PowerWater

DRINKING WATER QUALITY REPORT 2019

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Executive Summary

The Power and Water Corporation is committed to enriching the future for our community, our customers and each other. The safety and quality of our drinking water is a top priority for Power and Water.

Power and Water Corporation has been on a journey for a number of years now with our drinking water quality program.

As the Territory's multi-utility, we have a broad spectrum of responsibilities and obligations.
For our Board and executive teams, the most important issues are the safety of our people and our infrastructure, and the quality of our drinking water.

Over the past three years, we have implemented and reviewed our drinking water quality management system. The embedding of this system into our body of work has allowed us to test its robustness, and also change the culture in how we view the importance of water quality across our organisation.

Earlier this year, we undertook an assessment of the effectiveness of our journey, and are pleased to report we have successfully implemented safe drinking water measures for our customers across the Territory.

This outcome has served to strengthen our resolve to continue building on our recent successes.

During the year, we continued to work closely with other Northern Territory Government agencies, notably formalising our relationship with the Department of Health (DoH) on public health accountabilities and responsibilities pertaining to drinking water quality.

We also continued to work towards positive outcomes for the Katherine community through our involvement with the Northern Territory Per- and Poly-Fluorinated Alkyl Substances (PFAS) interagency working group.

We also saw a reduction in the number of water quality complaints over the year, which indicates our work to minimise the impact of seasonal variations is successful.

While this report is a record of our service delivery under the framework of the Australian Drinking Water Guidelines (ADWG), it also serves as a reminder of our accountability to continue delivering safe and reliable drinking water to our customers.

POWER AND WATER IS RESPONSIBLE FOR DELIVERING SAFE DRINKING WATER SERVICES TO ITS CUSTOMERS IN THE NORTHERN TERRITORY (NT)

Drinking Water Quality Report 2018–19

The annual Drinking Water Quality Report for 2018–19 ('the report') is a record of drinking water quality information for 92 Northern Territory communities from 1 July 2018 to 30 June 2019.

The report describes drinking water quality activities to the wider Northern Territory public and allows the Department of Health (DoH) to make public health assessments in a transparent way.

Section 1 explains the preventive water quality management activities undertaken in this period.

Section 2 describes the characteristics of the drinking water quality supplied to consumers, with the statistics presented in the Appendices. This section is broken into two parts:

- Part A – Major and minor urban centres
- Part B – Remote communities.

Operating Context

Power and Water is responsible for delivering safe drinking water services to its customers in the Northern Territory. This responsibility is established under the *Power and Water Corporation Act 2002*, the *Government Owned Corporations Act 2001* for urban centres and by agreement with the Northern Territory Government for remote centres.

The Power and Water Board of Directors is responsible to the Shareholding Minister for the corporation's performance and is required to provide a Statement of Corporate Intent (SCI) each financial year. The SCI sets out the organisational objectives and strategies over a four-year period.

Power and Water's strategic objectives as articulated in the SCI 2018–19 financial year was to:

- operate at least as efficiently as any comparable business
- maximise the sustainable return to the Northern Territory Government (NTG) on its investment in the corporation.

During the 2018–19 period the Regions and Remote Services business unit was separated into different functional areas, to work within the other business units of Power and Water. The Water Services business unit gained operational responsibility for all five major centres, 14 minor centres and 72 remote Aboriginal communities in the Northern Territory. Centralised functional support to Power Services and Water Services was provided through other business units for such aspects as customer service, business culture, information technology, finance, communications, governance, regulation, risk and compliance.

SECTION 1
Framework for Drinking Water Quality Management

Australian Drinking Water Guidelines (ADWG)

The ADWG is the primary reference on drinking water quality in Australia and the Northern Territory. It is designed to provide an authoritative reference on what defines safe, good quality drinking water as well as how it can be achieved and assured. The ADWG is published by the National Health and Medical Research Council in collaboration with the Natural Resource Management Ministerial Council.

The ADWG is developed based on the best available scientific evidence regarding both the health and aesthetic aspects of drinking water quality. The ADWG are the adopted standards and provide a common benchmark for assessing the acceptability of drinking water supplied to consumers across Australia.

The ADWG describes a preventative, risk management approach that encompasses all steps in water production - from catchment to consumer. The ADWG Framework for Management of Drinking Water Quality defines this preventative, integrated approach.

The Framework outlines four general areas for ensuring the provision of safe drinking water:

- organisational commitment to drinking water quality management
- system analysis and management
- supporting requirements
- review processes for continual improvement.

Across these four areas, the framework outlines 12 elements considered good practice for the integrated management of drinking water supplies. Together, these elements comprise a proactive approach for ensuring safe and reliable drinking water to the community.

There are rolling revisions to ensure the ADWG represents the latest scientific evidence on good quality drinking water. All assessments made in this report are made against version 3.4, updated in October 2017.

1

Commitment to drinking water quality management

Power and Water Corporation has a strong commitment to drinking water quality management, both at the level of management and individual employees. This is outlined in Power and Water's Drinking Water Quality Policy, continued investment in resourcing in the space and efforts to raise the profile of the NT Water Sector within the wider community.

In this reporting period, Power and Water has implemented a structural integration of the Regions and Remote and Water Services business units. This has brought the responsibilities of water supply and sewerage service provision in remote Aboriginal communities under the same business unit as the major and minor centres in the Northern Territory. This has the benefits of centralising technical design and operational functions within one area and ensuring equivalent standards of asset design and operation are implemented in all communities in the Northern Territory, regardless of location. This is a major undertaking, which will have substantial long-run benefits to all communities in the Northern Territory.

Power and Water has made substantial progress on the Memorandum of Understanding with the Department of Health and has continued to develop the Drinking Water Quality Management System (DWQMS) based on the ADWG Framework for the Management of Drinking Water Quality. Furthermore Power and Water has begun discussions to host the International Water Association (IWA) Health Related Water Microbiology Conference in Darwin, potentially in 2021.

All the policy statements support the DWQMS and commit the organisation to effective management of drinking water quality in all areas of the business (e.g. that water quality has appropriate staffing, training of employees, provision of adequate financial resources, active participation and reporting to the board or chief executive).

During this reporting year, Power and Water has undertaken a comprehensive, external audit against the Framework for Drinking Water Quality Management. This audit has been accompanied by a report with recommendations about opportunities for improvement. This report has been presented to Power and Water senior management. The undertaking of the process and the strong commitment shown by Power and Water management to continually improve is a strong demonstration of Power and Water's commitment to drinking water quality management.

In line with this commitment, Power and Water has developed, and the board has approved, Power and Water's Safe Water Plan 2019-2021. This plan, and the audit project will be described in later chapters, but outline a substantial investment in capital and organisational resources to improve drinking water quality management in the Northern Territory.

1

Partnerships

Power and Water collaborates with stakeholders for the provision of safe drinking water to all customers' and the protection of public health. This is primarily achieved by building effective partnerships with multiple governmental agencies.

Power and Water has a primary responsibility for providing customers with safe drinking water in accordance with sound commercial practices, its Operating Licence through the *Water Supply and Sewerage Services Act 2000* (NT), its remote customers under the *Power and Water Corporation Act 2002* (NT) and *Indigenous Essential Services Agreement.*

Northern Territory Government Departments

The NTG agencies partnering with Power and Water in protecting water quality are:

Department of Health (DoH)

The *Memorandum of Understanding between the Department of Health and the Power and Water Corporation for drinking water (*MoU), formalises the public health accountabilities and responsibilities.

DoH has important responsibilities in protecting public health under the *Public and Environmental Health Act 2011* (NT) and other relevant legislation. The MoU defines the regulatory role of the DoH for drinking water quality in the Northern Territory.

Department of Local Government, Housing and Community Development (DLGHCD)

The Power and Water subsidiary, Indigenous Essential Services (IES), is contracted by the DLGHCD to provide electricity, water and sewerage services to 72 remote Aboriginal communities and a number of outstations across the Northern Territory. This agreement commits both entities to delivering safe drinking water and to continual improvement via referencing the commitments in the MoU.

Department of Environment and Natural Resources (DENR)

DENR performs a regulatory role to control pollution and leads the development of the NTG regulatory framework for water.

The Department of Infrastructure, Planning and Logistics (DIPL)

DIPL protects water quality through appropriate land use planning and the regulation of private plumbing.

The Department of Primary Industry and Resources (DPIR)

DPIR undertakes independent analyses of water samples in Darwin and Alice Springs laboratories.

Northern Territory PFAS response

Power and Water has been working to understand the impact to public drinking water supplies from the historical use of firefighting foams.

The Northern Territory Per- and Poly-Fluorinated Alkyl Substances (PFAS) interagency working group was formed to coordinate the response across the Northern Territory. Power and Water is an active member of any response to contaminated site investigations, by helping to understand the impact on public water supplies.

Power and Water began monitoring for PFAS in customers' drinking water in October 2016. The results are reported on the Power and Water website, PFAS in the Territory and to the Northern Territory and Federal Departments of Health.

Further information about PFAS results and investigations can be found on the following websites:

Power and Water PFAS information
https://www.powerwater.com.au/networks_and_infrastructure/water_services/pfas

Australian Government Department of Health PFAS Information
http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-pfas.htm

Northern Territory Department of Health Media release
http://mediareleases.nt.gov.au/mediaRelease/21535

Department of Defence Hotline 1800 316 813 PFAS investigations
http://www.defence.gov.au/Environment/PFAS/

The Northern Territory Per- and poly-Fluorinated Alkyl Substances Interagency Working Group
https://ntepa.nt.gov.au/waste-pollution/compliance/pfas-investigation

2

Assessment of the drinking water supply system

The ADWG emphasise a preventative, risk management approach for ensuring the safety of water supplied to consumers. In order to do this, Power and Water undertake assessments of the water supply system to identify potential risks to water safety and ensure appropriate mitigation strategies are put in place.

Understanding the vulnerability of different water sources to contamination, and performing assessments of the likelihood of contamination are critical activities for a water utility. Examples of contamination sources include septic tanks, cattle, rubbish dumping and mining. A sanitary survey is performed to identify those contamination sources, and a hydrogeological assessment is performed to explore the vulnerability of an aquifer to contamination. Ultimately the two assessments are combined to determine the water treatment requirements for a scheme, in order to provide safe drinking water.

In this reporting period sanitary surveys and water safety assessments occurred at selected communities according to risk prioritisation and proximity of sites to each other for efficiency of project delivery. The communities are Angurugu, Darwin, Galiwinku, Maningrida, Milikapiti, Millingimbi, Minjilang, Numbulwar, Ramingining, Robinson River, Umbakumba, Weemol and Yarralin.

The barrier risk assessment process was refined in this reporting period, bedding it down within water safety plans and continuing to prioritise further investigations based upon risk as outlined in the Safe Water Plan 2019–2022.

Water sources

All major and minor urban centres serviced by Power and Water are either in part, or completely reliant upon groundwater for their drinking water supply. Most remote community drinking water supplies are from groundwater sources. Local subsurface aquifers, at a range of depths and in a variety of geological environments, are used. The groundwater is pumped to the surface through production bores.

Some drinking water sources are better protected than others, such as ‘closed’ catchments like Darwin River Reservoir. However, even the protected water sources are still vulnerable to a broad range of potential hazards and require active management to maintain good water quality.

Table 1 Summary of drinking water sources in major and minor urban centres

CENTRE	TYPE	TERRITORY REGION	SOURCE
Adelaide River	Minor	Northern	Groundwater
Alice Springs	Major	Southern	Groundwater (Roe Creek Borefield)
Batchelor	Minor	Northern	Groundwater
Borroloola[1]	Minor	Katherine	Groundwater
Cox Peninsula	Minor	Northern	Groundwater
Daly Waters	Minor	Katherine	Groundwater
Darwin	Major	Northern	Surface water (Darwin River Reservoir) + groundwater (10%)
Elliott	Minor	Barkly	Groundwater
Gunn Point	Minor	Northern	Groundwater
Katherine	Major	Katherine	Surface water (Katherine River) + groundwater (20%)
Kings Canyon	Minor	Southern	Groundwater
Larrimah	Minor	Katherine	Groundwater
Mataranka	Minor	Katherine	Groundwater
Newcastle Waters	Minor	Barkly	Groundwater
Pine Creek	Minor	Katherine	Surface water (Copperfield Reservoir – emergency) + groundwater (100%)
Tennant Creek	Major	Barkly	Groundwater (Kelly Well, Kelly Well West and Cabbage Gum Borefields)
Timber Creek	Minor	Katherine	Groundwater
Ti Tree	Minor	Southern	Groundwater
Yulara	Major	Southern	Groundwater

[1] The water source for the Borroloola town camps Garawa 1 and 2 is groundwater and is separate from the Borroloola source

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Table 2 Summary of drinking water sources in remote communities

CENTRE	TERRITORY REGION	SOURCE
Acacia Larrakia	Northern	Groundwater
Ali Curung	Southern	Groundwater
Alpurrurulam	Southern	Groundwater
Amanbidji	Katherine	Groundwater
Amoonguna	Southern	Groundwater
Ampilatwatja	Southern	Groundwater
Angurugu	Northern	Groundwater
Areyonga	Southern	Groundwater
Atitjere	Southern	Groundwater
Barunga	Katherine	Groundwater
Belyuen	Northern	Groundwater
Beswick	Katherine	Groundwater
Binjari	Katherine	Groundwater
Bulla	Katherine	Surface + Groundwater
Bulman	Katherine	Groundwater
Canteen Creek	Southern	Groundwater
Daguragu	Katherine	Groundwater
Engawala	Southern	Groundwater
Finke	Southern	Groundwater
Galiwinku	Northern	Groundwater
Gapuwiyak	Northern	Groundwater
Gunbalanya	Northern	Groundwater
Gunyangara	Northern	Groundwater
Haasts Bluff	Southern	Groundwater
Hermannsburg	Southern	Groundwater
Imangara	Southern	Groundwater
Imanpa	Southern	Groundwater
Jilkminggan	Katherine	Groundwater
Kalkarindji	Katherine	Groundwater
Kaltukatjara	Southern	Groundwater
Kintore	Southern	Groundwater
Kybrook Farm	Katherine	Groundwater
Lajamanu	Katherine	Groundwater
Laramba	Southern	Groundwater
Maningrida	Northern	Groundwater
Manyallaluk	Katherine	Groundwater
Milikapiti	Northern	Groundwater
Milingimbi	Northern	Groundwater
Milyakburra	Northern	Groundwater
Minjilang	Northern	Groundwater
Minyerri	Katherine	Groundwater
Mt Liebig	Southern	Groundwater
Nauiyu	Northern	Groundwater
Nganmarriyanga	Northern	Groundwater
Ngukurr	Katherine	Groundwater
Nturiya	Southern	Groundwater
Numbulwar	Northern	Groundwater
Nyirripi	Southern	Groundwater
Papunya	Southern	Groundwater
Peppimenarti	Northern	Groundwater
Pigeon Hole	Katherine	Groundwater
Pirlangimpi	Northern	Surface Water
Pmara Jutunta	Southern	Groundwater
Ramingining	Northern	Groundwater
Rittarangu	Katherine	Groundwater
Robinson River	Katherine	Groundwater
Santa Teresa	Southern	Groundwater
Tara	Southern	Groundwater
Titjikala	Southern	Groundwater
Umbakumba	Northern	Groundwater
Wadeye	Northern	Groundwater
Wallace Rockhole	Southern	Groundwater
Warruwi	Northern	Groundwater
Weemol	Katherine	Groundwater
Willowra	Southern	Groundwater
Wilora	Southern	Groundwater
Wurrumiyanga	Northern	Groundwater
Wutunugurra	Southern	Groundwater
Yarralin	Katherine	Groundwater
Yirrkala	Northern	Groundwater
Yuelamu	Southern	Groundwater
Yuendumu	Southern	Groundwater

Figure 1 Drinking water supply system – Water Services

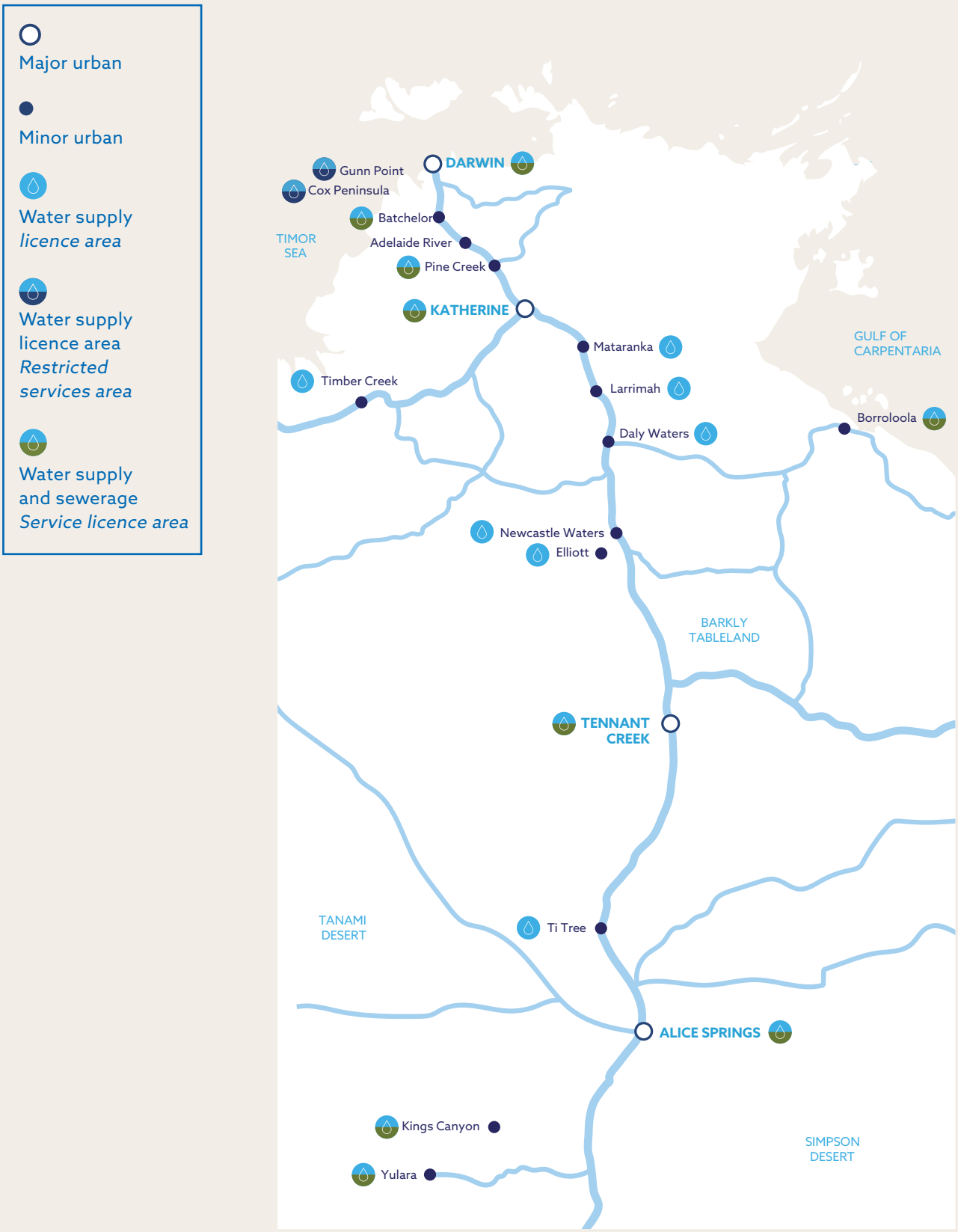
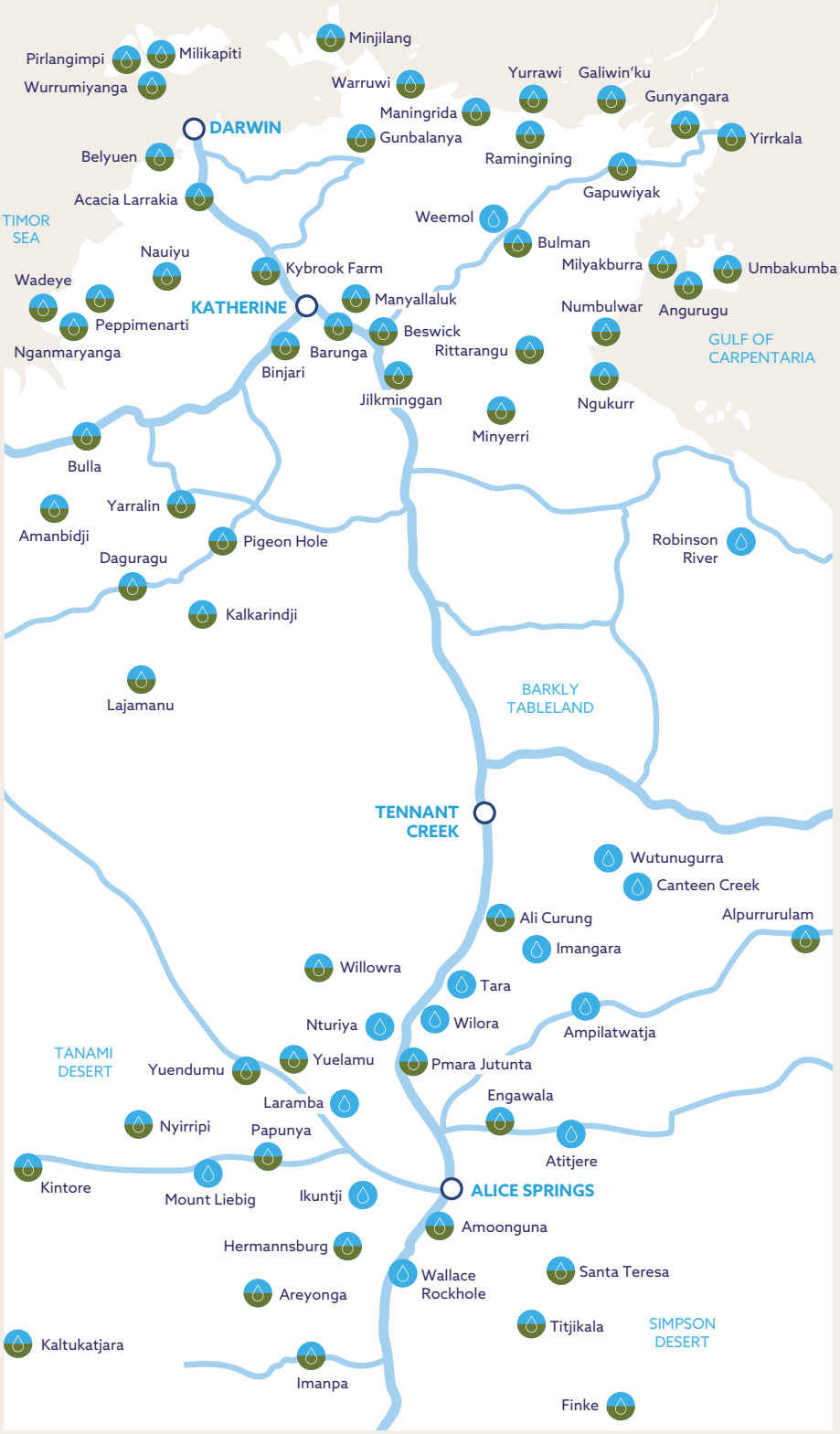


