

POWER AND WATER CORPORATION

THE DARWIN WATER STORY 2013

PowerWater 





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FOREWORD:

WATER IS PRECIOUS

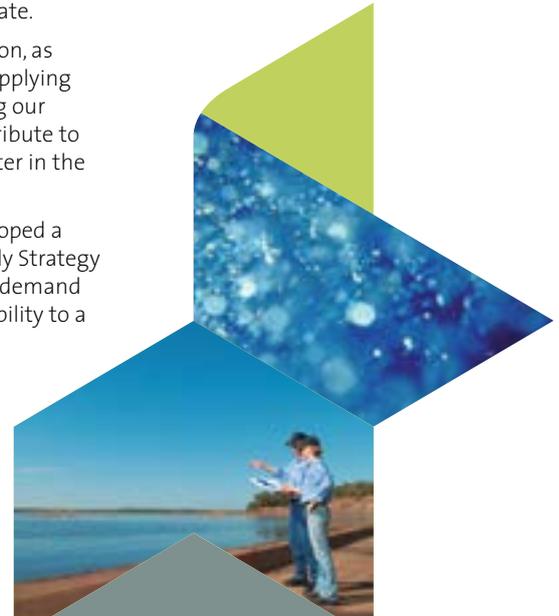
AS THE DARWIN REGION GROWS,
SO TOO DOES OUR AWARENESS
THAT WATER IS PRECIOUS. TO
MAINTAIN OUR LIFESTYLE,
WE NEED TO START 'LIVING
WATER SMART.'

The Darwin region's growing 'water literacy' means that many of us no longer take our water supplies for granted. We recognise that, although we are lucky enough to receive an annual drenching thanks to our Wet Season, we have highly variable rainfall and many long dry months and high evaporation. Our population is growing rapidly, as are business and industry and climate change will create additional challenges for our water supplies. Yet we still use significantly more water than comparable regions interstate.

Power and Water Corporation, as the body responsible for supplying our water and safeguarding our supplies, continues to contribute to the conversation about water in the Darwin region.

Power and Water has developed a Darwin Region Water Supply Strategy detailing a plan to balance demand for water with supply capability to a 2030 planning horizon.

This booklet provides a summary of the Strategy, providing facts about our current water supply and future challenges, plans and options for future water supplies for the Darwin region and a program to help the community start 'Living Water Smart'.



WHERE DOES OUR WATER COME FROM?

MOST OF OUR WATER – 85 PER CENT – COMES FROM THE DARWIN RIVER DAM, ABOUT 50KM SOUTH OF DARWIN. THE REMAINING 15 PER CENT COMES FROM THE MCMINNS AND HOWARD EAST BOREFIELDS NEAR HOWARD SPRINGS ABOUT 30KM TO DARWIN'S SOUTH-EAST.

Water from the dam and the borefield is piped to McMinns Storage and Transfer Station, where it is blended and piped to Darwin, Palmerston and the outer Darwin area.

Our water supply is strongly influenced by climate, especially the timing and variability of rainfall. Not only do we experience the extremes of wet and dry periods each year, but our rainfall varies considerably from year to year. Living without rainfall for up to eight months every year affects the amount of water we use, especially outdoors – for example, on our gardens – and also affects the amount of water flowing into Darwin River Dam.

Our water supply is affected by the Top End's:

- > *high average temperatures*
- > *high year-round rates of evaporation*
- > *monsoonal wet season of four to five months a year*
- > *long rain-free dry season of seven to eight months*

ABOUT DARWIN RIVER DAM

Darwin River Dam was constructed in 1972. It has an earth embankment 518 metres long with an unregulated 265 metre wide spillway.

