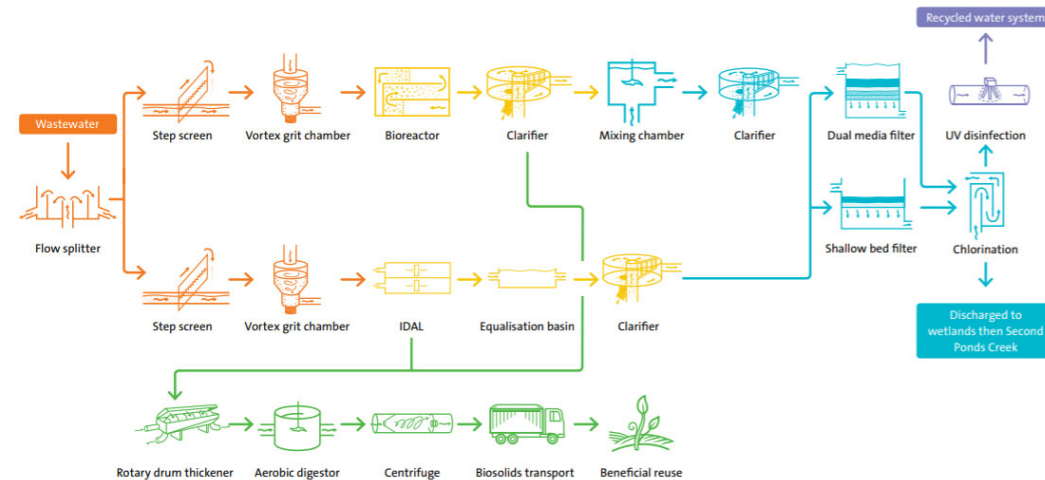
- Most of the major seawater desalination plants in Australia discharge brine concentrate back into the local marine environment.
- Plant at Perth has a low velocity open water intake and discharges concentrate into Cockburn Sound, a confined body of water. As such, it has been subject to some of the most rigorous environmental monitoring. It has been operating at full flow for ten years with no evidence of negative environmental impact¹



**Marine Life Surrounding Perth Desalination Plant
Diffuser**

- Some water recycling initiatives such as the Western Corridor Recycled Water Project (WCRWP) discharge the brine streams back to urban waterways ¹
- Though salinity is usually not the primary environmental concern with ROC discharged from recycling plants, environmental harm can result from an increased concentration of ammonia and chloramines
- Some plants such as the Rouse Hill Recycling Plant do not include RO in their treatment process and therefore do not have an ROC waste stream but produce other wastes such as biosolids that can be repurposed

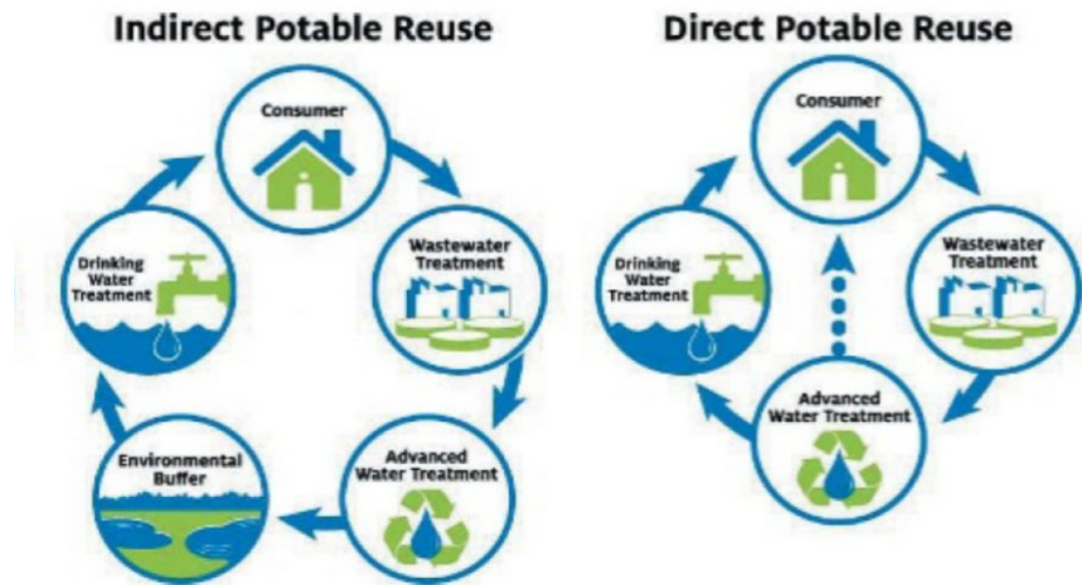
Brine management: AWPF



Rouse Hill Water Recycling Plant Process Flow Diagram

IPR & DPR in regulations in Australia vs United States

- Australia is implementing IPR with groundwater recharge and surface water augmentation projects. Use is limited and regulated by the EPA
- The US allows for Direct Potable Reuse (DPR) applicable to stringent regulation and are approved on a case-by-case basis
- California and Texas have the most vigorous criteria for DPR Projects while other states are currently in the process of developing streamlined regulations for these types of projects
- Direct Potable reuse is currently not used in Australia and even indirect potable reuse is not allowed in many parts of Australia due to local regulation



Australia	USA
DPR currently not allowed	DPR practiced in Texas since 2013, Streamlined regulations for DPR in California anticipated by end of 2023
Groundwater replenishment projects inspired by success in California in Western Perth	Groundwater replenishment projects in California
National strategy for urban water management needed in Australia. Many state and local regulations prohibit even IPR	Has initiated successful community engagement programs to enhance public support for potable reuse including in San Diego which successfully oversaw the percentage of citizens reporting strong opposition reduced from 45% to 12% ¹



*** Thank You**

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Key Takeaways/Q&A

- As highlighted by the Millennial drought, water recycling and desalination in Australia are imperative as climate independent water sources to facilitate its growing population in an era of climate change
- Streamlined regulations dictating DPR and IPR such as those being developed in California and Texas are needed in Australia to increase water recycling. The US is ahead of Australia in this regard.