Figure 2 Drinking water supply system – Regions and Remote

Water supply *licence area*

Water supply and sewerage *Service area*



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Preventative measures for drinking water quality management

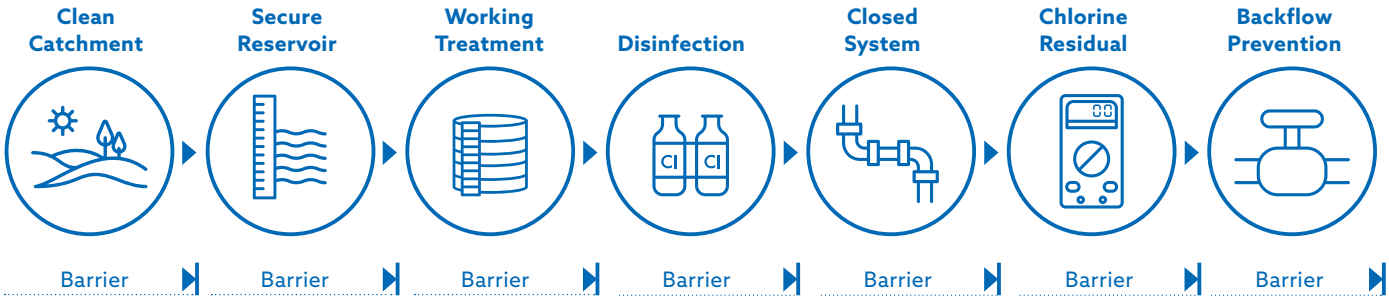
The ADWG mandate that robust, multiple barriers are implemented to prevent contaminants from entering the water supply system.

Barriers are not limited to water treatment and disinfection systems. In fact, some of the most important barriers to contaminant ingress are the water pipes and roofs on water tanks used to convey and store water prior to it reaching customer taps. Just like it is important to keep food stored appropriately prior to consuming it, maintaining appropriate system integrity ensures pathogens and chemicals do not enter water that is being supplied to consumers.

A multiple barrier approach

The ADWG recommend a 'catchment to consumer' approach for the management of water quality. The strength of multiple barriers is that a failure of one barrier may be compensated for by the remaining barriers, minimising the likelihood of contaminants passing through the entire treatment system. The placement of barriers in a conventional multiple barrier system is shown in Figure 3 below.

Figure 3 Typical multiple barrier system



From catchment to consumer multiple barriers to ensure safe drinking water

3

THE EFFECTIVENESS OF THIS CONTROL IS ASSESSED BY MONITORING, RECORDING AND ACTING ON INCIDENTS WHERE THE LEVEL FALLS BELOW THE SET TARGETS.

Protecting the source

Keeping a clean catchment and water source is a fundamental principle of Power and Water's Drinking Water Quality Policy. Implementing effective measures to protect source waters from contamination avoids the need for expensive, complicated treatment to treat the water.

Excluding contamination from water sources is a challenge, particularly in more urbanised areas such as the Howard East Borefield Catchment, which typically supplies 10 per cent of Darwin's drinking water. Rubbish dumping and hunting are common occurrences and while signage and fencing is in place, people frequently act to circumvent these attempts to exclude people from the catchment. Power and Water continues to educate community members regarding the importance of keeping catchments clean.

Due to the poor 2018–19 wet season, Power and Water has elected to reduce extraction from the Howard East Borefield in an attempt to minimise water shortages for rural residential users of water, who also share the aquifer. Power and Water's extraction from the Howard East Borefield is governed under a water extraction licence approved by the Department of Environment and Natural Resources.

Water treatment and disinfection

The ADWG state that the greatest risk to consumers is from pathogenic microorganisms and that protection of water sources and treatment are of paramount importance and should never be compromised.

In conjunction with other barriers to protect the water source, chlorination is a vital defence against microbiological contamination. Chlorine is the preferred purifier as it is simple to use, destroys pathogenic micro-organisms effectively and provides protection through the distribution system.

Power and Water proactively guards against risks presented by opportunistic pathogens such as *Naegleria fowleri* and *Burkholderia pseudomallei* by means of maintaining a set minimum free chlorine residual of 0.5 mg/L in all supplies at all times (0.3 mg/L for southern region remote communities).

The effectiveness of this control is assessed by monitoring, recording and acting on incidents where the level falls below the set targets.

In addition to potential microbiological contamination, the interaction between water stored for long periods in deep aquifers, and the surrounding geology can result in a wide range of naturally occurring minerals and deposits in the water, causing the water chemistry to become 'rich'. In some communities the physical and chemical characteristics of the water can exceed the levels recommended in the ADWG.

To ensure that drinking water supply meets the ADWG in three high risk communities (Ali Curung, Kintore and Yuelamu), Power and Water operates an Advanced Water Treatment (AWT) plant at each community. The AWT reduce levels of naturally occurring nitrate, fluoride and uranium, as well as salinity and hardness.

Across the major and minor urban centres barriers in place are shown in Table 4.

Disinfection upgrades

In 2017 Power and Water conducted a comprehensive review of chlorine disinfection systems across all 92 communities in the Northern Territory. This review identified an opportunity for improvement through the upgrading and standardising of chlorine disinfection systems.

In the 2019 reporting period a three year improvement program has been assembled to implement improvements on a priority basis. The current capital plans are to be implemented and completed by 2021. In remote communities, a $7.4 million, three year improvement program, is funded by DHLGCD.

Key deliverables for the disinfection infrastructure upgrades are:

- Chlorine dosing equipment redundancy.
- Chlorine online monitoring equipment.
- Disinfection equipment connectivity to process control systems.
- Alarming of events outside of standard operating parameters.

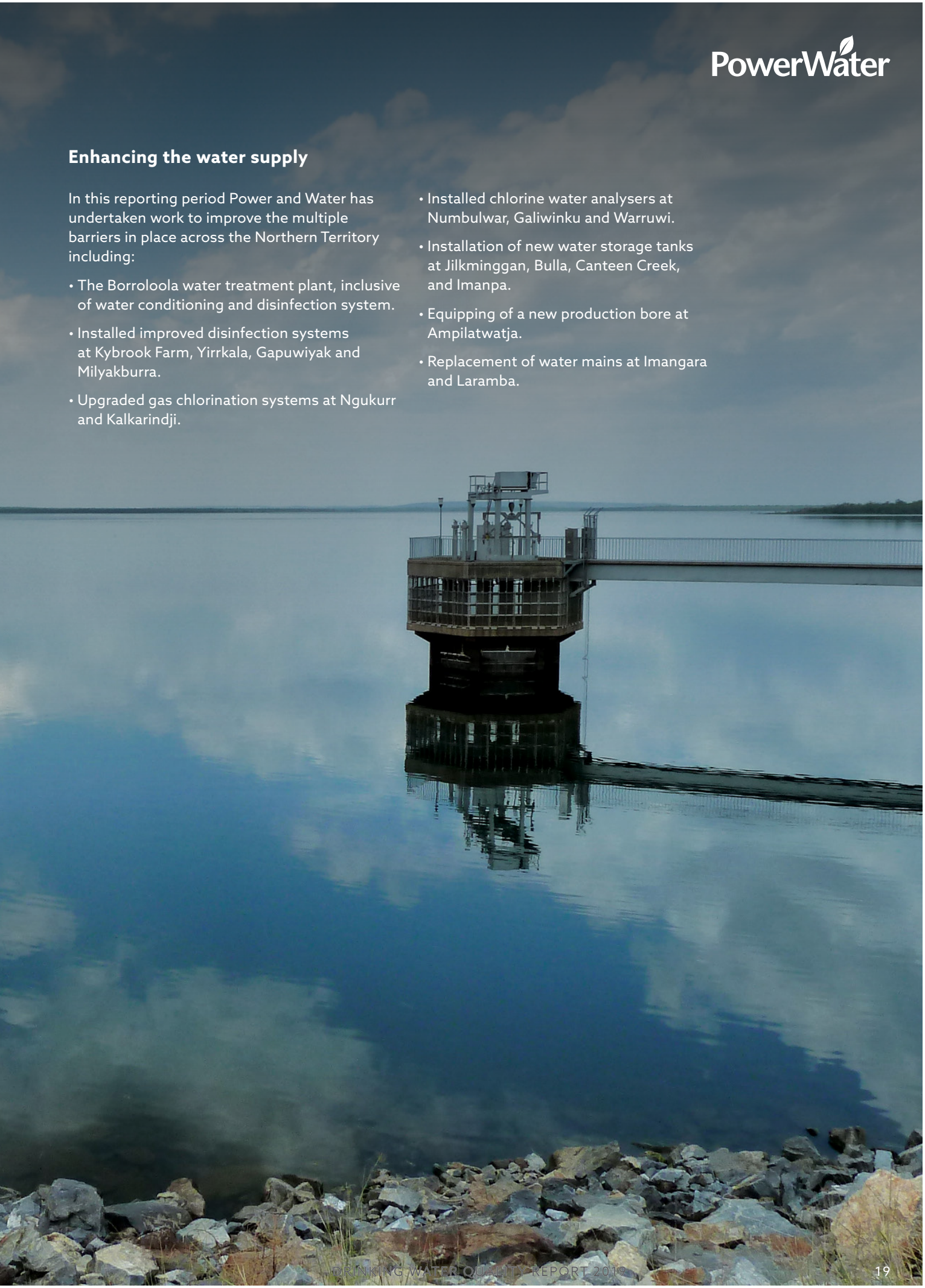
Table 3 Water quality barriers in major and minor urban centres

CENTRES	CATCHMENT PROTECTION	DETENTION RESERVOIRS AND AQUIFERS	BOREHEAD PROTECTION ZONE	BOREHEAD INTEGRITY	COAGULATION, FILTRATION OR MEMBRANE FILTRATION	DISINFECTION	STORAGE TANK INTEGRITY AND CLEANING	MAINTENANCE OF POSITIVE PRESSURE IN RETICULATION	BACK-FLOW PREVENTION IN RETICULATION	DISINFECTION RESIDUAL TO CUSTOMER'S METER
Adelaide River		■	■	■	■	■	■	■	■	■
Alice Springs	■	■	■	■		■	■	■	■	■
Batchelor		■	■	■		■	■	■	■	■
Borroloola		■	■	■		■	■	■	■	■
Cox Peninsula	■	■	■	■		■	■	N/A	N/A	■
Daly Waters	■	■	■	■		■	■	■	■	■
Darwin – groundwater	■	■	■	■		■	■	■	■	■
Darwin – surface water	■	■	N/A	N/A		■	■	■	■	■
Elliott		■	■	■		■	■	■	■	■
Gunn Point		■	■	■		■	■	■	■	■
Katherine – groundwater		■	■	■		■	■	■	■	■
Katherine – surface water			N/A	N/A	■	■	■	■	■	■
Kings Canyon	■	■	■	■		■	■	■	■	■
Larrimah	■	■	■	■		■	■	■	■	■
Mataranka		■	■	■		■	■	■	■	■
Newcastle Waters	■	■	■	■		■	■	■	■	■
Pine Creek – groundwater		■	■	■		■	■	■	■	■
Pine Creek – surface water			N/A	N/A		■	■	■	■	■
Tennant Creek		■	■	■		■	■	■	■	■
Timber Creek		■	■	■		■	■	■	■	■
Ti Tree	■	■	■	■		■	■	■	■	■
Yulara	■	■	■	■	■	■	■	■	■	■

Enhancing the water supply

In this reporting period Power and Water has undertaken work to improve the multiple barriers in place across the Northern Territory including:

- The Borroloola water treatment plant, inclusive of water conditioning and disinfection system.
- Installed improved disinfection systems at Kybrook Farm, Yirrkala, Gapuwiyak and Milyakburra.
- Upgraded gas chlorination systems at Ngukurr and Kalkarindji.
- Installed chlorine water analysers at Numbulwar, Galiwinku and Warruwi.
- Installation of new water storage tanks at Jilkminggan, Bulla, Canteen Creek, and Imanpa.
- Equipping of a new production bore at Ampilatwatja.
- Replacement of water mains at Imangara and Laramba.



4

Operational procedures and process control

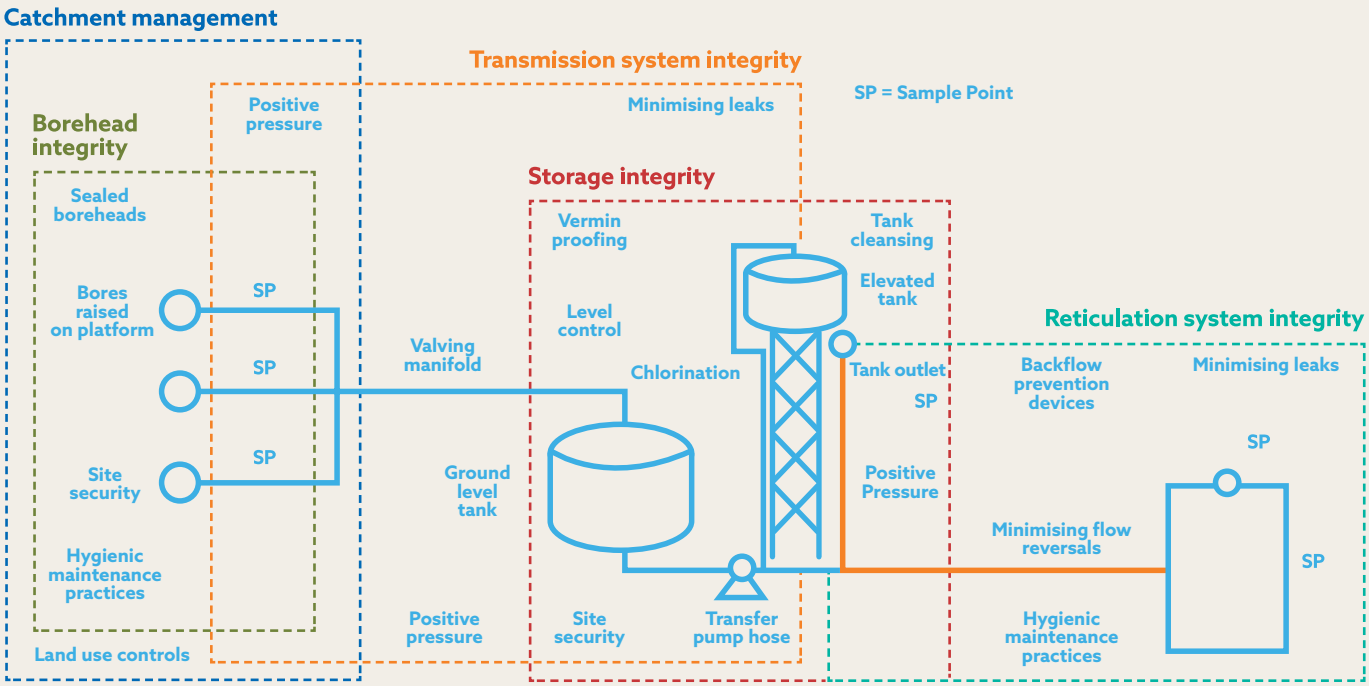
The ADWG require that a water supply utility maintain appropriate operational procedures and process control, to ensure appropriately safe water is supplied to consumers at all times.

Process control requirements are determined by factors such as water supply system configuration, location of the scheme and communications infrastructure available. A major long-term improvement to telemetry and process control for remote communities is included in the upgrades to disinfection systems that are underway across the Northern Territory. Table 5 and Figure 4 represent the infrastructure configuration common in most minor urban centres and remote communities.

Table 4 Water infrastructure in major and minor urban centres

WATER SOURCE	WATER TREATMENT	WATER STORAGE	WATER DISTRIBUTION SYSTEM
Typically, water is extracted from underground aquifers via bores. Surface water sources, such as reservoir's, rivers and springs, are used to supply drinking water in a few communities.	Water treatment is primarily through disinfection such as sodium hypochlorite, chlorine gas and UV disinfection. Other treatment systems such as sand filters and clarifiers are used in communities that also use surface water sources, and Power and Water is investing in more advanced treatment in some communities.	The water is then stored in tanks, typically consisting of at least one large tank on the ground and a smaller tank elevated on a stand. The water is transferred from the ground level tank to the elevated tank using transfer pumps. Some communities have pressure pumps in place of elevated tanks.	Underground pipes and rising mains distribute the drinking water throughout the community to consumers' taps. Typically, these are gravity systems and are inspected through manholes and flushed using water hydrants.