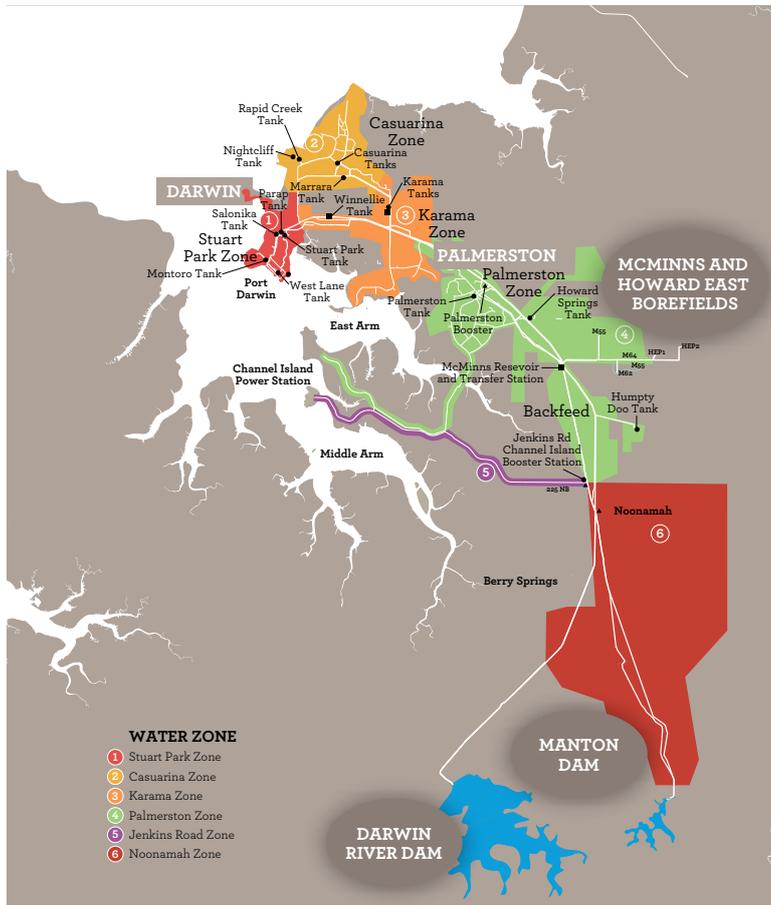
In 2010, Power and Water upgraded the embankment and raised the spillway at Darwin River Dam to increase the full supply level by 1.3 metres. This increased the yield of the dam by about 20 per cent and resulted in a storage capacity of 320 000 megalitres.

Power and Water currently extracts around 37 000 megalitres a year from Darwin River Dam.

Most of the catchment area around Darwin River Dam is undeveloped and has restricted public access. A catchment management plan is in place to control threats such as wild fires and weeds, recognising the catchment as a refuge for native flora and fauna and as a public water supply source.

The majority of the land is freehold and owned by Power and Water; most of the rest falls within the Finnis River Land Trust.





McMINNS AND HOWARD EAST BOREFIELDS

The McMinns and Howard East Borefields are integral to ensuring we have diversity in our water supply. Power and Water is licensed to extract 8420 megalitres per year from the six production bores in the McMinns and Howard East Borefields but because of operational constraints (eg. routine maintenance), extraction from the borefields is usually limited to 6000 megalitres per year, or about 15 per cent of Darwin's annual supply.

The McMinns Borefield was established in the 1960s on the Koolpinyah dolomite aquifer. Stage 1 of the Howard East Borefield was commissioned in 2001 to supplement the supply from the McMinns Borefield.

When McMinns Borefield was first established in outer Darwin, its location was relatively remote. Since the 1980s, the area has been extensively developed as a rural living

area. Property owners use private bores to extract water from the same groundwater resource for household and irrigation needs and some is extracted for commercial horticulture.

The Department of Land Resource Management continues to study and model the groundwater resources in the area.

It is estimated that Power and Water's extraction from its six production bores represents less than 20 per cent of the total annual extraction from the aquifer, with the majority of extraction from the 3000 or more rural residential and horticultural bores.

WHAT ABOUT MANTON DAM?

Manton Dam was constructed in the early 1940s by the Department of Defence to provide a reliable source of water for Darwin during World War II. About 50km south-east of Darwin, Manton Dam has a storage capacity of 14 000 megalitres and was the city's primary source of water until the Darwin River Dam was commissioned in 1972.

Although Power and Water is licensed to extract 7300 megalitres a year from Manton Dam, the dam is not currently used as part of Darwin's water supply system because of inadequate infrastructure and water quality challenges including recreational use of the dam.