Figure 4 Typical minor urban centre and remote community water supply configuration



Water supply process control

Automated and remote control of many water supply system assets is used to improve response times and ensure data capture. In order to do this, Power and Water uses Supervisory Control and Data Acquisition (SCADA) systems. These systems consist of two, equally important parts:

- A Wide Area Network (WAN) which is extended around the water supply scheme using radio telemetry, to allow different Power and Water Assets to communicate with each other
- A telemetry link back to the Power and Water servers in Darwin, Katherine and Alice Springs. This link is provided by either fiber-optic cable link, or satellite communications.

Power and Water's SCADA system monitors control points in water supplies using a range of online monitoring systems in each centre. Apart from monitoring the status and performance of infrastructure, this system provides continuous monitoring for specific water quality parameters such as chlorine, fluoride, conductivity, turbidity and pH levels. Infield sampling or measurements, such as temperature and chlorine residuals, help to identify performance issues and provide direction for corrective actions.

A key outcome of the disinfection upgrade program is to extend online monitoring and SCADA communications to communities that previously have not had remote monitoring access. Online monitoring significantly reduces response times and greatly improves the ability to troubleshoot problems, which in the past have required expensive site visits to repair.

Operational procedures

Established procedures and water quality information are made readily available to all employees via Power and Water's intranet site and via the Water Safety Plans. During the 2018–19 reporting period, a total of 20 procedures received updates, including:

- The Essential Services Operator (ESO) Manual.
- Water sampling and collection procedures.
- The response to bacteriological contamination in water supplies procedure.
- A management standard of catchment and water supply protection, namely wellhead protection zones.

Materials and chemicals

Materials used by Power and Water that contact potable water must normally comply with AS/NZS 4020:2005, *Testing of products for use in contact with drinking water* or other relevant standards.

Chemical suppliers used by Power and Water are required to provide an analysis report of the chemical to be supplied. Chemicals must comply with the relevant ANSI/AWWA standard, and the management system at the site of manufacture of the chemical must be certified to ISO 9001.

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Verification of drinking water quality

A key aspect of the ADWG Framework for the Management of Drinking Water Quality is the use of monitoring to verify the quality of water supplied to customers.

It is important to understand that verification monitoring is the final step in a long line of processes put in place to ensure that safe water is supplied to consumers. As such, failures that are identified by verification monitoring are indicative of failures in upstream barriers to exclude contaminants from the water supply system; and require immediate corrective action and investigation into the cause of the failure.

Power and Water monitor a comprehensive range of parameters, including microbial, physical, chemical and radiological characteristics to ensure the water meets the ADWG and is fit for distribution to customers.

Customer satisfaction

Monitoring of consumer comments and complaints provides valuable information on potential problems, which may not have been identified by operational monitoring. The ADWG recommends that water suppliers evaluate customer complaints.

Specific water quality complaints made by Power and Water customers during the reporting period can be found in Section 2 of this report. This includes a summary of drinking water quality complaints by type (e.g. clarity/dirtiness/particles, alleged illness, taste and other) for the Darwin water supply between 2018 and 2019.

Power and Water conducts customer satisfaction surveys and encourages customers to submit feedback. The information is collated and evaluated in preparation for submission to the National Performance Report (NPR).

Water quality monitoring

The Power and Water drinking water quality monitoring program is developed in consultation with the DoH and is approved by the Chief Health Officer. This document is a comprehensive description of the water quality monitoring undertaken by Power and Water and is inclusive of all centres. It details the locations of water sampling points, the frequency of sampling, the types of samples to be collected, specifies sample preservation techniques to be employed and sample bottles to be used, and specifies which laboratories Power and Water will use to perform water quality analysis.

The extensive monitoring program requires the collection of thousands of operational and verification samples across the Northern Territory. Water is routinely sampled at specific locations in the water supply system and then sent to laboratories for analysis.

Remote community water samples are collected by ESOs and transported back to Darwin and Alice Springs by light aircraft for testing by accredited laboratories.

Operational monitoring

Operational monitoring is used to trigger immediate short-term corrective action or to inform long term planning or evaluations. Source water and treatment performance monitoring are important components of operational monitoring as they provide an indication of disinfection performance. Detailed studies and investigations help Power and Water to increase the understanding of the drinking water quality at each supply.

The extensive data and information from our operational monitoring program is used internally and is not reported here.

Verification (compliance) monitoring

Verification monitoring of water quality parameters is the final check that the barriers and preventative measures implemented to protect public health are working effectively. Verification data is used for assessing conformance with the ADWG, compliance with agreed levels of service and as a trigger for short-term corrective action, if required.

Section 2 of this report provides more details and an assessment of the verification data collected for this reporting period.

WATER IS ROUTINELY SAMPLED AT SPECIFIC LOCATIONS IN THE WATER SUPPLY SYSTEM AND THEN SENT TO LABORATORIES FOR ANALYSIS.

5

THE ANALYTICAL PROCEDURES USED TO DETECT PATHOGENS ARE COMPLEX AND SPECIFIC FOR EACH PATHOGEN.

Water quality indicators

It is not practical for all potential water contaminants to be monitored in a drinking water quality monitoring program, so indicators are used to verify the water quality.

The key indicator parameters used to determine the water quality for the reporting period are described in the following sections. Section 2 of this report provides an assessment of the data found in the Appendices.

Microbiological parameters

Disease-causing organisms, or pathogens, pose an immediate risk to public health. The risk from pathogens in water supplies can vary significantly in a short period of time, therefore frequent microbiological monitoring is required for an assessment.

The analytical procedures used to detect pathogens are complex and specific for each pathogen. Indicator organisms are used to determine if contamination has occurred.

Power and Water monitored the following indicator organisms:

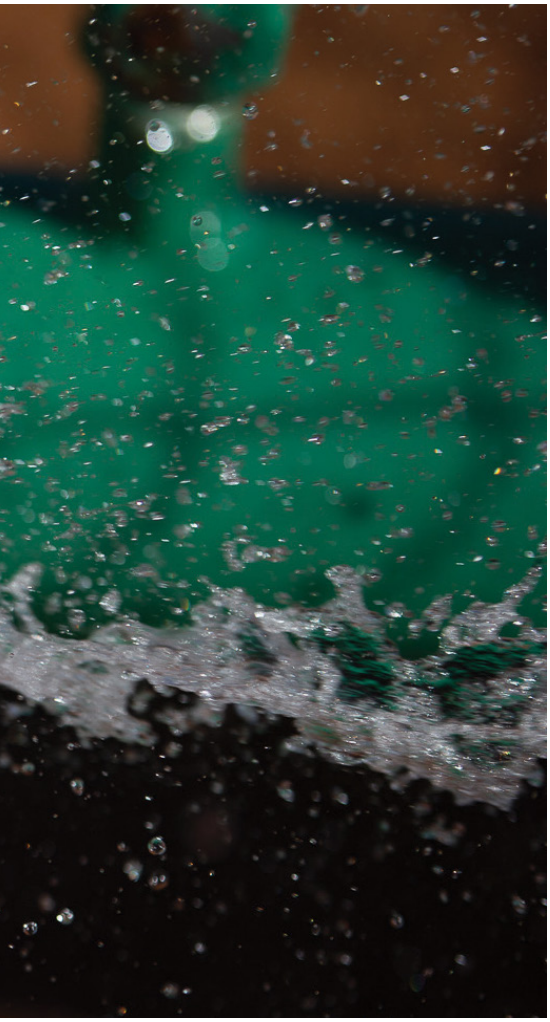
- *Escherichia coli (E. coli)* indicates faecal contamination from warm-blooded animals, including humans and hence, the potential for the presence of disease-causing micro-organisms
- Total coliforms indicate the range of bacteria found in many soil and aquatic environments and can provide a measure of disinfection and the cleanliness of the drinking water supply more generally.

The ADWG performance requirements stipulate that no *E. coli* should be detected in drinking water. The guidelines also include the requirement that rigorous corrective action be undertaken and documented in response to an *E. coli* detection, to prevent potential recurrences of faecal contamination.

Power and Water also continued to monitor for the presence of *Naegleria fowleri (N. fowleri)*, a free-living amoeboflagellate found in soil and aquatic environments in the Northern Territory. *N. fowleri* is almost harmless to drink and not associated with faecal contamination. This pathogen causes a rapid and usually fatal infection, primary amoebic meningoencephalitis, acquired when contaminated water is forced into the nasal passages.

Power and Water aims to maintain a level of chlorine in all distribution systems to control *N. fowleri.* The ADWG recommends controlling *N. fowleri* by maintaining a minimum free chlorine level of 0.5 mg/L.

Power and Water has continued to investigate for the presence of the pathogen *Burkholderia pseudomallei,* the agent responsible for the disease melioidosis. Power and Water works closely with the Menzies School of Health Research to identify drinking water characteristics likely to be at risk.



The results of monitoring for these indicator organisms and pathogens are presented in Section 2.

Chemical parameters (Health)

Power and Water monitors numerous chemical parameters to indicate the water quality supplied to customers. A wide range of measurable characteristics, compounds or constituents can be found in water and may affect its quality. The results for the typical health related chemical parameters are presented in tables in the Appendices.

Organic chemicals

Unfortunately, there is no way to practically test for all organic chemicals in existence. Instead, specific tests must be ordered to test for specific chemicals, based upon an understanding of their likelihood to exist within a certain water supply system. Power and Water undertakes a broad range of organic chemical testing, with a number of the chemicals of interest outlined below:

Trihalomethanes

Chlorine introduced into a water supply as a disinfectant will also react with naturally occurring organic matter in the water to produce by-products of disinfection such as trihalomethanes (THMs). All major and minor urban centres were monitored for THMs. Results can be found in tables in the Appendices.

Pesticides

The use of restricted chemical products is managed by the various government departments. Pesticides (insecticides and herbicides) are used in our catchments. DoH requires testing for these chemicals when there is the potential for water supply contamination. Our pesticide monitoring program focuses on 46 commonly used pesticides including organochlorine, organophosphate and triazine pesticides, insecticides and acidic herbicides.

Per and Poly-fluoroalkyl Substances (PFAS)

Per- and Poly-fluoroalkyl substances (PFAS) are manufactured chemicals that have numerous industrial uses. Due to PFAS persistence and mobility in the environment, they have emerged as a potential water contaminant in some situations, notably cases where fire-fighting foams have been used. Power and Water monitors for these chemicals, and the results are reported on the Power and Water website.

Chemical and physical parameters (Aesthetic)

Aesthetic parameters are the chemical and physical characteristics of water quality that pose no threat to human health, however can affect drinking water appearance, taste, feel and odour. This includes total dissolved solids (TDS), hardness (calcium and magnesium carbonates and sulfates), colour, pH and a few common metals.

The aesthetic quality will affect the acceptance of drinking water and is usually the first change in water quality observed. Results for the annual assessment of aesthetic parameters are shown in tables in the Appendices.

Radionuclides

Low levels of radioactivity are occasionally detected in drinking water supplies in the Northern Territory. The radionuclides responsible for this radioactivity are natural and a characteristic of the local hydrogeology.

Details of the radiological assessment are reported in Section 2. Results are shown in tables in the Appendices.

6

Management of incidents and emergencies

Power and Water provides water supply and sewerage services to customers spread across the entire Northern Territory, from Elcho Island in the North East, to Docker River in the extreme South West – 1,600 kilometers apart.

Our customers are subjected to the full range of natural and weather-related events, such as extreme heat, flooding and tropical cyclones. The geographical spread means that typically, every year at least one water supply operated by Power and Water is affected by a tropical cyclone somewhere in the Top End.

Power and Water is prepared for the management of incidents that could compromise water quality.

The MoU between Power and Water and the regulator governs the response to water quality emergencies and the communication actions to the DoH as the regulator. Actions are based on the quick management of issues and designed not to impede on regulator independence.

The nature of any event is clearly defined in the document, *Protocol for the Notification by Power and Water Corporation of Drinking Water Quality and Supply Reportable Incidents and Events to the Department of Health.* This protocol defines emergency scenarios, the communication and the established procedures to respond.

In this reporting period Power and Water continued to develop and improve water quality incident notification.

Incidents and emergencies which occurred during this reporting period are discussed in Section 2 Part A for major and minor urban centres and Section 2 Part B for Remote Communities.


PowerWater

7

Employee awareness and training

The ADWG emphasise that appropriate employee awareness and training of the importance of water quality related tasks are critical for the supply of safe water. Power and Water continues to have a focus on developing a professional, capable and accountable workforce and include providing a range of formal and informal training opportunities for all staff.

Organisational development

Power and Water continues to foster employee responsibility and motivation throughout our workforce. A primary mechanism for this is through continuing to fund employees to participate in a culture and leadership program. This training aims to grow employee responsibility and motivation, and to embed a constructive and positive working culture throughout our organisation.

Industry training

In major and minor centres, Power and Water employees operate all key water supply and sewerage functions. A key part of performing these activities well is a strong commitment from Power and Water to ensure all operators achieve Certificate III or Certificate IV in Water Operations.

This training provides operators broad training and offers the opportunity for specialisation in areas such as: water and wastewater treatment, water supply distribution (network), trade waste, catchment operations, irrigation, dam safety and operations and source protection, river groundwater diversions and licensing, and construction and maintenance.

Essential Services Operators (ESO) Water Competency Assessments

In remote Aboriginal communities across the Northern Territory, water supply and sewerage system operational functions are performed by Essential Services Operators (ESOs) under the supervision of Power and Water personnel. Power and Water has a contract with private companies that provide ESO services

POWER AND WATER CONTINUES TO FOSTER EMPLOYEE RESPONSIBILITY AND MOTIVATION THROUGHOUT OUR WORKFORCE.

in each of the 72 communities in the Northern Territory.

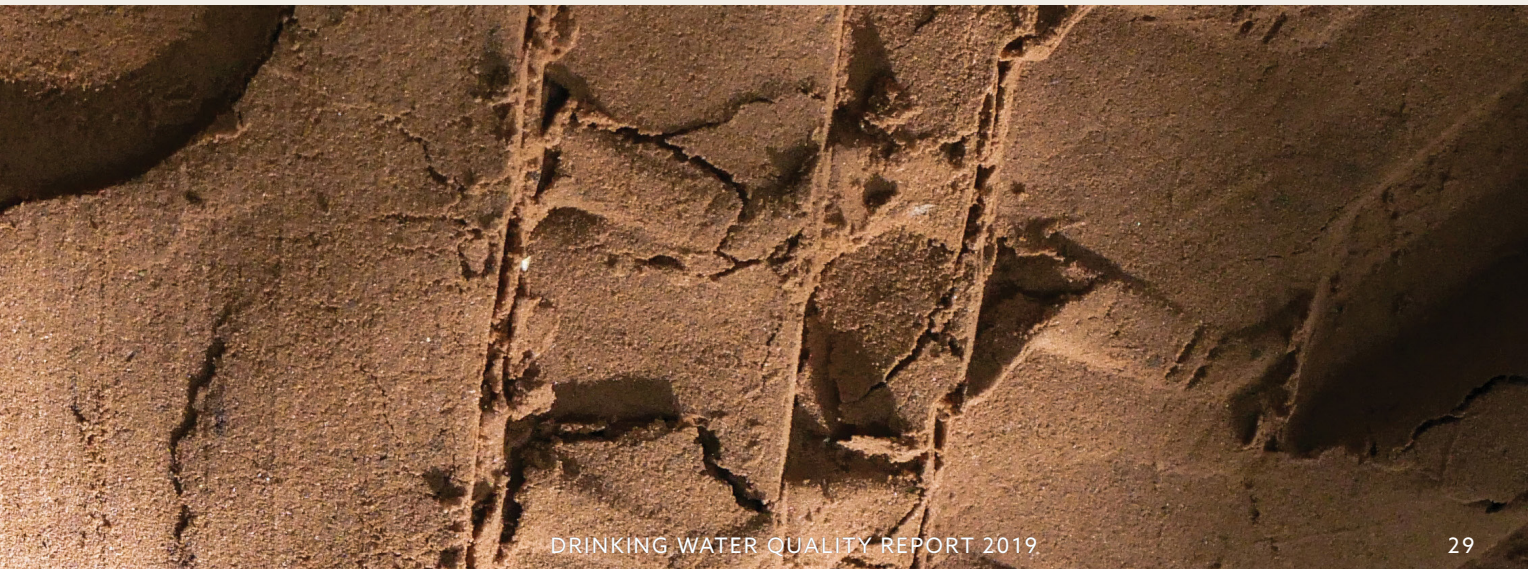
The long distances, sometimes difficult access and challenges in communicating with remote communities means that Power and Water relies on ESOs to provide the 'eyes and ears' on the ground. As a result, Power and Water rely on ESOs to provide first response and to troubleshoot many problems before a Power and Water employee can attend the site. This is an important responsibility and means that ESO training and competency is of critical importance to the supply of safe drinking water in these places.

During the 2018–19 reporting year, Power and Water performed a comprehensive assessment into the competency of ESOs to perform water related duties. Under this program, the competence of at least one ESO in every remote Aboriginal community in the Northern Territory was assessed. The competence of more than 110 ESOs was assessed and found to be acceptable in all cases. In addition, Power and Water recommended that the Certificate II in remote area essential services be updated to reflect upgrades in asset capability in many communities and be rolled out to all ESOs in the future. This training would be included as a requirement in ESO contracts.

Water in the Bush

Water in the Bush is the Northern Territory's premier water industry event, and brings together Northern Australia water professionals, the community and industry to share knowledge on issues affecting water. Power and Water continues to maintain a strong presence at the event. Presentations related to water quality given by Power and Water at the conference include:

- *Managing Water Quality across the Territory* – by Steven Porter – Senior General Manager, Water Services
- *Power and Water Corporation's Drinking Water Quality Management System* – by Elizabeth Gadd – Water and Wastewater Treatment Engineer, Water Services
- *Developing a Water Supply Solution for Katherine in Response to PFAS Contamination of Local Groundwater* – by Trevor Durling – Senior Headworks Planning Engineer, Water Services.



8

Community involvement and awareness

Our customers are at the heart of everything we do and involving the community is vitally important to delivering quality drinking water.

Growing community interest in water quality issues in this reporting period was met with innovative community engagement and award winning customer service by Power and Water.

This year we have revamped our website, to focus it on our goal to be a customer centric, high-performance multi-utility. See our website at www.powerwater.com.au.

Engaging with our community

Collaboration

The Borroloola water treatment upgrade project was recognised multiple times national and international. The project was awarded the innovation prize from the Northern Territory Australian Water Association and nominated as an outstanding project for public participation and community engagement by the International Association of Public Participation.

Much of the success of the project was due to the innovative approach to public participation, which featured an art project in partnership with the Borroloola School. Power and Water supplied art equipment, engaged a local artist to guide the students and organised for the artwork to be enlarged and transferred onto the water treatment infrastructure.

The project was delivered in late 2018.

Communication

Power and Water maintains an online presence both through our website and social media to provide multiple channels for customers to contact us and to help us deliver a range of informative, educational and engaging content. Facebook, Twitter and LinkedIn are the main social media platforms we use.

Making a contribution

Power and Water also supports the community through in-kind assistance.

This may include our people volunteering at events and with community organisations or providing our popular water refill stations and water bottles at community events.

This year we have ensured Territorians and visitors to the Northern Territory have stayed well hydrated. Events include the Arafura Games, Darwin Festival, Mindil Beach Markets, Seabreeze Festival, Italian Festival, National Aboriginal and Torres Strait Islander Art Awards (NATSIAAs), School Sport NT and Helping People Achieve's Health and Wellness Festival.

Water smart programs

The garden tune up rebate helps to remind customers of their water responsibilities after the meter. This year, over 1,800 garden tune ups were carried out in Darwin.

Living Water Smart's school based curriculum unit "That's My Water!" was delivered to 380 Grade 5/6 students at four schools in Darwin. The Darwin Water Challenge also took place with 150 Year 7 students, who were tasked with coming up with unique projects to help save water.

The Living Water Smart's community leak program continued in Katherine after being launched in 2017. The Katherine community continued to reduce water demand, this time by 20 per cent as a result of the extension of water conservation measures.