THE DISTRIBUTION NETWORK

The Darwin region water supply system provides drinking water to customers in five water supply zones: Stuart Park, Casuarina, Karama, Palmerston/Darwin rural and Channel Island/Humpty Doo.

About 118 500 people, on about 50 000 properties (including residential, commercial, industrial and government) have access to drinking water at the turn of a tap.





HOW MUCH WATER DO WE USE?

DARWIN REGION RESIDENTS AND BUSINESSES USE OVER TWICE AS MUCH WATER AS OTHER COMPARABLE COMMUNITIES – AND THE AMOUNT WE USE IS CONTINUING TO GROW FASTER THAN THE POPULATION IS GROWING.

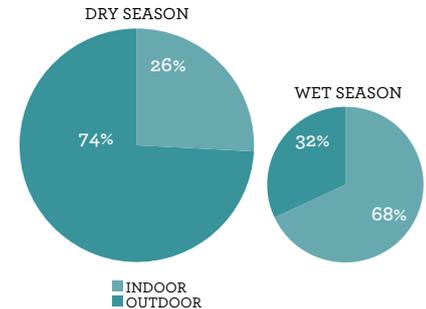
Water consumption in the Darwin region doubles between the wet and dry seasons, challenging our water supply and storage network. Water use within these seasons is closely aligned with climatic conditions such as temperature and rainfall.

In the dry season we typically use more than 160 megalitres of water per day, reducing to about 80 megalitres per day during the wet season.

Home use is the biggest component: over half the water consumed in the Darwin region is used by the residential sector, followed by the non-residential commercial and government sectors.

We use about three-quarters of our water outdoors, although this varies greatly according to the season. Household outdoor use increases as much as ten times in the dry season.

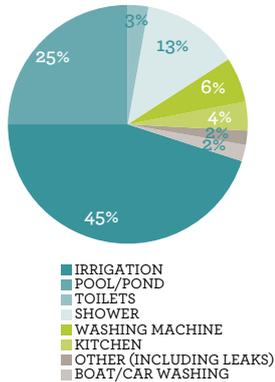
DARWIN SEASONAL WATER END USE



DARWIN REGION WATER SUPPLY CONSUMPTION SEGMENTATION



DARWIN AVERAGE END WATER USE



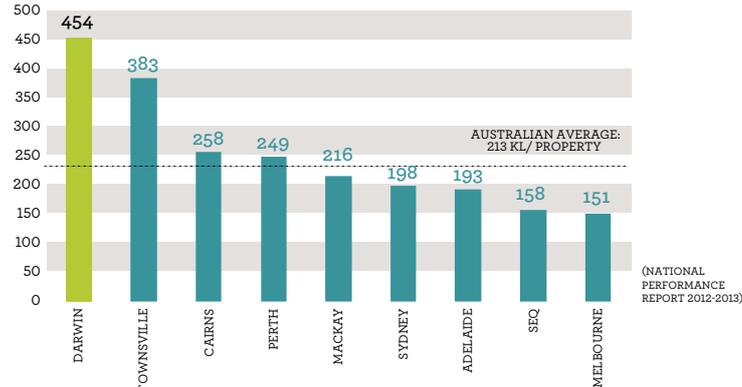
HOW DO WE COMPARE?

Darwin region households typically consume almost three times as much water as the national average, as the graph below shows.

Our residential consumption is very high, even when compared with areas of similar climate; such as Cairns, Townsville and Mackay. These three

areas have similar growth pressures to the Darwin region. However, despite having challenging climates like ours, the Cairns, Townsville and Mackay communities appreciate how precious water is and have worked with authorities to reduce water consumption.

AVERAGE ANNUAL RESIDENTIAL WATER SUPPLIED (KL/PROPERTY)



OUR ATTITUDES TO WATER USE AND WHERE IT COMES FROM

As part of its role, Power and Water conducts surveys every few years to learn more about community attitudes to our water and where it comes from.

In 2013, Power and Water surveyed almost 400 Darwin region residents, all of whom use mains water, do not rely on rainwater tanks or personal bores, and do not work in the area of supplying water or water conservation. The survey found:

- ▶ Almost one quarter of respondents did not know where Darwin's water comes from. Just over half said it came from Darwin River Dam, 37 per cent said it came from the Manton Dam and 13 per cent said rain (multiple responses were allowed).
- ▶ 64 per cent of all respondents claimed that Darwin's water supply replenishes naturally each year, 27 per cent reported it's a limited resource and 9 per cent did not know.

- ▶ Those who had not lived in Darwin their whole lives were asked whether they use less or more water since moving here. Over half said they use more water than where they lived previously, just under one quarter said they use about the same and 8 per cent said they use less.
- ▶ 37 per cent of respondents said they or someone in their household washes their car in their driveway, 10 per cent said they wash boats in their driveway and 15 per cent watered their garden for more than an hour every day.

The latest survey builds on research conducted in 2005 and focus groups held in 2012. The findings included:

- ▶ More than half of all residents and businesses believed that water conservation in Darwin is critical. Residents and businesses agreed it is socially responsible for them to monitor water use.
- ▶ Being well informed about the effect of water consumption on the water supply system and educated on water efficiency actions was a key driver to saving water.

In response to the findings Power and Water:

- ▶ has improved the provision of water efficiency information for water users
- ▶ promotes water efficiency for new developments
- ▶ has included additional information on water bills
- ▶ has developed publications for householders including the Green Guide and Water Wise Gardening
- ▶ provides useful water use benchmarking for businesses to compare water use to comparable averages and best practices from other similar organisations
- ▶ provides water audit services and advice for businesses and residential customers.

DO WE HAVE ENOUGH WATER?

THE DARWIN REGION HAS GROWN SUBSTANTIALLY OVER THE PAST 30 YEARS. AT THE SAME TIME, OUR WATER USE HAS REMAINED UP TO THREE TIMES THAT OF OTHER AREAS AROUND AUSTRALIA. CONTINUED GROWTH WILL FURTHER STRETCH OUR EXISTING WATER SUPPLY SYSTEM.

RAINFALL VARIATION

The Darwin region is subject to climatic and rainfall variability just like anywhere else in Australia. The rainfall variability strongly affects water security in the Darwin region.

EL NIÑO AND LA NIÑA

The term El Niño refers to the situation when sea surface temperatures in the central to eastern Pacific Ocean are significantly warmer than normal. This recurs every three to eight years and generally results in below average rainfall in the Darwin region. When the eastern Pacific Ocean is cooler than normal, a La Niña event occurs, generally resulting in above average rainfall in the Darwin region.

In 2010-11 and 2011-12, we experienced two of the most significant La Niña events in Australia's recorded meteorological history. This led to above average rainfall in the Darwin region, including a record 2918.4mm of rain at the Darwin airport rain gauge. However, the

2012-13 wet season brought below average rainfall that led to limited inflows to Darwin River Dam.

Annual rainfall in the Darwin River Dam catchment, like that of the Darwin region, is also highly variable, strongly affecting inflows and water levels in the reservoir.



OUR FLUCTUATING WATER STORAGE LEVELS

Water levels in Darwin River Dam fall significantly every year due to water being extracted and evaporating throughout the year. They are usually replenished to some degree by rainfall and runoff each wet season as shown in the graph below.

The Darwin region experienced a significant series of poor wet seasons (equivalent to a drought) of 12 years, from 1984 to 1996, in which Darwin River Dam did not fill and spill. Conversely, with above average rainfall during the past 15 years, Darwin River Dam has filled and spilled most years since 1997.

However, if a period of poor wet seasons returns combined with growing demand for water, water levels in Darwin River Dam could fall to unsustainable levels not previously experienced.

'System yield' is a term used to describe the volume of water that can be harvested in order to achieve the adopted standard of service (in other words, the acceptable frequency of water restrictions).