In remote communities, smart water meters were installed in Ngukurr, Minyerri, Amanbidji, and Engawala to complement the existing smart water meters already operational in Galiwinku, Milingimbi, Gunbalanya, Kybrook Farm, Yuendumu, Santa Teresa, Ali Curung, Yuelamu, and Epenarra during this reporting period.

The use of smart meters enabled Power and Water to pin-point individual sites, while a broad remote community engagement program occurred. A television and radio advertising campaign increased customer awareness of the need for water efficiency due to limited sources and provide specific tips on how to be water efficient in remote communities.

9

Research and development

Research and development activities help to ensure continual improvement and the ongoing capability to meet drinking water quality requirements.

WITHIN THIS YEAR POWER AND WATER HAS DEVELOPED A NEW, THREE-YEAR RESEARCH STRATEGY.

The ADWG promote continued research and development to maintain a water utility at the cutting-edge of knowledge related to water quality management. This research and development can be both fundamental research on priority water quality related areas and also applied research, such as the validation of water treatment processes.

Within this year Power and Water has developed a new, three-year research strategy. This strategy identifies priority areas for research specific to our business and outlines a roadmap to see key initiatives undertaken and implemented within our business. In addition, the strategy outlines a desire to grow strategic partnerships with key research organisations in the Northern Territory, such as Charles Darwin University.

Power and Water is a member of various water industry groups that undertake research work.

WaterRA projects

Power and Water is an industry member of Water Research Australia Limited (WaterRA), a not for profit organisation that conducts collaborative and relevant research on water quality issues of national importance. WaterRA aims to ensure that knowledge gained from this research is transferred to industry by bringing together key water research groups and industry members across Australia.

As an active member of WaterRA, Power and Water participates and contributes funding to numerous research and development initiatives and workshops. Power and Water is partnering on a major project to explore the management within water supplies of *B. pseudomalle*, the bacterium responsible for meliodoisis. This project is scheduled for commencement in late 2019.

Charles Darwin University

In line with a growing research relationship with Charles Darwin University, Power and Water participated in a project to better understand *Cryptosporidium* inactivation under environmental conditions typical of northern Australia to assist in the risk management of catchments in warm temperate and tropical environments.

10

Documentation and reporting

The Australian Drinking Water Guidelines emphasise that documentation provides the foundation of a robust drinking water quality management system. Power and Water, as a government-owned multi-utility achieves this outcome through the use of the Power and Water Drinking Water Quality Management System, a document control framework and electronic records management system.

Operational data and process monitoring and reporting is maintained through Power and Water's data historian, with automated reporting of deviations in operating parameters to appropriate parties. Power and Water continues to invest in improved monitoring and communications infrastructure to aid in automated reporting.

Controlled documentation

Document control and management is undertaken by a central business function at Power and Water. In this reporting period the team developed a number of tools and enhancements to streamline accessing documentation, primarily within Power and Water's intranet.

Drinking Water Quality Reporting

Power and Water continues to develop systematic reporting processes for water quality performance across the Northern Territory. During the 2018–19 year effort was made to improve the use of the Power and Water data historian to automate reporting across the Northern Territory, streamlining the reporting process and improving the accuracy of reporting.

Reporting to stakeholders and regulators

During this year, Power and Water's Annual Report was tabled in the Northern Territory Legislative Assembly. This report is a key mechanism for informing our Shareholding Minister and the Northern Territory Parliament about our business performance as a whole.

Power and Water produces a number of drinking water-related reports for various stakeholders including:

DoH

- Reportable incidents or events that have the potential to effect public health
- Notifiable events for exceedances to health or aesthetic characteristics
- Monthly compliance reporting.

DLGHCD

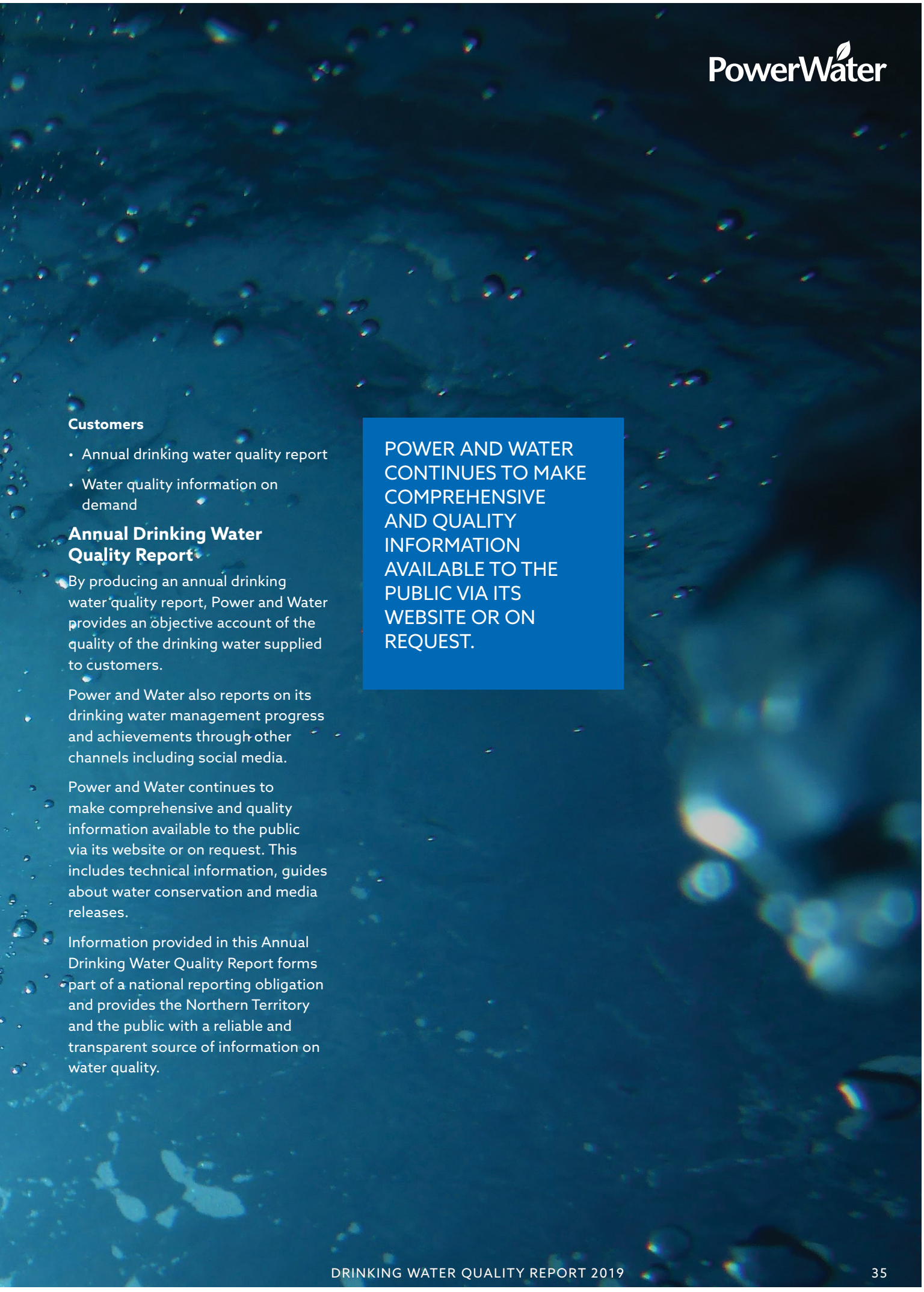
- Annual water source status report
- Annual traffic light report

Bureau of Meteorology

- Groundwater reports

DENR

- Extraction licences compliance reports



Customers

- Annual drinking water quality report
- Water quality information on demand

Annual Drinking Water Quality Report

By producing an annual drinking water quality report, Power and Water provides an objective account of the quality of the drinking water supplied to customers.

Power and Water also reports on its drinking water management progress and achievements through other channels including social media.

Power and Water continues to make comprehensive and quality information available to the public via its website or on request. This includes technical information, guides about water conservation and media releases.

Information provided in this Annual Drinking Water Quality Report forms part of a national reporting obligation and provides the Northern Territory and the public with a reliable and transparent source of information on water quality.

POWER AND WATER CONTINUES TO MAKE COMPREHENSIVE AND QUALITY INFORMATION AVAILABLE TO THE PUBLIC VIA ITS WEBSITE OR ON REQUEST.

11

Evaluation and audit

The long-term evaluation of water quality results and the use of an audit program help to determine adherence with the requirements of the Australian Drinking Water Guidelines.

In previous years, self-assessments undertaken according to the AQUALITY have identified areas for improvement, which Power and Water has worked hard to address. During the 2018–19 year the evaluation and audit program work continued through an independent AQUALITY audit.

AQUALITY Audit

The Water Services Association of Australia has developed the AQUALITY tool. AQUALITY is the standard in Australia for assessing the depth of adoption of the 12 elements of the Framework for Drinking Water Quality Management within an organisation.

During the 2018–19 year Power and Water engaged an external expert auditor, Water Futures, to undertake a third party external AQUALITY audit of Power and Water's Drinking Water Quality Management System.

The 2019 AQUALITY audit enabled Power and Water to identify aspects of water quality management requiring improvement.

This external AQUALITY audit found that Power and Water has developed a drinking water quality management system, with detailed aspects understood by relevant staff within the business.

Power and Water strives to be a best practice, customer focussed multi-utility. While these audit results met with Power and Water's desired goal, opportunities for improvement are the way for any organisation to make itself better. These opportunities have been incorporated into our Safe Water Plan 2019–2021, which charts our continuous improvement journey over the next three years.

Review and continual improvement

Senior executive support, commitment and ongoing involvement are essential to the continual improvement to drinking water quality management.

In this reporting period, substantial changes were made to the operating model of Power and Water to bring the corporation in line with our goal to be a best-practice, commercially focused and customer centric multi-utility. The integration of the services in remote Aboriginal communities into the Water Services, Power Services and Core Operations business units was a major undertaking. This will have the effect of creating a more uniform hierarchy for assessment of priorities for improvements in water quality for all our customers.

Water Quality Management Review

During this reporting period, the senior executive reviewed the outcomes of the AQUALITY audit program, and has overseen the development of the Safe Water Plan 2019–2021. The Safe Water Plan is the key medium-term continuous improvement tool used by Power and Water to improve water quality across the Northern Territory. The Safe Water Plan 2019–2021 has received the approval of Power and Water's Board and is on the way to being implemented over the next three years.

SECTION 2
Drinking Water Quality and Performance

PART A

Major and minor centres

MICROBIOLOGICAL RESULTS

Bacteria

Monitoring objective

Bacterial indicators are used for verifying the effectiveness of treatment and to assess the microbiological cleanliness of the water. Monitoring for indicator bacteria provides a useful communication tool to verify that the barriers to protect public health are working effectively.

Monitoring program

Power and Water's drinking water monitoring programs require that samples, representative of the quality of water supplied to consumers, be collected and analysed for *E. coli* at a minimum frequency. The results from this monitoring are used to demonstrate compliance and are reported as verification of the microbiological quality.

Operational monitoring for bacteria provides the detailed information needed to maintain a treatment process within defined parameters (process control). This information is not reported here.

The drinking water monitoring programs required a total of 3,687 samples to be collected for bacteriological verification assessment from 20 centres across the Northern Territory over the reporting period. A total of 4,038 samples were taken. The sample collection performance for individual urban centres for the recent period 2017–18 is presented in Table 13 and Table 14 in the Appendices.

Limitations of monitoring

Microbiological verification monitoring is not intended to provide an absolute measure of safety because of the inherent sampling and analysis limitations. Samples only ever represent a small percentage of the total water consumed. Analytical methods take substantial time to produce a result, which means the water is already consumed before a result is received.

Compliance performance

Performance can be regarded as satisfactory if over the preceding 12 months:

- At least the minimum number of programmed samples has been tested for *E. coli*.

For the 2018–19 reporting period, 99 per cent of scheduled samples were collected across all communities. Further information is detailed in Appendix B Tables 11 to12.

No *E. coli* is detected in 100 per cent of samples as per the ADWG (this excludes repeat or special purpose samples).

During the 2018–19 reporting period, the 100 per cent *E. coli* free target was achieved in all major and minor urban centres in the Northern Territory. Figure 5 and 6 show the percentage of samples taken in major urban centres between 2014 and 2019 in which no *E. coli* were detected.

A summary of the incidents that occurred during the monitoring period can be found in Table 9.

Figure 5 Percentage of samples taken in major urban centres in which no *E. coli* was detected for monitoring program periods 2014–19

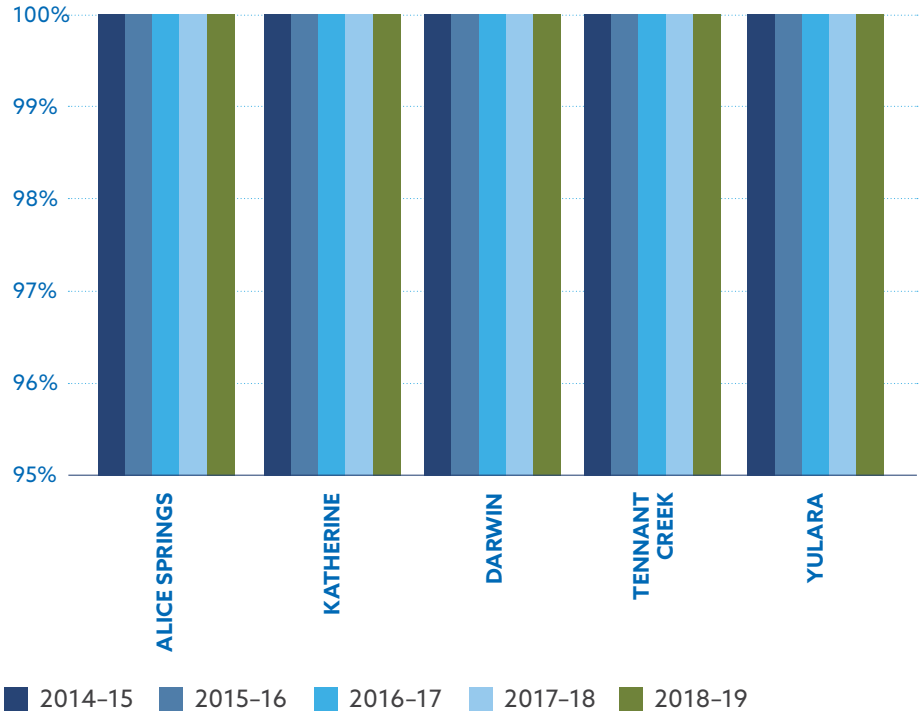
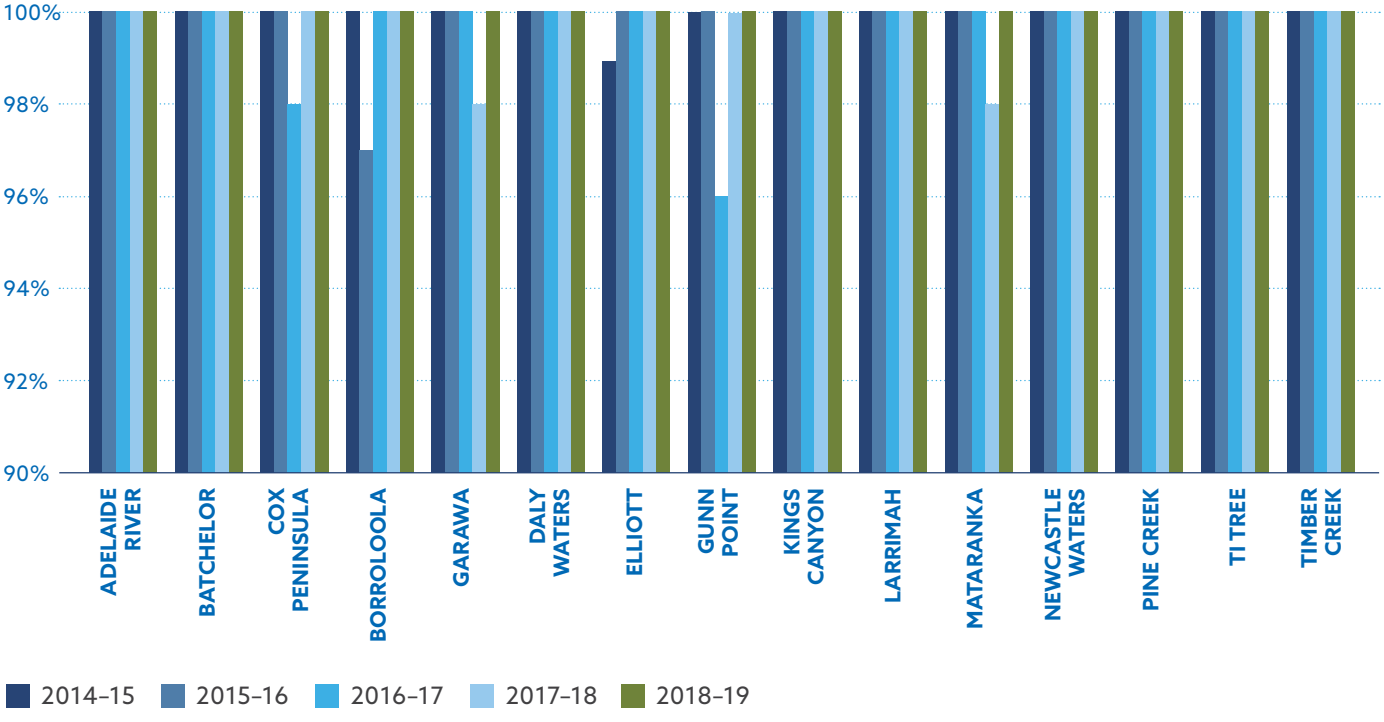


Figure 6 Percentage of samples taken in minor urban centres in which no *E. coli* was detected for monitoring program periods 2014–19



Naegleria fowleri

Investigations into and the detection of *N. fowleri* in the Darwin distribution system in 2005 prompted Power and Water to undertake extensive monitoring of water supplies and to implement procedures to controlling the hazard.

An effective chlorine residual maintained throughout the distribution system provides protection and limits the regrowth of *N. fowleri*. Free chlorine at 0.5 mg/L or higher will control *N. fowleri*, provided the disinfectant persists at that concentration throughout the water supply system. The target is to maintain a minimum free chlorine residual of not less than 0.5 mg/L throughout the entire supply.

During the reporting period, Water Services conducted the routine *N. fowleri* monitoring program, collecting 196 samples from Darwin. Across the Northern Territory sampling for investigation also occurred at centres without previous detection or in the sediments cleaned out of the drinking water distribution tanks.

The results from the 2018–19 *N. fowleri* monitoring program can be found in Table 5.

Table 5 Thermophyllic Amoeba detections, monitored supplies and investigation 2018–19

CENTRE ROUTINE MONITORING	SAMPLES COLLECTED	AMOEBA TOTAL (ORGS/L)	HARTMANELLA (/L)	NAEGLERIA - TOTAL (ORGS/L)	NAEGLERIA FOWLERI (ORGS/L)	WILLAERTIA MAGNA (ORGS/L)
Darwin Verification Distribution System	196	2	1	0	0	1
Total Samples	**196**					
CENTRE INVESTIGATIVE MONITORING	**CENTRE ROUTINE MONITORING**					
Alice Springs	6	0	0	0	0	0
Katherine	30	0	0	0	0	0
Tennant Creek Investigative	56	0	0	0	0	0
Gunn Point Investigative	43	1	1	0	0	0
Yulara Investigative	8	0	0	0	0	0
Total Samples	**143**					

Burkholderia pseudomallei

B. pseudomallei is the agent responsible for melioidosis and despite being ubiquitous in the tropics, the understanding in a drinking water context is developing. Appropriate chlorination controls this pathogen, with recent research helping to identify water supplies at risk of contamination.

Power and Water's drinking water monitoring programs have included *B. pseudomallei* as an investigative and research activity since its detection in Darwin rural private supplies in 2010. Power and Water works closely with the Menzies School of Health Research to identify water supplies at risk.

CHEMICAL AND PHYSICAL RESULTS

The results of monitoring water quality parameters are presented in this report as statistical values.

Health related parameters are reported as a 95th percentile where statistically adequate data is available. If data is limited, values are reported as the maximum value. As specified by the Australian Drinking Water Guidelines, aesthetic and other parameters are reported as a mean value.

Table 14 and Table 15 in the Appendices show one year of results for the health, aesthetic and other parameters in each major and minor urban centre drinking water respectively.

Radiological results

All water supplies are examined to gain an initial screening level of gross alpha and gross beta activity concentrations. The Annual Radiological Dose (ARD) is calculated only for supplies that had one or more samples above the screening level.

To comply with the ADWG, the radiological data used in the calculation of the total annual radiation dose must be no more than two years outside the reporting period for groundwater supplies and no more than five years for surface water. Data covers the period: 2014–19 for surface water and 2017–19 for groundwater.

Annual assessment

All water supplies passed the annual ADWG radiological limit of 1 mSv/yr in 2018–19. As shown in Table 6, the majority of water supplies complied with the ADWG screening level, with gross alpha and gross beta radioactivity levels below 0.5 Bq/L (PASS) during reporting periods. Results for the radiological assessment of all supplies for 2018–19 are shown in Table 13 in the Appendices.

Kings Canyon's water supply has higher levels of natural occurring radionuclides than other Northern Territory water supplies and as a result is intensely monitored. Kings Canyon radiological dose passes the guideline limit during the reporting period 2018 to 2019.

ALL WATER SUPPLIES PASSED THE ANNUAL ADWG RADIOLOGICAL LIMIT OF 1 MSV/YR IN 2018–19

Table 6 Summary of annual radiological assessments

REPORTING YEAR		2014 15	2015 16	2016 17	2017 18	2018 19
Total number of centres sampled[1]		20	20	20	20	20
Number of centres that comply to the screening level (0.5Bq/L)	Major	3	3	2	4	5
	Minor	11	12	12	12	14
Number of centres exceed the annual guideline value (1.0 mSv/year)	Major	None	None	None	None	None
	Minor	1	1	None	None	None

[1] The town camps Garawa 1 and 2 are provided emergency support and monitoring.

Chemical health parameters

Trihalomethanes

During the 2018–19 monitoring period, all urban water supplies were assessed for THMs. The concentration of THMs for water supplies ranged during the period from <0.004 to 0.080mg/L, all well below ADWG health guideline limit of 0.25 mg/L, Table 13 in the Appendices.

THM levels remain similar to those measured in previous years. The low levels of THMs measured in the water supplies is due to the low level of total organic carbon, the precursors of THMs, in Northern Territory waters.

Pesticides

The pesticide monitoring program focuses on 46 commonly used pesticides, including organochlorine, organophosphate and triazine pesticides, insecticides and acidic herbicides.

Although monitored for several years, pesticides have rarely been detected in Northern Territory water supplies, despite use in some areas. Due to these results, pesticide monitoring during 2018–19 was restricted to Darwin and Katherine water supplies. These supplies are considered potentially vulnerable to pesticide contamination with agricultural activities and rubbish dumping close to production bores and surface water sources.

Good management of surface water sources and bores reduces the risk of drinking water becoming contaminated with pesticides. Bores are required to be constructed to standards that ensure bore head integrity and prevent surface water (potentially containing pesticides) from entering the bore. Pesticide use is strictly controlled in catchments for surface waters, such as reservoirs and rivers.

Nitrate

Nitrate concentrations in the Northern Territory groundwater come from a variety of natural sources. Termite mounds, nitrogen fixing bacteria and plants contribute to the soil nitrate levels.

The ADWG recommends that nitrate concentrations between 50–100 mg/L are a health consideration for infants younger than three months, although levels up to 100 mg/L can be safely consumed by adults.

Ti Tree drinking water typically has nitrate levels on or around 50 mg/L and less than 100 mg/L. The DoH gives regular advice to Ti Tree customers who are bottle feeding infants that the water should not be used.

Lead

The presence of lead in household plumbing is a problem worldwide, as any lead in brass fittings is dissolved into the water. Lead is not found in the source water used for public water supplies. Instead, lead can enter tap water when plumbing materials containing lead start to corrode.

Lead was not detected from most of the water samples taken in the Northern Territory. However where the sample site plumbing has started to corrode lead can be detected.

A DECREASE IN THE NUMBER OF WATER QUALITY COMPLAINTS OCCURRED IN THE 2018–19 REPORTING PERIOD.

CUSTOMER SATISFACTION

Water quality customer complaints

Complaints from consumers concerning the quality of their drinking water mostly focus on the aesthetic aspects of appearance, taste and odour. Like other Australian drinking water providers, Power and Water records all water quality complaints made by customers and reports them to the National Water Commission.

Number of complaints

Table 7 shows the total number of complaints specific to water quality made by customers between 2015 and 2019. A decrease in the number of water quality complaints occurred in the 2018–19 reporting period.

A month by month breakdown of Darwin water quality complaints is shown in Figure 7 and reflects a discernible pattern between complaints in water quality and seasonality. The main water complaint was discoloured water such as clarity and particles. Seasonal changes to temperature and wind cause water quality changes in Darwin River Reservoir and flow changes in the distribution.

As with many water supply reservoirs, Darwin River Reservoir is subject to seasonal water quality changes. Stratification is the development of distinct layers of water of different temperature or density at various depths in a water body. Stratification develops when the upper layers of the reservoir are heated faster than the heat can disperse into the lower depths of the reservoir. The differences between the layers limit circulation between them and leads to significantly different aesthetic water qualities.

Once the reservoir has stratified, a large amount of energy is required to disrupt the layered structure and mix the reservoir again. Destratification occurs once the surface temperature cools during a monsoonal event or when the dry season trade wind and cool nights arrive. The layers mix to produce discoloured water throughout the reservoir. Low quality anoxic water from the depths of the reservoir mix in with the surface water and it is drawn into the supply.

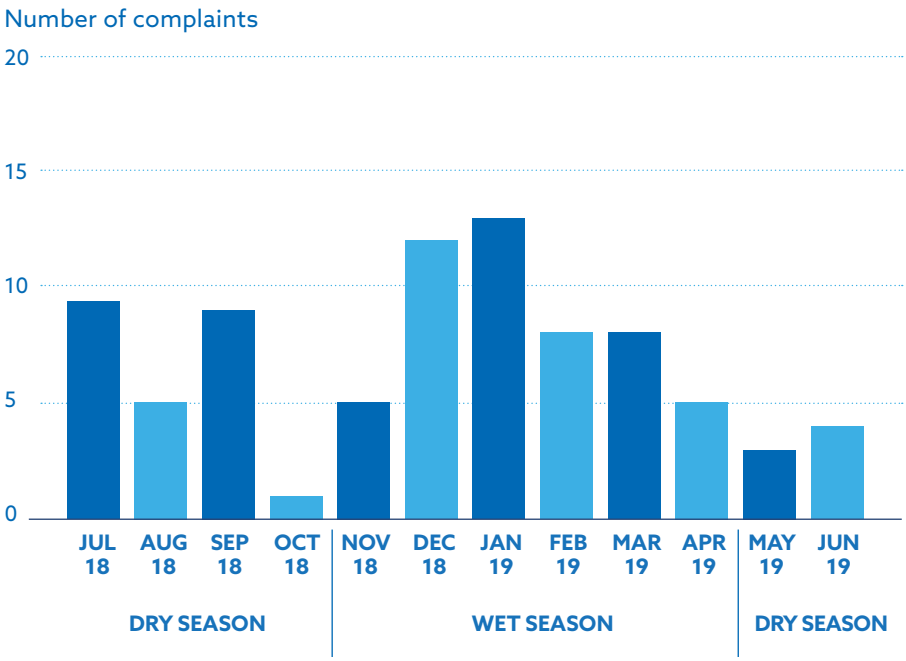
Iron and manganese entering the distribution system oxidise and will precipitate out of solution, creating discoloured water. This pattern corresponds with the comparatively high number of complaints received in the wet season and early dry season shown in Figure 7.

Power and Water strives to minimise the impact of these seasonal variations. If a customer reports discoloured water, the mains supplying the customer's residence is flushed. In addition, water quality is monitored at a number of locations in the Darwin water supply to gauge the extent of discoloured water and determine when widespread flushing is required.

Table 7 Water quality complaints

REGION	PROPERTIES (2018 2019)	2014 15	2015 16	2016 17	2017 18	2018 19
Adelaide River	96	6	0	0	0	1
Alice Springs	12,502	4	4	0	9	6
Darwin	60,749	208	212	117	127	71
Katherine	2,242	2	4	0	3	5
Tennant Creek	1,228	0	0	0	0	0
Borroloola	255	0	0	0	0	0
Total	**76,774**	**220**	**220**	**117**	**139**	**84**
Complaints per 1000 properties (for the water supply system specified)	Properties based on number of meters	2.93	2.93	1.56	1.81	1.11

Figure 7 monthly drinking water quality complaints received for the Darwin water supply in 2018–19.



Types of complaints

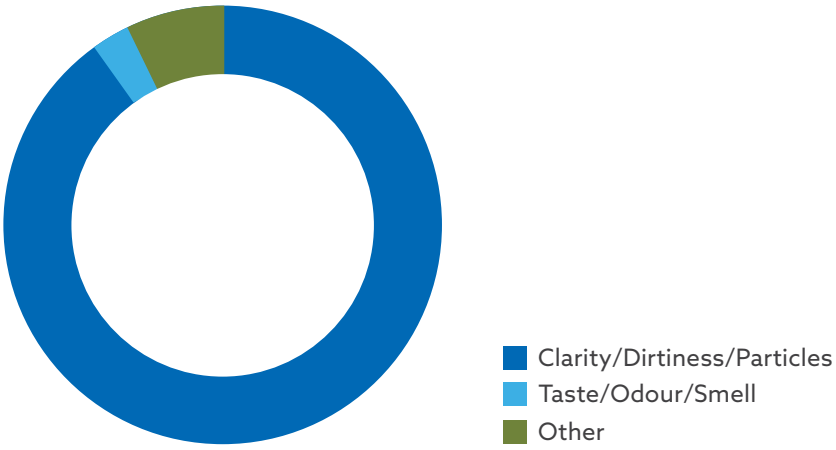
Ninety per cent of Darwin's customer complaints related to discoloured water. The majority of discoloured water is normally a destratification event at the reservoir or flow changes dislodging sediments in the distribution pipes.

Milkiness or cloudiness is most commonly due to the re-pressurising of water pipes. This causes trapped air to dissolve in the water and minute air bubbles form when the tap is turned on, creating a milky appearance, which clears if the water is left to stand.

Customer complaints about odour are attributable to free chlorine residuals. Chlorine is maintained at a minimum of 0.5 mg/L and at this level it can be objectionable to some customers. This level is required as a response to the detection of *N. fowleri* in some Northern Territory water supplies.

If there is doubt as to the cause of a water quality problem, an investigation is carried out and when necessary, water samples are taken and analysed.

Figure 8 Customer complaints for Darwin 2018–19 by complaint type



PowerWater

IN ALL INCIDENTS THE REMEDIAL ACTIONS WERE GIVEN PRIORITY AND THE DOH WAS NOTIFIED TO HELP DETERMINE THE MOST EFFECTIVE CORRECTIVE ACTIONS.

RECORDED EMERGENCIES/INCIDENTS

During the 2018–19 reporting period the following incidents occurred:

- Three 'backflow events' were detected in the Darwin region, including Palmerston
- *E. coli* was not detected from verification water samples

In all incidents the remedial actions were given priority and the DoH was notified to help determine the most effective corrective actions. Investigations were conducted to determine the likely causes and identified preventive corrective actions.

E. coli detections

During the reporting period, no *E. coli* was recorded from verification water samples, see Table 12 and 13.

Backflow detections

Backflow is the unwanted reverse flow of water from a customer's premises to the Corporation's water supply system. Under normal conditions, water flows from Power and Water's pressurised water supply system to the customer's property. It is possible for water to flow in the reverse direction if pressure changes. This backflow has the potential to contaminate drinking supply.

Prevention of backflow is usually achieved by the use of Backflow Prevention Devices (BPD) located at strategic points like the water meter as part of a barrier approach to minimise the risk of contamination of the water supply.

To protect the potable water supply from backflow contamination, Power and Water require backflow prevention devices to be installed at the property boundary (containment protection). A program of checking backflow prevention devices identified three situations where backflow may have occurred, see Table 8.

The extent of the backflow and water quality of the backflow into the distribution was found to be suitable for drinking in all three situations. The BPD were checked and new devices installed and at the strategic points.

Table 8 Incidents during the drinking water quality monitoring program period 2018–19

SUPPLY	INCIDENT	DETECTION DATE	LOCATION
Darwin	Backflow	01 August 2018	Kitchener Drive
Darwin	Backflow	03 August 2018	Thorngate Road
Darwin	Backflow	28 September 2018	Frances Bay Drive

PART B

Remote communities

MICROBIOLOGICAL PARAMETERS

Water quality data compiled in Appendix B for the 2018–19 reporting period have been processed according to the ADWG recommends for the long term evaluation of health and aesthetic parameters:

- one year of data be used
- for health related parameters, the maximum value (or 95th percentile where there are greater than 30 data points) and significant figure should be used for the reporting period
- for aesthetic parameters, the average value for data in the reporting period should be reported
- for radiological analysis, two years of data should be used for ground water sources, and five years of data for surface water sources. The reported value should be the maximum result for the reporting period.

Monitoring objective

Bacterial indicators are used for verifying the effectiveness of treatment and to assess the microbiological cleanliness of the water. Monitoring for indicator bacteria provides a useful communication tool to verify that the barriers to protect public health are working effectively.

Monitoring program

Power and Water's drinking water monitoring programs require that samples, representative of the quality of water supplied to consumers, be collected and analysed for *E. coli* at a minimum frequency. The results from this monitoring are used to demonstrate compliance and are reported as verification of the microbiological quality.

Operational monitoring for bacteria provides the detailed information needed to maintain a treatment process within defined parameters (process control). This information is not reported here.

The sample collection performance for individual remote centres for the recent period 2018–19 is presented in Table 15 to Table 17 in the Appendices.

Limitations of monitoring

Microbiological verification monitoring is not intended to provide an absolute measure of safety because of the inherent sampling and analysis limitations. Samples only ever represent a small percentage of the total water consumed. Analytical methods take substantial time to produce a result, which means the water is already consumed before a result is received.

FOR THE 2018–19 REPORTING PERIOD, 98 PER CENT OF SCHEDULED SAMPLES WERE COLLECTED ACROSS ALL REMOTE COMMUNITIES.

CHEMICAL AND PHYSICAL PARAMETERS

Compliance performance

Performance can be regarded as satisfactory if over the preceding 12 months:

- at least the minimum number of programmed samples has been tested for *E. coli*
- samples tested are representative of the quality of water supplied to consumers
- no *E. coli* is detected in 100 per cent of samples as per the ADWG (this excludes repeat or special purpose samples).

For the 2018–19 reporting period, 98 per cent of scheduled samples were collected across all remote communities. Further information is detailed in Appendix B Tables 15 to 18.

During the 2018–19 reporting period, the 100 per cent *E. coli* free target was achieved in all Remote centres in the Northern Territory. Bulla and Nauiyu had *E. coli* detected in the drinking water samples. Bulla detections were due to a failure of the disinfection system while Nauiyu detections were due to error collecting the sample; see recorded emergencies section and Table 10.

The results of monitoring water quality parameters are presented in this report as statistical values.

Health related parameters are reported as a 95th percentile where statistically adequate data is available. If data is limited, values are reported as the maximum value. As specified by the Australian Drinking Water Guidelines, aesthetic and other parameters are reported as a mean value.

Tables 20 to 27 in the Appendices show the results of the health, aesthetic and other parameters for all remote communities.

Radiological results

All water supplies are examined to gain an initial screening level of radioactivity. Communities that had one or more samples above the screening level have the annual radiological dose (ARD) calculated.

To comply with the ADWG, the radiological data used in the calculation of the total annual radiation dose should be no more than two years outside the reporting period for ground water supplies, and no more than five years for surface water.

As shown in Table 10, all water supplies passed the annual guideline limit of 1 mSv/yr in 2018–19. The majority of water supplies pass the ADWG screening level during reporting periods.

The radiation dose is calculated only for supplies that had one or more samples failing the screening level. Results for the radiological assessment of all supplies for 2018–19 are shown in Table 19, 21, 23 and 25 in the Appendices.

Table 9 Summary of annual radiological assessments

REPORTING YEAR		2018 19
Total number of centres sampled		70
Number of communities that comply to the screening level (0.5Bq/L)	Northern Region	23
	Katherine Region	17
	Barkly Region	2
	Southern Region	11
Number of communities exceed the annual guideline value (1.0 mSv/year)		None

Health parameters

Physical and chemical health parameters are water quality characteristics that may present a risk if the consumer is exposed to concentrations above ADWG levels over a lifetime. An assessment of the data for this reporting period can be found in the Appendices.

Antimony concentrations in drinking water are recommended by the ADWG to not exceed 0.003 mg/L.

For this reporting period antimony concentrations ranged between 0.005 mg/L and 0.007 mg/L in Beswick's water supply. Samples are collected on a quarterly basis to monitor the levels. Antimony occurs naturally in the ground and through the dissolution of minerals and ores in the water.

Barium concentrations in drinking water are recommended by ADWG to not exceed 2 mg/L.

For this reporting period barium levels ranged between 4 mg/L and 10 mg/L. in Bulla's water supply. Samples are collected on a quarterly basis to monitor the levels of barium present in the water at Bulla.

Fluoride concentrations in drinking water are recommended by ADWG to not exceed 1.5 mg/L.

Fluoride is one of the most abundant elements in the Earth's crust. It naturally occurs in groundwater supplies and is present in most food and beverage products and toothpaste.

The concentration of natural fluoride in Territory groundwater supplies depends on the type of soil and rock that the water comes into contact with. Generally, surface water sources have low natural fluoride concentrations (around <0.1 to 0.5 mg/L) whereas groundwater sources may have relatively high levels (range from 1.0 to 10 mg/L).

In the correct amounts, fluoride in drinking water helps build strong, healthy teeth that resist decay. Power and Water operate five fluoride optimisation systems in remote communities including Angurugu, Maningrida, Nguiu, Umbakumba, and Wadeye. The minimum fluoride for protection against dental caries is about 0.5 mg/L, although about 1.0 mg/L is optimal in temperate climates.

The majority of communities in the Barkly and Southern regions have fluoride levels between 0.5 mg/L and 1.5 mg/L. Maximum fluoride values recorded of 1.7mg/L,1.9mg/L, and 1.9mg/L at Alpurrurulam, Nyirripi, and Yuelamu respectively for the 2017-18 reporting year (Figure 9).

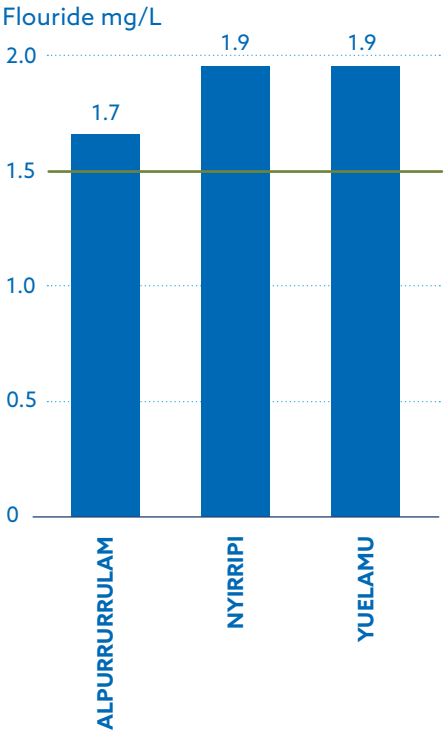
In contrast, most water supplies in the Northern and Katherine regions have naturally low fluoride levels due to the nature of the shallow groundwater supplies and use of surface water supplies in some communities.