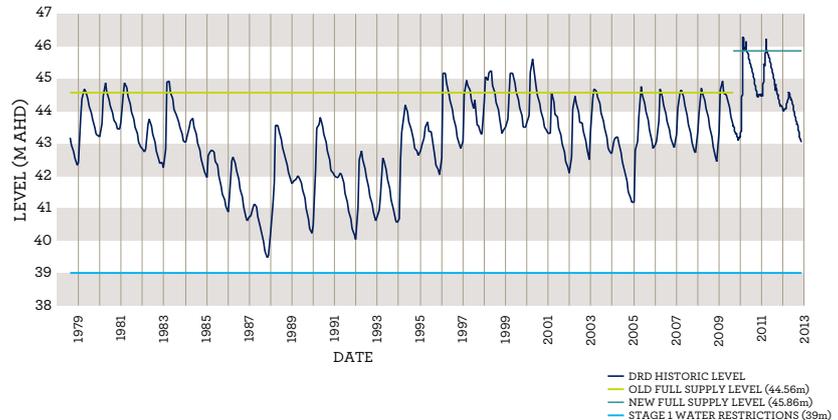
OUR CURRENT WATER SUPPLY STATUS

The current system yield for the Darwin region water supply is 42 780 megalitres per year, comprising the Darwin River Dam yield of 36 780 megalitres per year and the borefield extraction of 6000 megalitres per year. Power and Water also aims to

maintain a 10 per cent 'headroom' buffer to address the large annual fluctuations in demand experienced in the Darwin region. The headroom also provides a buffer against potential unplanned increases in demand associated with rapid industrial development.

Taking into account customer growth, demand management initiatives and the need for headroom, the target water system yield for the Darwin region is 47 864 megalitres per year – this means we are facing a shortfall of 5084 megalitres per year between our water supply capability and targeted standard of service.

DARWIN RIVER DAM WATER LEVELS – 1978-2013



WHAT ARE THE CHALLENGES FOR OUR WATER SUPPLY?

RISK OF LOSS OF SUPPLY

If we unexpectedly lost supply from our principal water source, Darwin River Dam, water supply to the Darwin region would be greatly affected. Loss of supply could be caused by, for example, contamination or infrastructure failure.

The existing groundwater supply cannot currently meet the Darwin region's targeted emergency supply requirements if supply from Darwin River Dam was interrupted.

Power and Water is further developing the Howard East Borefield in 2014-15, enabling the borefield to provide emergency supply capacity beyond 2030. This will also allow Power and Water to better access its licensed groundwater allocation, reducing the shortfall in the water supply system.

GROWING DEMAND FOR WATER

Growth in water consumption, alongside population growth, as well as catering for increases associated with large industrial developments in the Darwin region, is driving the need for additional sources of water in the short term and beyond.

Power and Water is meeting the challenge of demand growth through implementing a range of demand management and water efficiency initiatives alongside the delivery of a water source development programme.



CATCHMENT RISKS

A number of significant risks have the potential to impact on the sources of the Darwin region's water supply.

In the McMinns Borefield, land next to Power and Water's water supply bores has been developed for rural residential and horticultural land uses. These land uses pose a real risk of contamination to the public water supply.

Conditions in the region's surface water catchments also pose a number of significant risks to water quality in reservoirs. These risks include illegal access to the catchment, erosion and flood damage, bushfires, feral animals and weeds.

Power and Water has developed a Catchment and Water Source Protection Strategy to support the proactive management and protection of our water supply catchments. Protection zones have been established around production bores to help reduce the risk of contamination. Where rural residential development has

occurred next to existing bores, Power and Water works with the Department of Health to ensure site-appropriate wastewater treatment and disposal systems are installed and maintained.

WATER QUALITY

In the Darwin region, to ensure we have continued access to safe drinking water, Power and Water manages the water supply under the Framework for Management of Drinking Water Quality, a key part of the Australian Drinking Water Guidelines.

Our drinking water supplies are protected through a multiple barrier approach, which is universally recognised as the foundation for ensuring safe drinking water. A 'barrier' such as disinfection is a measure used to reduce water quality risks. The most significant barrier for the Darwin region water supply is that the main source of supply (Darwin River Dam) has a closed catchment. In other words, the risk of external activities causing adverse water quality problems is very low.

Complaints about the Darwin region's water quality generally relate to the way it looks, an aesthetic issue largely governed by seasonal variation in reservoir water quality and water demand. Darwin River Dam is highly stratified, which limits the mixing of different layers of water. Stratification occurs when the sun heats the upper layers faster than the heat can disperse into the lower depths. The difference in density between the hotter surface and the cooler bottom limits mixing between these layers.