Nitrate levels in Territory drinking water supplies have been partially attributed to nitrogen fixing by native vegetation and cyanobacteria crusts on soils. Termite mounds appear to be a significant nitrate source, possibly due to the presence of nitrogen-fixing bacteria in many termite species and the nitrogen-rich secretions used to build mounds.

The ADWG recommends that nitrate levels between 50–100 mg/L are a health consideration for infants younger than three months, although levels up to 100 mg/L can be safely consumed by adults.

Power and Water has installed Advanced Water Treatment systems at Ali Curung, Yuelamu and Kintore to reduce nitrate levels to below the guideline of 50mg/L. Centres that remain around 50 mg/L include Pmara Jutunta, (as well as Ti Tree) and Nturiya. The DoH gives regular advice to customers about the suitability of the water when bottle feeding infants.

Figure 9 Communities with maximum fluoride levels greater than 1.5 mg/L



Uranium is found in some groundwater aquifers from the local geological formations. Conventional water treatment processes are not effective in removing uranium so Power and Water is investigating viable economic options to lower uranium concentrations at the communities of Willowra, Wilora, Laramba and Yuendumu.

Communities with elevated levels of uranium in the water supply, recorded during the reporting period, are shown in Figure 10.

Aesthetic parameters

Aesthetic parameters are characteristics associated with the acceptability of water to the consumer in terms of appearance, taste and odour of the water.

Chloride is recommended by ADWG to not exceed 250 mg/L to avoid salty tasting water. The taste threshold of chloride is in the range 200–300 mg/L. The chloride content of water can affect corrosion of pipes and fittings.

Typical values depend to a large extent on local groundwater geological conditions, but concentrations of 150 mg/L are not uncommon in some areas. Chloride is present in natural waters from the dissolution of salt deposits in soil and rock.

Communities with elevated levels of chloride in the water supply recorded during the reporting period are shown in Figure 11.

Chlorine is used as disinfectants for drinking water supplies. Based on health considerations, the guideline value for total chlorine in drinking water is 5mg/L. Free chlorine has an odour threshold in drinking water about 0.6mg/L, but some people are particularly sensitive and can detect amount as low as 0.2mg/L. At some points in a water supply the odour threshold value of 0.6mg/L is exceeded, in order to maintain an effective disinfectant residual within other parts of the supply.

Figure 10 Communities with maximum uranium levels greater than 0.017 mg/L

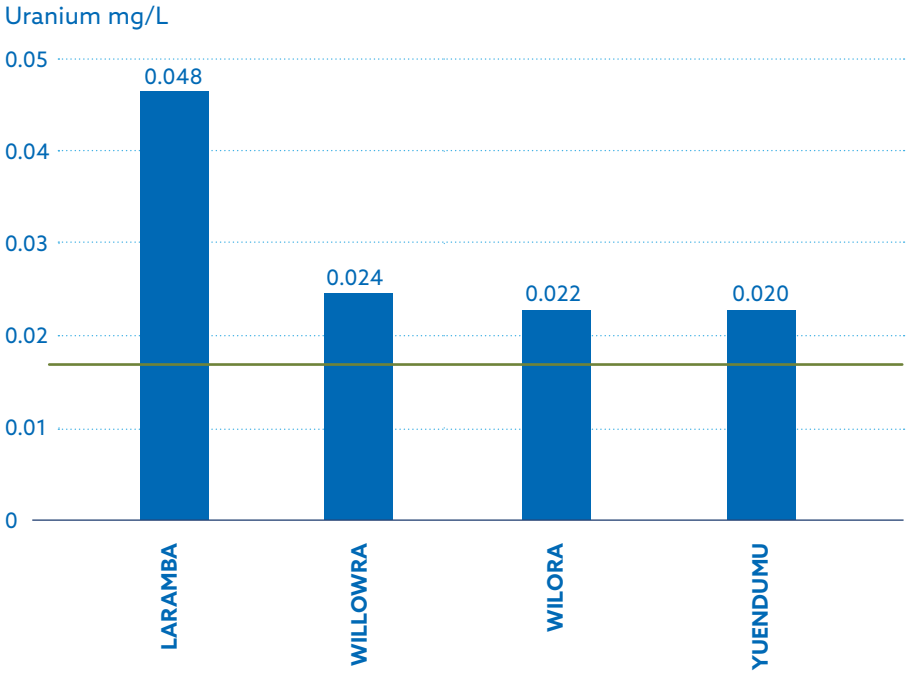
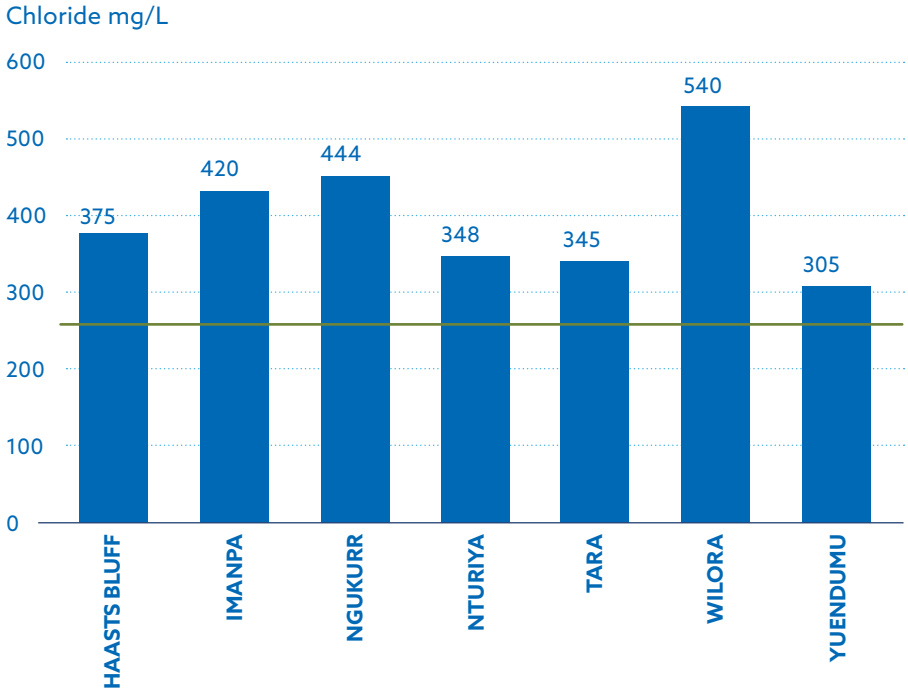


Figure 11 Communities with average chloride levels greater than 250 mg/L taste threshold



Hardness is primarily the amount of calcium and magnesium ions in water and is expressed as a calcium carbonate ($CaCO_3$) equivalent. High hardness requires more soap to achieve lather and may lead to excessive scaling in hot water pipes and fittings.

Soft water or water low in total calcium and magnesium ions, may also cause corrosion in pipes, although this will depend on other physical and chemical characteristics such as pH, alkalinity and dissolved oxygen. The ADWG recommends hardness levels below 200 mg/L to minimise scaling in hot water systems.

Hard water or water with calcium carbonate levels above 500mg/L (Figure 12) may lead to excessive scaling of pipes and fittings, which can impact on infrastructure service life and indirectly impact health through impeding access to water.

Typically across the Territory groundwater supplies close to the coast are described as 'soft', as the water is drawn from relatively shallow aquifers with naturally low pH and hardness levels. Inland water supplies are often described as 'hard', as the water is stored for longer periods in deeper aquifers resulting in 'rich' water chemistry.

Iodine has a taste threshold of 0.15 mg/L in water. The element iodine is present naturally in seawater, nitrate minerals and seaweed, mostly in the form of iodide salts. It may be present in water due to leaching from salt and mineral deposits. It is considered as an essential trace element for humans.

Iron has a taste threshold of about 0.3 mg/L in water and becomes objectionable above 3 mg/L.

High iron concentrations give water a rust-brown appearance and can cause staining of laundry and plumbing

Figure 12 Communities with average hardness levels greater than 500 mg/L

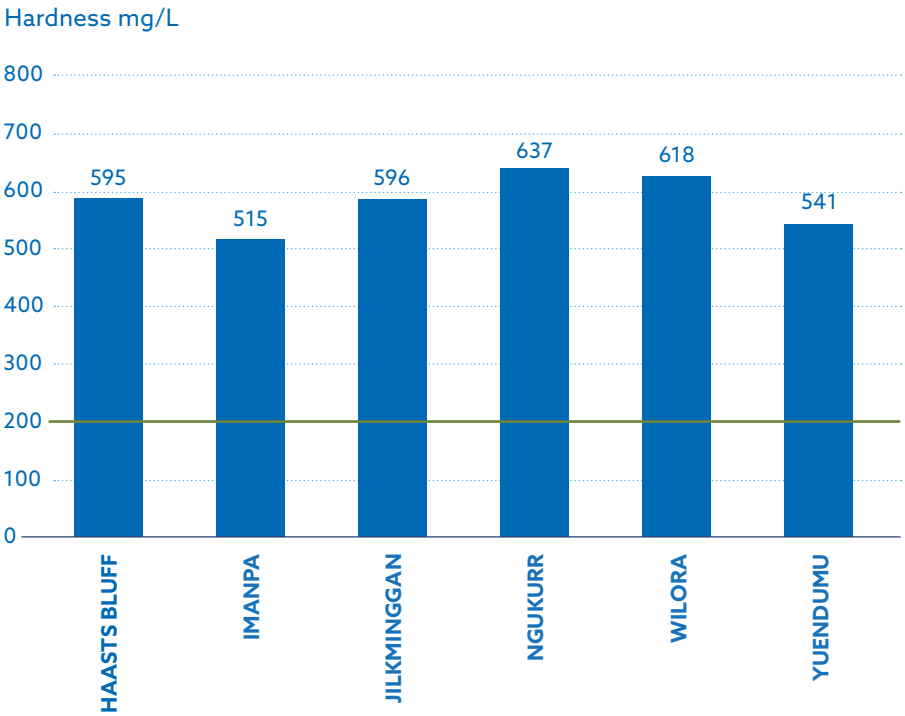
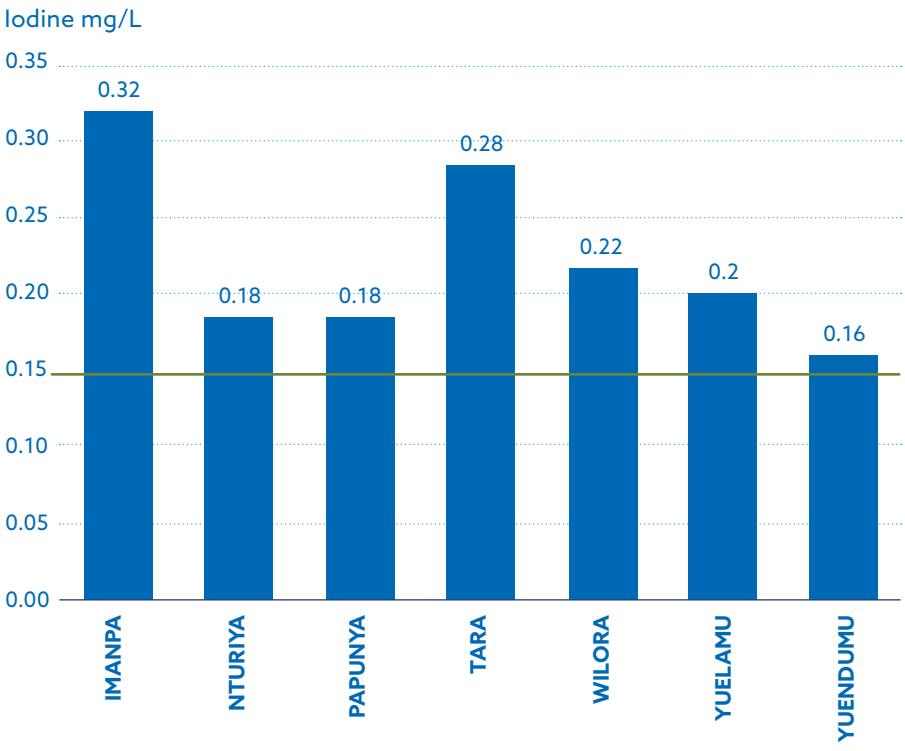


Figure 13 Communities with average iodine levels greater than 0.15 mg/L

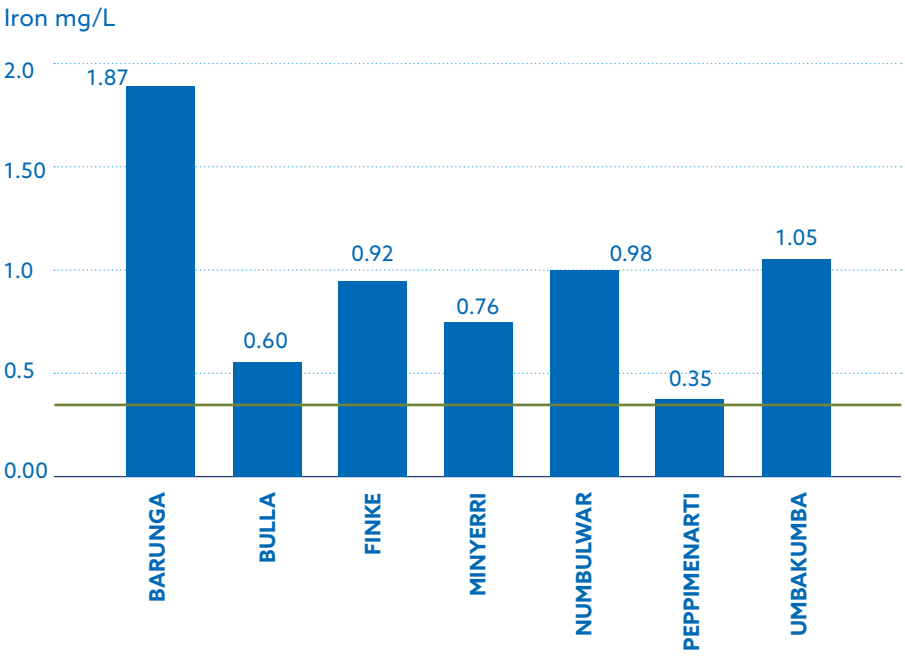


fittings and blockages in irrigation systems. The concentration of iron at the tap can also be influenced by factors such as rusting iron pipes.

Economically viable options to reduce iron levels are being investigated. Some options include infrastructure changes to maximise iron oxidation and settling, altering the operation of the production bores to maximise the use of those with reduced iron levels, and also preliminary assessments of water treatment plants. Peppimenarti and Numbulwar have both had infrastructure installed within the ground level storage tanks that maximise iron fallout, therefore providing cleaner water within the community.

Communities regularly monitored for iron levels above 0.3 mg/L can be seen (Figure 14).

Figure 14 Communities with average iron concentration greater than 0.3 mg/L

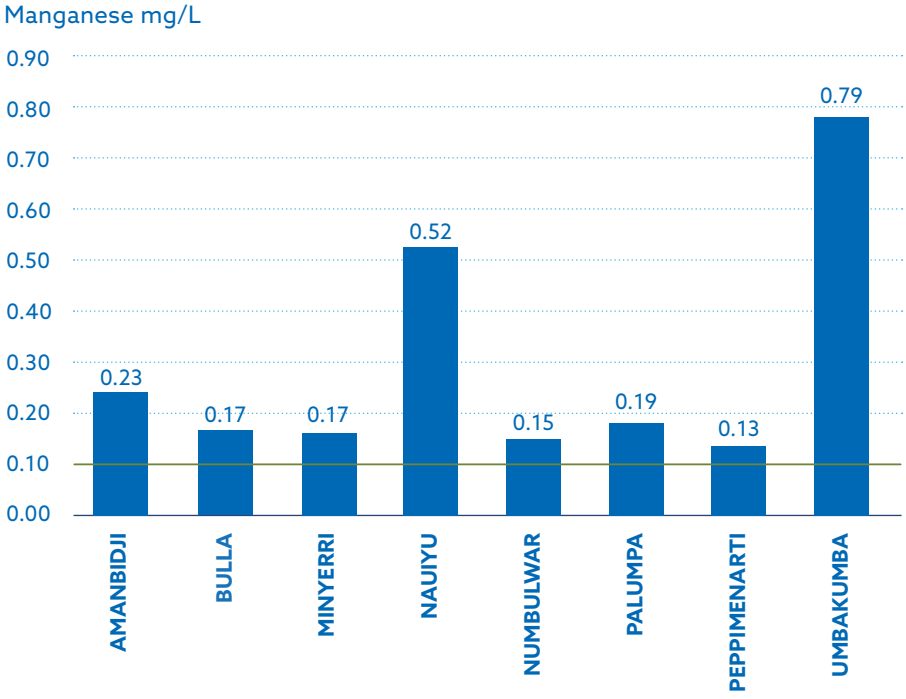


Manganese imparts an undesirable taste to water and stains plumbing fixtures and laundry. The ADWG recommends concentrations not exceed 0.5 mg/L for health considerations and 0.1 mg/L for aesthetic considerations.

Manganese occurs naturally in the ground and through the dissolution of minerals and ores in the groundwater.

For the 2017–18 reporting year, elevated aesthetic manganese levels are present in Nauiyu, Nganmarriyanga (Palumpa), Numbulwar, Bulla and Minyerri as shown in Figure 15.

Figure 15 Communities with average manganese concentration greater than 0.1 mg/L



pH levels below 6.5 are likely to cause corrosion of pipes and fittings while levels above 8.5 can cause scaling, particularly on hot water systems. The ADWG recommend pH levels in drinking water should be between 6.5 and 8.5.

Typically, Territory communities that rely on groundwater supplies near the coast are described as 'corrosive', as the water is drawn from relatively shallow aquifers and has naturally low pH and hardness levels.

Silica forms scale on surfaces, the ADWG recommend not exceeding 80 mg/L to avoid this. Elevated silica levels have been identified in Lajamanu, Kintore, Laramba, Nyirripi, and Pmara Jutunta as shown in Figure 16.

Sodium is recommended by ADWG to not exceed180 mg/L to avoid salty tasting water. The sodium ion is widespread in water due to the high solubility of sodium salts and the abundance of mineral deposits.

Total dissolved solids (TDS) affect how the water tastes. TDS comprise sodium, potassium, calcium, magnesium, chloride, sulphate, bicarbonate, carbonate, silica, organic matter, fluoride, iron, manganese, nitrate and phosphate.

Water with low TDS can taste flat, while water with TDS above 500 mg/L could cause scaling in taps, pipes and hot water systems. Levels greater than 900 mg/L significantly affect taste and may also cause moderate to severe scaling.

Based on taste, the ADWG recommend TDS levels below 600 mg/L.