This can lead to layers with significantly different water qualities. Seasonal weather patterns can cause a mixing of these layers affecting aesthetic quality.

Also, with the first major rains of the wet season, or after heavy rainfall associated with cyclones, dissolved organic matter in the catchment may enter Darwin River Dam leading to an increase in dirty-looking water making it through to our taps.

Recent changes at Darwin River Dam have increased the area of the water body when full. It is anticipated that

dirty water episodes will increase over the next few years while these new areas adjust to more frequent immersion.

Power and Water has implemented an ongoing monitoring program at Darwin River Dam to collect data to assess the water quality changes driven by the changes to the full supply level. Consumer expectations are driving the need to improve aesthetic water quality. Power and Water is considering options to improve the aesthetic quality of water delivered to the community, through planning for future water treatment capability and improving the management of our catchments.

POTENTIAL IMPACT OF CLIMATE CHANGE

Climate change has already been evident through recorded meteorological changes in the Northern Territory and elsewhere around the country and the world.

In the Northern Territory, like elsewhere, climate change will affect meteorological elements including temperature, rates of evaporation, rainfall (and runoff and recharge to groundwater), sea levels and storm surge as well as the occurrence and severity of cyclones.

Power and Water has undertaken assessments based on a range of different climate change scenarios, and has adopted a mid-range emissions scenario developed by CSIRO for its water supply planning.

Climate change is expected to impact on the Darwin region's water supply system yield. Modelling has identified significant potential impact on the yields available from Manton Dam and Darwin River Dam.

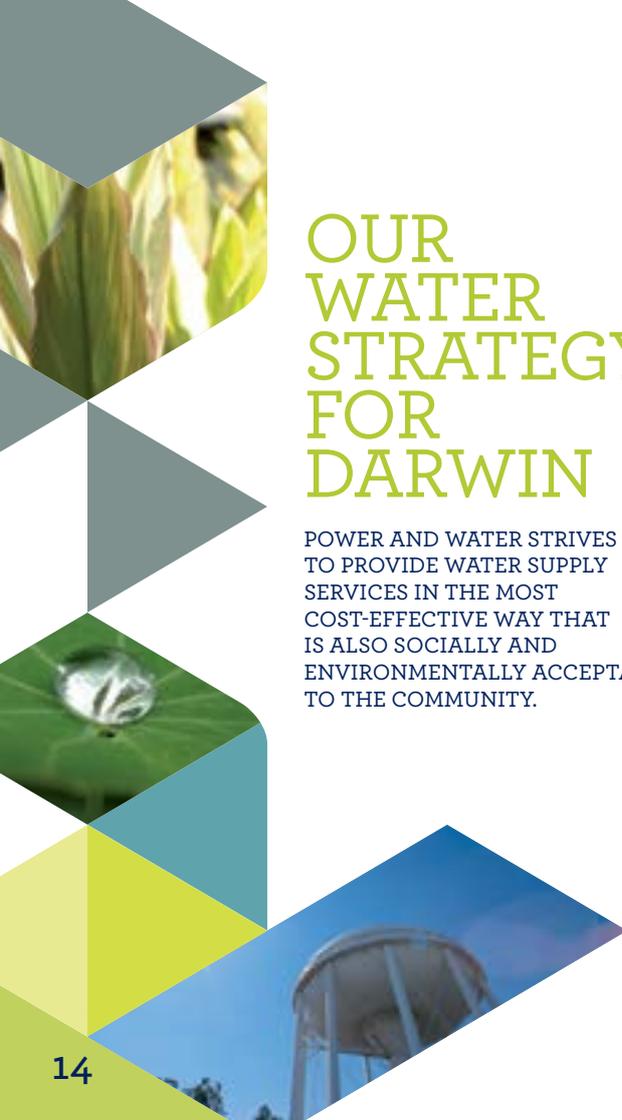
Wet season rainfall is not expected to vary significantly; however, increased rates of evapotranspiration in the catchment will lead to reduced inflows. Combined with increased evaporation from the dams themselves, this will lead to a reduction in available water for the region's water supply.

Modelling has identified the potential for a 13 per cent reduction in yield from Darwin River Dam and a 3 per cent reduction in yield from Manton Dam by 2030.

The impacts of climate change on water consumption are difficult to predict. Through benchmarking with other Australian water agencies and demand modelling, Power and Water has adopted a 3 per cent increase in demand associated with climate change by 2030 for its water supply planning.

Power and Water will incorporate the latest information on climate change in its re-assessment of water source yields every 5 years.





OUR WATER STRATEGY FOR DARWIN

POWER AND WATER STRIVES TO PROVIDE WATER SUPPLY SERVICES IN THE MOST COST-EFFECTIVE WAY THAT IS ALSO SOCIALLY AND ENVIRONMENTALLY ACCEPTABLE TO THE COMMUNITY.

Securing water sources for our current and future needs is a fundamental part of Power and Water's service to the community.

The Darwin region is now at a point where more water is required to keep up with the growing water demand. At the same time we are consuming very high amounts of water. So it makes sense to be more efficient in our use of the water we already have to meet our short term growth before developing more sources in the medium to longer term.

SHORT TERM

Demand side actions

Living Water Smart is a five year program aimed at helping the Darwin region reduce water use by 10 000 megalitres per year, or about a quarter of the current Darwin region water demand.



Darwin Region

Water savings are being made through a range of initiatives:

Homes and businesses

- ▶ 5000 residential water audits with highest water users prioritised.
- ▶ 250 water audits of highest commercial and industrial water users, leading to development of water efficiency management plans to maintain water efficiency savings.
- ▶ Development of residential and non-residential (by sector) water efficiency benchmark guidelines.
- ▶ Development of voluntary water saving guidelines.
- ▶ Incentives through targeted rebates and smart metering.

Parks and ovals

- ▶ New smart water irrigation technology systems at parks and ovals across Darwin, Palmerston and Litchfield local councils.
- ▶ Development of water efficiency management plans and tools for scheduling irrigation (to maintain water efficiency savings).

Schools, hospitals and Defence

- ▶ Water audits leading to development of water efficiency management plans to maintain water efficiency savings.
- ▶ Education resources and program developed for ongoing water efficiency education.

Reuse and infrastructure management

- ▶ Investigation and planning opportunities to recycle water.
- ▶ Development and implementation of leak detection program.
- ▶ Development and implementation of pressure management plan.
- ▶ Providing industry training for leak detection in properties.
- ▶ Smart water meters to support constant awareness of water efficiency for homes and businesses, accommodation, hospitals and defence, and schools projects.

Rebates

- ▶ A rebate and retrofits program (public and targeted) to support homes and businesses, accommodation, hospitals and schools.

Supply side actions

Power and Water will also work with Northern Territory Government departments to implement water efficient practices and initiatives in their front-line services.

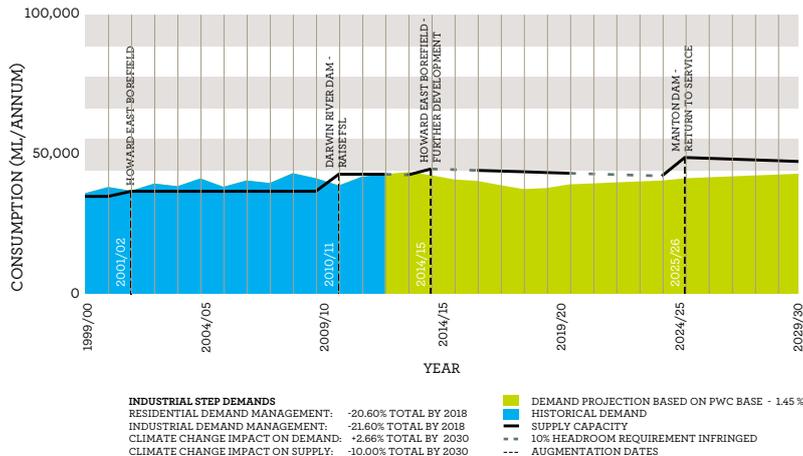
By focusing on water efficiency through Living Water Smart over the next five years, we will develop tools and establish significant legacies to help us maintain water efficient lifestyles.

To provide additional water for the Darwin region in the short to

medium term, Power and Water is working to return Manton Dam to service by 2025. The project involves the construction of new intake infrastructure and a pumping station, a new transmission main and a water treatment plant.