Figure 16 Communities with average silica level greater than 80 mg/L

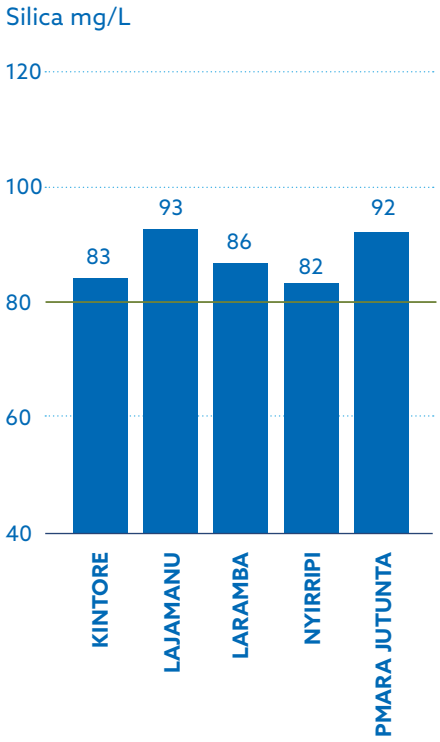
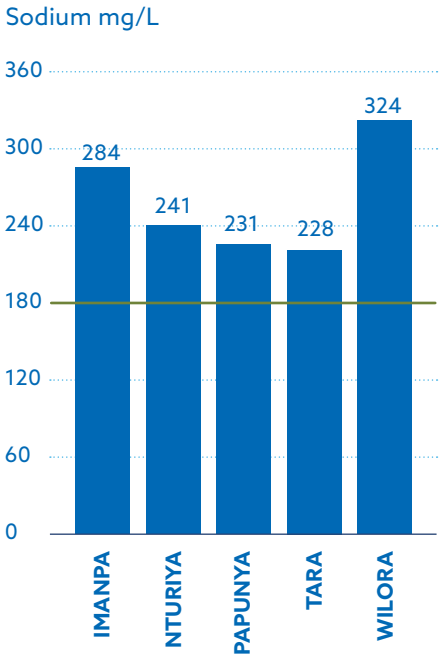


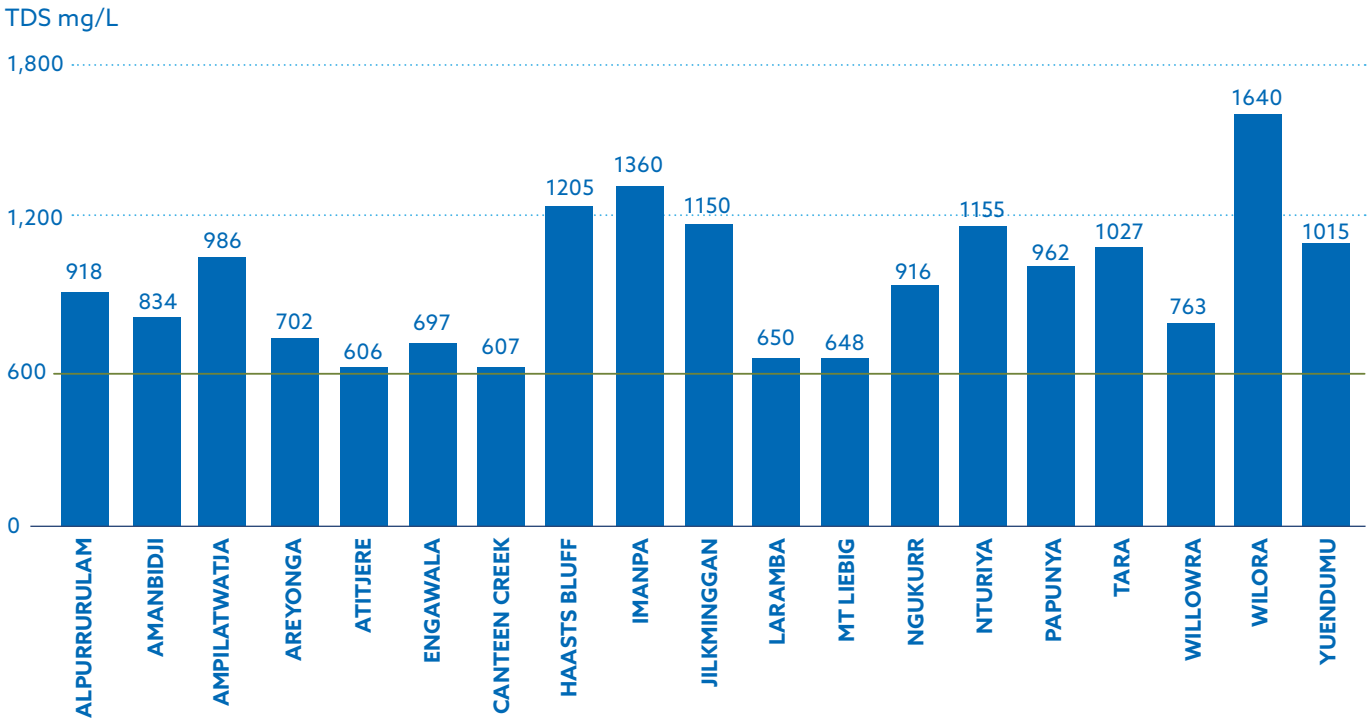
Figure 17 Communities with average sodium concentration greater than 180 mg/L



More information is also available from the Power and Water website: http://www.powerwater.com.au/news_and_publications/publications/remote_communities

The results of water quality testing for each of the communities are provided in the tables Appendix B.

Figure 18 Communities with levels of TDS greater than 600 mg/L



RECORDED EMERGENCIES/INCIDENTS

Power and Water responds immediately to emergencies or incidents, with the primary response being to ensure adequate disinfection of the water supply, followed by reporting to the regulator, to help determine the most effective corrective actions. Investigations were conducted to determine the likely cause and the effect of the corrective actions. During the 2018–19 reporting period, five incidents occurred.

E. coli detections

E. coli was detected on two occasions over the 2018–19 reporting period. The DoH did not have to issue any public advice due to *E. coli* detections. Immediate action was taken including a Water Quality Specialist attending both communities to confirm the treatment system performance and to undertake resampling.

The *E. coli* detection at Nauiyu was identified to be caused by sampling. The investigation found this sample was contaminated during collection, so the DoH had no need to issue advice.

The detection of *E. coli* at the elevated tank in Bulla was investigated and identified as a disinfection failure due to elevated turbidity in the water. The supply was resampled and there were no detections in any of the resamples.

Precautionary boil water alerts

Two precautionary boil water alerts were issued by DoH for disinfection incidents that occurred at Bulla and the communities affected by Tropical Cyclone Trevor.

In Bulla, operational issues caused uncertainty about water disinfection, with staff unable to verify disinfection on-site or using on-line remote sensing. A precautionary boil water alert was issued and remained in place until on-site verification was undertaken.

At several communities, Tropical Cyclone Trevor affected the water supply. As part of the emergency response protocol, Power and Water turned off the chlorination system and issued a standing boiled water alert as operators were unable to undertake any maintenance at the community for a number of days following the cyclone. Once safe to do so and on receipt of safe water quality analysis the boil water alert was lifted at the last community on 21 March 2018.

Table 10 *E. coli* incidents during the drinking water quality monitoring program period 2018–19

YEAR	SUPPLY	SAMPLES WITH *E. COLI* DETECTIONS	COLLECTION DATE	NUMBER OF *E. COLI* DETECTED IN SAMPLE (MPN/10ML)
2018–19	Nauiyu	1	19 March 2019	10
	Bulla	1	19 March 2019	8

Glossary of acronyms

ADWG	Australian Drinking Water Guidelines 2011
ANSI	American National Standards Institute
ARD	Annual Radiological Dose
AS/NZS	Australian/New Zealand Standards
AWA	Australian Water Association
AWT	Advance Water Treatment
AWWA	American Water Works Association
DENR	Department of Environment and Natural Resources
DIPL	Department of Infrastructure, Planning and Logistics
DLGHCD	Department of Local Government, Housing and Community Development
DoH	Department of Health
DPIR	Department of Primary Industry and Resources
DWQMS	Drinking Water Quality Management System
ESO	Essential Service Operator
FC/TC	Free chlorine/Total chlorine ratio
FIS	Facilities Information System
GOC	Government Owned Corporation
IBM	International Business Machines
ICS	Industrial Control System
IES	Indigenous Essential Services
ISO	International Organisation for Standardisation
MoU	Memorandum of understanding
MSHR	Menzies School of Health Research
N/A	Not applicable
NHMRC	National Health and Medical Research Council
NPR	National Performance Report
NRMMC	National Resources Management Council
NT	Northern Territory
NTG	Northern Territory Government
PAM	Primary amoebic meningoencephalitis
PI System	Process information system
RM8	Record Manager 8
SA	South Australia
SCADA	Supervisory control and data acquisition
TDS	Total dissolved solids
THMs	Trihalomethanes
UV	Ultraviolet
WIMS	Work Information Management System
WIOA	Water Industry Operators Association
WaterRA	Water Research Australia

Units of measurement

Bq/L	becquerels per litre
mg/L	milligrams per litre
MPN/100mL	most probable number per 100 millilitre
mSv/yr	millisieverts per year
ML	mega litres
µS/cm	micro Siemens per centimetre
HU / CU	Hazen unit/ colour unit

Legend: Results table (Appendices A and B)

Health parameters	Assessments are reported as the 95th percentile for large data sets (30 or more samples) and maximum value for small data sets. Data covers the period 2017–18. Exceedances are shown bold.
Aesthetic parameters	Assessments are reported as the mean. Data covers the period 2017–18. Exceedances are shown bold.
Other parameters	Assessments are reported as the mean. Data covers the period 2017–18. Exceedances are shown bold. No guideline value applicable
<	All values reported proceeded by "<" indicate the value is below the level of detection of the analytical method.

APPENDIX A
Drinking water quality: Major and minor centres

Table 11 Bacteriological monitoring in major centres 2018–19

CENTRE	PARAMETER (MPN/100ML)	TARGET LEVEL	TOTAL NO. SAMPLES REQUIRED	TOTAL NO. SAMPLES COLLECTED	TOTAL EXCEEDANCES (NO.)	SAMPLES PASSING REPORTING LEVEL (%)
Alice Springs	*E. coli*	No *E. coli* in 100% samples	187	188	0	100%
	Total Coliforms	<10 in 95% of samples	187	188	0	100%
Katherine	*E. coli*	No *E. coli* in 100% samples	182	183	0	100%
	Total Coliforms	<10 in 95% of samples	182	183	0	100%
Darwin	*E. coli*	No *E. coli* in 100% samples	585	590	0	100%
	Total Coliforms	<10 in 95% of samples	585	590	2	99%
Tennant Creek	*E. coli*	No *E. coli* in 100% samples	208	208	0	100%
	Total Coliforms	<10 in 95% of samples	208	208	0	100%
Yulara	*E. coli*	No *E. coli* in 100% samples	52	52	0	100%
	Total Coliforms	<10 in 95% of samples	52	52	0	100%

Table 12 Bacteriological monitoring in minor centres 2018–19

CENTRE	PARAMETER (MPN/100ML)	TARGET LEVEL	TOTAL NO. SAMPLES REQUIRED	TOTAL NO. SAMPLES COLLECTED	TOTAL EXCEEDANCES (NO.)	SAMPLES PASSING REPORTING LEVEL (%)
Adelaide River	*E. coli*	No *E. coli* in 100% samples	104	104	0	100%
	Total Coliforms	<10 in 95% of samples	104	104	1	99%
Batchelor	*E. coli*	No *E. coli* in 100% samples	104	101	0	100%
	Total Coliforms	<10 in 95% of samples	104	101	0	100%
Cox Peninsula	*E. coli*	No *E. coli* in 100% samples	52	52	0	100%
	Total Coliforms	<10 in 95% of samples	52	52	1	98%
Borroloola	*E. coli*	No *E. coli* in 100% samples	156	147	0	100%
	Total Coliforms	<10 in 95% of samples	156	147	1	99%
Garawa[1]	*E. coli*	No *E. coli* in 100% samples	104	98	0	100%
	Total Coliforms	<10 in 95% of samples	104	98	0	100%
Daly Waters	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Elliott	*E. coli*	No *E. coli* in 100% samples	156	156	0	100%
	Total Coliforms	<10 in 95% of samples	156	156	0	100%
Gunn Point	*E. coli*	No *E. coli* in 100% samples	26	26	0	100%
	Total Coliforms	<10 in 95% of samples	26	26	0	100%
Kings Canyon	*E. coli*	No *E. coli* in 100% samples	156	156	0	100%
	Total Coliforms	<10 in 95% of samples	156	156	0	100%
Larrimah	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Mataranka	*E. coli*	No *E. coli* in 100% samples	48	48	0	100%
	Total Coliforms	<10 in 95% of samples	48	48	0	100%
Newcastle Waters	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Pine Creek	*E. coli*	No *E. coli* in 100% samples	156	156	0	100%
	Total Coliforms	<10 in 95% of samples	156	156	0	100%
Ti Tree	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Timber Creek	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%

[1] Water Services support Mabunji in providing emergency support and operation of the Garawa system.

Table 13 Health parameters in major and minor centres 2018–19

	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	BORON	CADMIUM	CHLORINE (TOTAL)	CHROMIUM	COPPER	FLUORIDE
ADWG Units	0.003 mg/L	0.01 mg/L	2 mg/L	0.06 mg/L	4 mg/L	0.002 mg/L	5 mg/L	0.05 mg/L	2 mg/L	1.5 mg/L
Community	Health parameters – 95th percentile or maximum values									
Alice Springs	<0.0002	<0.0005	0.1	<0.001	0.1	<0.0002	2	<0.005	0.06	0.54
No. samples collected	8	8	8	8	8	8	187	8	8	8
Darwin	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	2	<0.005	0.09	0.75
No. samples collected	18	18	18	18	18	18	589	18	18	70
Katherine	<0.0002	0.001	<0.05	<0.001	<0.02	<0.0002	2	<0.005	0.09	0.75
No. samples collected	4	4	4	4	4	4	183	4	4	56
Tennant Creek	<0.0002	0.002	0.1	<0.001	0.5	<0.0002	1	<0.005	0.02	1.4
No. samples collected	4	4	4	4	4	4	208	4	4	52
Yulara	<0.0002	<0.0005	<0.05	<0.001	0.8	0.0002	1	<0.005	<0.01	0.16
No. samples collected	6	6	6	6	6	6	52	6	6	8
Adelaide River	<0.0002	0.002	<0.05	<0.001	0.04	<0.0002	1	<0.005	0.03	0.34
No. samples collected	23	23	23	23	23	23	98	23	23	4
Batchelor	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	2	<0.005	0.03	<0.1
No. samples collected	6	6	6	6	6	6	101	6	6	6
Cox Peninsula	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	3	<0.005	0.06	<0.1
No. samples collected	2	2	2	2	2	2	51	2	2	2
Borroloola	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	2	<0.005	<0.01	<0.1
No. samples collected	6	6	6	6	6	6	147	6	6	6
Garawa	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	2	<0.005	0.02	<0.1
No. samples collected	4	4	4	4	4	4	98	4	4	4
Daly Waters	0.001	<0.0005	0.05	<0.001	0.3	<0.0002	1	<0.005	0.05	0.17
No. samples collected	8	8	8	8	8	8	36	8	8	8
Elliott	<0.0002	<0.0005	0.2	<0.001	0.4	<0.0002	2	<0.005	0.06	0.88
No. samples collected	6	6	6	6	6	6	153	6	6	6
Gunn Point	0.004	<0.0005	0.05	<0.001	0.02	<0.0002	1	<0.005	<0.01	0.24
No. samples collected	2	2	2	2	2	2	27	2	2	2
Kings Canyon	<0.0002	0.001	<0.05	<0.001	0.3	<0.0002	1	0.01	0.05	0.50
No. samples collected	4	4	4	4	4	4	156	4	4	4
Larrimah	<0.0002	<0.0005	0.05	<0.001	0.2	<0.0002	2	<0.005	0.02	0.23
No. samples collected	4	4	4	4	4	4	36	4	4	4
Mataranka	<0.0002	<0.0005	0.1	<0.001	0.06	<0.0002	1	<0.005	0.3	0.32
No. samples collected	4	4	4	4	4	4	48	4	4	2
Newcastle Waters	<0.0002	0.0005	0.3	<0.001	0.3	<0.0002	1	<0.005	0.09	0.92
No. samples collected	6	6	6	6	6	6	33	6	6	6
Pine Creek	<0.0002	0.009	<0.05	<0.001	0.02	<0.0002	2	<0.005	0.1	0.59
No. samples collected	34	34	34	34	34	34	155	34	34	6
Ti Tree	<0.0002	0.001	0.05	<0.001	0.4	<0.0002	1	<0.005	0.02	0.87
No. samples collected	3	3	3	3	3	3	36	3	3	36
Timber Creek	<0.0002	0.001	1	<0.001	0.1	<0.0002	2	<0.005	0.1	1.5
No. samples collected	11	11	11	11	11	11	35	11	11	11

Numbers in **bold** exceed the guideline value.

PowerWater

LEAD	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	NITRATE	RADIOLOGICAL	SELENIUM	SILVER	THMS	URANIUM
0.01 mg/L	0.5 mg/L	0.001 mg/L	0.05 mg/L	0.02 mg/L	50 mg/L	1 mSv/yr	0.01 mg/L	0.1 mg/L	0.25 mg/L	0.017 mg/L
<0.001	<0.005	<0.0001	<0.005	<0.002	7	0.1	0.001	<0.01	<0.004	0.0088
8	8	8	8	8	8	18	8	8	4	8
0.002	0.04	<0.0001	<0.005	<0.002	0.3	PASS	<0.001	<0.01	0.061	0.00004
18	18	18	18	18	17	11	18	18	6	18
0.003	<0.005	<0.0001	<0.005	0.002	0.8	PASS	<0.001	<0.01	0.075	0.00001
4	4	4	4	4	4	2	4	4	12	4
<0.001	<0.005	<0.0001	<0.005	<0.002	50	PASS	0.003	<0.01	0.018	<0.00001
4	4	4	4	4	4	13	4	4	4	4
<0.001	<0.005	0.0001	<0.005	<0.002	30	PASS	<0.001	<0.01	0.006	<0.000012
6	6	6	6	6	8	6	6	6	2	6
0.003	0.06	<0.0001	<0.005	<0.002	0.9	PASS	<0.001	<0.01	0.011	0.00004
23	23	23	23	23	4	5	23	23	2	23
0.002	<0.005	<0.000	<0.005	<0.002	1	PASS	<0.001	<0.01	<0.004	0.0002
6	6	6	6	6	6	2	6	6	3	6
0.003	<0.005	<0.0001	<0.005	<0.002	0.5	PASS	<0.001	<0.01	<0.004	0.00002
2	2	2	2	2	2	5	2	2	1	2
<0.001	0.2	<0.0001	<0.005	0.004	1	0.3	<0.001	<0.01	<0.004	0.00044
6	6	6	6	6	6	5	6	6	3	6
0.002	0.1	<0.0001	<0.005	<0.002	0.6	PASS	<0.001	<0.01	<0.004	0.00018
4	4	4	4	4	4	1	4	4	2	4
<0.001	0.005	<0.0001	<0.005	0.004	10	PASS	0.002	<0.01	0.08	0.0031
8	8	8	8	8	8	1	8	8	2	8
0.001	<0.005	<0.0001	<0.005	<0.002	10	PASS	0.002	<0.01	0.005	0.0064
6	6	6	6	6	6	4	6	6	3	6
0.007	0.02	<0.0001	<0.005	0.004	0.5	PASS	<0.001	<0.01	<0.004	0.00056
2	2	2	2	2	2	1	2	2	1	2
<0.001	<0.005	0.0003	<0.005	0.004	5	1	0.003	<0.01	0.007	0.0019
4	4	4	4	4	4	55	4	4	2	4
<0.001	<0.005	<0.0001	<0.005	<0.002	3	PASS	0.002	<0.01	0.009	0.0022
4	4	4	4	4	4	2	4	4	2	4
<0.001	<0.005	<0.0001	<0.005	<0.002	0.4	PASS	<0.001	<0.01	<0.004	0.00065
4	4	4	4	4	2	2	2	4	2	4
0.002	<0.005	<0.0001	<0.005	<0.002	10	PASS	<0.001	<0.01	<0.004	0.0051
6	6	6	6	6	6	2	6	6	3	6
0.001	0.2	<0.0001	<0.005	<0.002	0.8	PASS	<0.001	<0.01	<0.004	0.0051
34	34	34	34	34	6	13	34	34	3	34
<0.001	<0.005	<0.0001	<0.005	<0.002	**60**	PASS	0.002	<0.01	0.005	0.0071
3	3	3	3	3	35	4	3	3	2	3
0.001	<0.005	<0.0001	<0.005	<0.002	1	PASS	<0.001	<0.01	0.01	0.0022
11	11	11	11	11	11	2	11	11	2	11