The following chart identifies Power and Water's programme for water source development in the Darwin region. The actual timing of the return to service of Manton Dam depends on demand growth and the results of the Living Water Smart project.

CURRENT WATER SOURCE DEVELOPMENT PROGRAMME



MEDIUM TO LONG TERM

There are a number of potential sources of water that could be used to augment the Darwin region's water supply in the medium term (beyond 2025). Power and Water is investigating a range of options to ensure additional sources of water can be developed over time to support continued growth and economic development in the region.

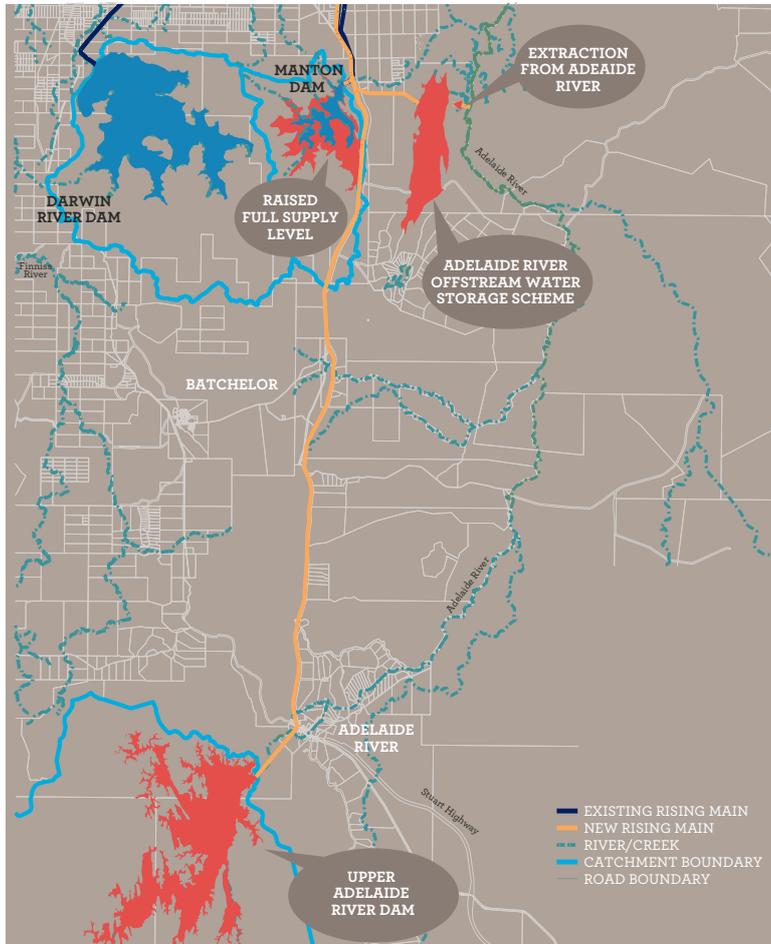
A preliminary assessment of potential water source options undertaken over the past five years has identified a shortlist of options for further assessment. Power and Water is now undertaking detailed hydrological, geophysical, engineering and environmental studies to determine the viability and priority of the short listed options.

Options being considered include:

- ▶ a new in-stream dam (on the upper Adelaide River)
- ▶ an off-stream storage (in the Murrakai region), filled with water harvested from flood flows in the Adelaide River
- ▶ augmentation of Manton Dam's storage
- ▶ the potential use of desalination.

The figure (right) identifies the three shortlisted medium term surface water supply options being investigated.

There is also potential for Power and Water to work with and encourage Darwin region residents and organisations to introduce options that reduce the use of drinking water for other purposes. These options include rainwater tanks, greywater reuse and wastewater recycling, which could be implemented over time where financially viable.



HOW TO GET INVOLVED

You can find more detailed information on the Darwin Region Water Supply Strategy in the technical version of the publication, available on Power and Water's website powerwater.com.au

You can find out more and register your interest for Living Water Smart by visiting the website livingwatersmart.com.au

You can provide feedback on the Darwin Region Water Supply Strategy by contacting Power and Water (see contact details over page).



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