Table 14 Aesthetic and other parameters in major and minor centres 2018–19

	ALUMINIUM	CHLORIDE	CHLORINE (FREE)	COPPER	COLOUR (TRUE)	HARDNESS (AS CACO3)	IRON	MANGANESE	PH	SILICA	SODIUM
ADWG Units	0.2 mg/L	250 mg/L	0.6 mg/L	1 mg/L	15 CU	200 mg/L	0.3 mg/L	0.1 mg/L	6.5-8.5 pH unit	80 mg/L	180 mg/L
Community	Aesthetic parameters – mean values										
Alice Springs	<0.02	75	**0.8**	0.02	<2	**215**	<0.02	<0.005	7.8	17	80
No. samples collected	8	8	187	8	8	8	8	8	8	8	8
Darwin	0.03	5	**1.1**	0.04	<2	59	<0.02	<0.005	7.5	15	8
No. samples collected	4	4	183	4	4	4	4	4	4	4	4
Katherine	<0.02	6	**1.3**	0.02	3	30	0.08	0.02	7.3	12	3
No. samples collected	18	18	590	18	18	18	18	18	18	18	18
Tennant Creek	<0.02	128	**1**	0.01	<2	**204**	<0.02	<0.005	7.8	**87**	129
No. samples collected	4	4	208	4	4	4	4	4	4	4	4
Yulara	<0.02	56	**0.9**	<0.01	<2	16	<0.02	<0.005	7.3	8	47
No. samples collected	6	8	52	6	8	8	6	6	8	8	8
Adelaide River	<0.02	25	**1.2**	0.01	<2	120	<0.02	0.01	7.9	27	48
No. samples collected	28	4	28	4	4	28	28	4	4	4	4
Batchelor	<0.02	6	**1.2**	0.02	<2	168	<0.02	<0.005	7.4	18	5
No. samples collected	6	6	101	6	6	6	6	6	6	6	6
Cox Peninsula	<0.02	10	**2**	0.04	<2	3	<0.02	<0.005	6.8	21	8
No. samples collected	2	2	51	2	2	2	2	2	2	2	2
Borroloola	0.02	10	**1.3**	<0.01	<2	85	0.03	0.04	8.1	14	6
No. samples collected	6	6	147	6	6	6	6	6	6	6	6
Garawa	0.02	13	**1.2**	0.01	<2	5	0.1	0.03	6.5	14	10
No. samples collected	4	4	98	4	4	4	4	4	4	4	4
Daly Waters	<0.02	**300**	**1**	0.2	<2	**546**	0.04	<0.005	7.3	32	180
No. samples collected	8	8	36	8	8	8	8	8	8	8	8
Elliott	<0.02	148	**1.1**	0.02	<2	**405**	<0.02	<0.005	7.8	48	81
No. samples collected	6	6	153	6	6	6	6	6	6	6	6
Gunn Point	<0.02	10	**0.6**	<0.01	<2	109	0.1	0.01	7.6	11	8
No. samples collected	2	2	27	2	2	2	2	2	2	2	2
Kings Canyon	<0.02	268	**0.9**	0.03	<2	**373**	0.03	<0.005	7	19	129
No. samples collected	4	4	156	4	4	4	4	4	4	4	4
Larrimah	<0.02	205	**1.1**	0.01	<2	**491**	0.1	<0.005	7.7	41	132
No. samples collected	4	4	36	4	4	4	4	4	4	4	4
Mataranka	<0.02	25	**1.1**	0.07	<2	**320**	0.02	<0.005	7.6	29	18
No. samples collected	4	2	48	4	2	2	4	4	2	2	2
Newcastle Waters	<0.02	44	**1.1**	0.03	<2	**301**	<0.02	<0.005	7.7	56	54
No. samples collected	6	6	33	6	6	6	6	6	6	6	6
Pine Creek	0.03	13	**1.3**	0.05	3	139	0.1	0.05	7.1	47	34
No. samples collected	34	6	156	34	6	6	34	34	6	6	6
Ti Tree	<0.02	69	**1**	0.01	<2	**216**	<0.02	<0.005	8.1	**92**	68
No. samples collected	3	36	36	3	36	36	3	3	36	36	36
Timber Creek	<0.02	38	**1.1**	0.04	<2	**408**	<0.02	<0.005	7.2	21	21
No. samples collected	11	11	36	11	11	11	11	11	11	11	11

Numbers in **bold** exceed the guideline value

PowerWater

SULFATE	TDS	TURBIDITY	ZINC	ALKALINITY (AS $CACO_3$)	BROMIDE	CALCIUM	ELECTRICAL CONDUCTIVITY	IODINE	MAGNESIUM	POTASSIUM	TIN
250 mg/L	600 mg/L	5 NTU	3 mg/L	mg/L	mg/L	mg/L	µS/cm	0.15 mg/L	mg/L	mg/L	mg/L
48	467	0.5	<0.01	234	0.19	47.7	819	0.03	23.55	5.18	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
0.6	92	0.3	<0.01	67	0.02	14.5	163	<0.01	5.48	0.5	<0.01
4	4	4	4	4	4	4	4	4	4	4	4
<0.3	54	1	<0.01	26	0.03	6.3	78	<0.01	3.54	3.5	<0.01
18	18	18	18	18	18	18	18	18	18	18	18
36	**666**	0.2	<0.01	270	0.52	33.1	1125	0.12	29.48	27.53	<0.01
4	4	4	4	4	4	4	4	4	4	4	4
9	160	0.5	<0.01	<20	0.15	3.9	303	<0.01	1.46	4.79	<0.01
8	8	8	6	8	6	8	8	6	8	8	6
<0.3	246	1	<0.01	193	0.07	19.3	448	<0.01	17.45	17.45	<0.01
4	4	4	28	4	4	4	4	28	4	4	28
<0.3	175	0.4	<0.01	170	0.01	15	350	<0.01	31.68	0.2	<0.01
6	6	6	6	6	6	6	6	6	6	6	6
<0.3	45	0.7	0.035	<20	0.01	0.7	57	<0.01	0.25	0.85	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
<0.3	110	0.6	<0.01	85	0.02	32.2	207	<0.01	1.08	0.78	<0.01
6	6	6	6	6	6	6	6	6	6	6	6
<0.3	45	1.2	<0.01	<20	0.02	0.5	70	<0.01	1	0.9	<0.01
4	4	4	4	4	4	4	4	4	4	4	4
131	**1,181**	0.9	<0.01	414	1.1	132.3	1,988	0.05	52.41	19	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
23	**703**	0.5	0.01	382	0.41	92	1,250	0.04	42.55	18	<0.01
6	6	6	6	6	6	6	6	6	6	6	6
<0.3	136	0.4	3	116	0.02	20.3	255	<0.01	14	0.85	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
156	**832**	0.4	0.04	138	0.74	75.8	1,475	0.09	44.65	21.7	<0.01
4	4	4	4	4	4	4	4	4	4	4	4
96	**941**	0.4	<0.01	418	0.6	110.5	1,650	0.04	52.3	11.83	<0.01
4	4	4	4	4	4	4	4	4	4	4	4
<0.3	409	0.2	<0.01	335	0.11	78.1	750	<0.01	30.4	4.5	<0.01
2	2	2	4	2	4	2	2	4	2	2	4
4	536	0.5	0.01	387	0.12	68.3	893	0.04	31.65	23.77	<0.01
6	6	6	6	6	6	6	6	6	6	6	6
33	264	0.6	0.01	158	0.03	20.3	432	<0.01	21.5	1.35	<0.01
3	6	6	34	6	34	6	6	34	6	6	34
27	534	0.3	<0.01	212	0.23	49.9	803	0.07	22.3	18.16	<0.01
36	36	36	3	36	3	36	36	3	36	36	3
<0.3	483	0.2	0.01	435	0.15	62.1	927	0.01	61.34	5.4	<0.01
11	11	11	11	11	11	11	11	11	11	11	11

APPENDIX B
Drinking water quality: Remote communities

Table 15 Bacteriological monitoring in Northern region communities 2018–19

CENTRE	PARAMETER (MPN/100ML)	TARGET LEVEL	TOTAL NO. SAMPLES REQUIRED	TOTAL NO. SAMPLES COLLECTED	TOTAL EXCEEDANCES (NO.)	SAMPLES PASSING REPORTING LEVEL (%)
Acacia Larrakia	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	1	97%
Angurugu	*E. coli*	No *E. coli* in 100% samples	153	**137**	0	100%
	Total Coliforms	<10 in 95% of samples	153	**137**	0	100%
Belyuen	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	1	97%
Galiwinku	*E. coli*	No *E. coli* in 100% samples	204	**195**	0	100%
	Total Coliforms	<10 in 95% of samples	204	**195**	1	99%
Gapuwiyak	*E. coli*	No *E. coli* in 100% samples	153	**147**	0	100%
	Total Coliforms	<10 in 95% of samples	153	**147**	0	100%
Gunbalanya	*E. coli*	No *E. coli* in 100% samples	153	**150**	0	100%
	Total Coliforms	<10 in 95% of samples	153	**150**	2	99%
Gunyangara	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Maningrida	*E. coli*	No *E. coli* in 100% samples	255	**249**	0	100%
	Total Coliforms	<10 in 95% of samples	255	**249**	0	100%
Milikapiti	*E. coli*	*No E. coli in 100% samples*	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Milingimbi	*E. coli*	No *E. coli* in 100% samples	153	**147**	0	100%
	Total Coliforms	<10 in 95% of samples	153	**147**	0	100%

Table 15 continued Bacteriological monitoring in Northern region communities 2018–19

Milyakburra	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Minjilang	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Nauiyu	*E. coli*	No *E. coli* in 100% samples	48	48	1	98%
	Total Coliforms	<10 in 95% of samples	48	48	1	98%
Nguiu	*E. coli*	No *E. coli* in 100% samples	153	**152**	0	100%
	Total Coliforms	<10 in 95% of samples	153	**152**	0	100%
Nganmarriyanga	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Numbulwar	*E. coli*	No *E. coli* in 100% samples	153	**150**	0	100%
	Total Coliforms	<10 in 95% of samples	153	**150**	0	100%
Peppimenarti	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	1	97%
Pirlangimpi	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Ramingining	*E. coli*	No *E. coli* in 100% samples	204	**199**	0	100%
	Total Coliforms	<10 in 95% of samples	204	**199**	0	100%
Umbakumba	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Wadeye	*E. coli*	No *E. coli* in 100% samples	255	**250**	0	100%
	Total Coliforms	<10 in 95% of samples	255	**250**	0	100%
Warruwi	*E. coli*	No *E. coli* in 100% samples	36	**34**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**34**	0	100%
Yirrkala	*E. coli*	No *E. coli* in 100% samples	153	**150**	0	100%
	Total Coliforms	<10 in 95% of samples	153	**150**	0	100%

*Numbers in **bold** indicate fewer than required samples collected in the monitoring program

Appendix B

Table 16 Bacteriological monitoring in Katherine region communities 2018–19

CENTRE	PARAMETER (MPN/100ML)	TARGET LEVEL	TOTAL NO. SAMPLES REQUIRED	TOTAL NO. SAMPLES COLLECTED	TOTAL EXCEEDANCES (NO.)	SAMPLES PASSING REPORTING LEVEL (%)
Amanbidji	*E. coli*	No *E. coli* in 100% samples	36	**30**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**30**	0	100%
Barunga	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Beswick	*E. coli*	No *E. coli* in 100% samples	36	**30**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**30**	0	100%
Binjari	*E. coli*	No *E. coli* in 100% samples	36	**30**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**30**	0	100%
Bulla	*E. coli*	No *E. coli* in 100% samples	36	40	1	98%
	Total Coliforms	<10 in 95% of samples	36	40	1	98%
Bulman	*E. coli*	No *E. coli* in 100% samples	36	33	0	100%
	Total Coliforms	<10 in 95% of samples	36	33	0	100%
Daguragu	*E. coli*	No *E. coli* in 100% samples	24	24	0	100%
	Total Coliforms	<10 in 95% of samples	24	24	0	100%
Jilkminggan	*E. coli*	No *E. coli* in 100% samples	36	35	0	100%
	Total Coliforms	<10 in 95% of samples	36	35	0	100%
Kalkarindji	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	2	94%
Kybrook Farm	*E. coli*	No *E. coli* in 100% samples	36	**34**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**34**	0	100%
Lajamanu	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Manyallaluk	*E. coli*	No *E. coli* in 100% samples	36	33	0	100%
	Total Coliforms	<10 in 95% of samples	36	33	0	100%
Minyerri	*E. coli*	No *E. coli* in 100% samples	36	**30**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**30**	0	100%
Ngukurr	*E. coli*	No *E. coli* in 100% samples	153	**144**	0	100%
	Total Coliforms	<10 in 95% of samples	153	**144**	0	100%
Pigeon Hole	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	1	97%
Rittarangu	*E. coli*	No *E. coli* in 100% samples	36	**36**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**36**	0	100%

Table 16 continued Bacteriological monitoring in Katherine region communities 2018–19

Robinson River	*E. coli*	No *E. coli* in 100% samples	36	**36**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**36**	0	100%
Weemol	*E. coli*	*No E. coli* in 100% samples	36	34	0	100%
	Total Coliforms	<10 in 95% of samples	36	34	0	100%
Yarralin	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%

*Number in **bold** letter indicate samples collected less than required in the monitoring program

Table 17 Bacteriological monitoring in Barkly region communities 2018–19

CENTRE	PARAMETER (MPN/100ML)	TARGET LEVEL	TOTAL NO. SAMPLES REQUIRED	TOTAL NO. SAMPLES COLLECTED	TOTAL EXCEEDANCES (NO.)	SAMPLES PASSING REPORTING LEVEL (%)
Ali Curung	*E. coli*	No *E. coli* in 100% samples	36	32	0	100%
	Total Coliforms	<10 in 95% of samples	36	32	0	100%
Alpurrurulam	*E. coli*	No *E. coli* in 100% samples	36	33	0	100%
	Total Coliforms	<10 in 95% of samples	36	33	0	100%
Canteen Creek	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Imangara	*E. coli*	No *E. coli* in 100% samples	36	33	0	100%
	Total Coliforms	<10 in 95% of samples	36	33	0	100%
Nturiya	*E. coli*	No *E. coli* in 100% samples	36	33	0	100%
	Total Coliforms	<10 in 95% of samples	36	33	0	100%
Tara	*E. coli*	No *E. coli* in 100% samples	36	**36**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**36**	0	100%
Willowra	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Wilora	*E. coli*	No *E. coli* in 100% samples	36	33	0	100%
	Total Coliforms	<10 in 95% of samples	36	33	0	100%
Wutunugurra	*E. coli*	No *E. coli* in 100% samples	36	33	0	100%
	Total Coliforms	<10 in 95% of samples	36	33	0	100%

*Numbers in **bold** indicate fewer than required samples collected in the monitoring program

Appendix B

Table 18 Bacteriological monitoring in Southern region communities 2018–19

CENTRE	PARAMETER (MPN/100ML)	TARGET LEVEL	TOTAL NO. SAMPLES REQUIRED	TOTAL NO. SAMPLES COLLECTED	TOTAL EXCEEDANCES (NO.)	SAMPLES PASSING REPORTING LEVEL (%)
Amoonguna	*E. coli*	No *E. coli* in 100% samples	36	42	0	100%
	Total Coliforms	<10 in 95% of samples	36	42	0	100%
Ampilatwatja	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Areyonga	*E. coli*	No *E. coli* in 100% samples	36	**34**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**34**	0	100%
Atitjere	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Engawala	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Finke	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Haasts Bluff	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Hermannsburg	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Imanpa	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Kaltukatjara	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Kintore	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Laramba	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Mt Liebig	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Nyirripi	E. coli	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Papunya	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Pmara Jutunta	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%

Table 18 continued Bacteriological monitoring in Southern region communities 2018–19

Santa Teresa	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Titjikala	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Wallace Rockhole	*E. coli*	No *E. coli* in 100% samples	36	36	0	100%
	Total Coliforms	<10 in 95% of samples	36	36	0	100%
Yuelamu	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%
Yuendumu	*E. coli*	No *E. coli* in 100% samples	36	**33**	0	100%
	Total Coliforms	<10 in 95% of samples	36	**33**	0	100%

*Numbers in **bold** indicate fewer than required samples collected in the monitoring program

Table 19 Drinking water quality in Northern region communities (Health parameters)

Numbers in **bold** exceed the guideline value.	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	BORON	CADMIUM	CHROMIUM	COPPER	FLUORIDE
ADWG Units	0.003 mg/L	0.01 mg/L	2 mg/L	0.06 mg/L	4 mg/L	0.002 mg/L	0.05 mg/L	2 mg/L	1.5 mg/L
Community	Health parameters – 95th percentile or maximum values								
Acacia Larrakia	<0.0002	0.001	<0.05	<0.001	<0.02	<0.0002	<0.005	0.01	0.17
No. Samples	2	2	2	2	2	2	2	2	2
Angurugu	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	0.02	0.78
No. Samples	2	2	2	2	2	2	2	2	92
Belyuen	<0.0002	0.003	<0.05	<0.001	0.02	<0.0002	<0.005	<0.01	0.50
No. Samples	2	2	2	2	2	2	2	2	2
Galiwinku	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.02	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Gapuwiyak	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	0.3	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Gunbalanya	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.02	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Gunyangara	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.2	<0.1
No. Samples	2	2	2	2	2	2	2	1	2
Maningrida	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	<0.01	1.0
No. Samples	2	2	2	2	2	2	2	2	102
Milikapiti	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	0.08	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Milingimbi	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	<0.005	0.02	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Milyakburra	<0.0002	<0.0005	<0.05	<0.001	0.06	<0.0002	<0.005	0.04	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Minjilang	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	<0.005	0.02	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Nauiyu	<0.0002	0.006	<0.05	<0.001	<0.0002	<0.0002	<0.005	0.07	0.41
No. Samples	13	13	13	13	13	13	13	13	13
Nganmarriyanga	<0.0002	0.002	0.3	<0.001	0.04	<0.0002	<0.005	<0.01	0.29
No. Samples	2	2	2	2	2	2	2	2	2
Numbulwar	<0.0002	0.001	0.4	<0.001	0.06	<0.0002	<0.005	0.1	0.16
No. Samples	8	8	8	8	8	8	8	8	8
Peppimenarti	<0.0002	0.001	0.2	<0.001	0.04	<0.0002	<0.005	<0.01	0.55
No. Samples	8	8	8	8	8	8	8	8	8
Pirlangimpi	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	<0.01	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Ramingining	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.03	<0.1
No. Samples	4	4	4	4	4	4	4	4	4
Umbakumba	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	0.03	0.80
No. Samples	3	3	3	3	3	3	3	3	3
Wadeye	<0.0002	<0.0005	0.1	<0.001	0.02	<0.0002	<0.005	0.04	0.77
No. Samples	3	3	3	3	3	3	3	3	97
Wurrumiyanga	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.04	0.83
No. Samples	2	2	2	2	2	2	2	2	93
Warruwi	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	<0.005	0.01	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Yirrkala	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.08	<0.1
No. Samples	2	2	2	2	2	2	2	2	2

PowerWater

LEAD	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	NITRATE	RADIOLOGICAL	SELENIUM	SILVER	URANIUM
0.01 mg/L	0.5 mg/L	0.001 mg/L	0.05 mg/L	0.02 mg/L	50 mg/L	1 mSv/yr	0.01 mg/L	0.1 mg/L	0.017 mg/L
<0.001	0.01	<0.0001	<0.005	<0.002	0.4	PASS	<0.001	<0.01	0.00048
2	2	2	2	2	2	1	2	2	2
<0.001	0.01	<0.0001	<0.005	<0.002	0.4	PASS	<0.001	<0.01	0.00004
2	2	2	2	2	2	3	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.1	PASS	<0.001	<0.01	0.0015
2	2	2	2	2	2	6	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.7	PASS	<0.001	<0.01	0.00004
2	2	2	2	2	2	3	2	2	2
<0.001	<0.005	<0.0001	<0.005	0.004	3	PASS	<0.001	<0.01	0.00003
2	2	2	2	2	2	3	2	2	2
<0.001	0.01	<0.0001	<0.005	<0.002	0.5	PASS	<0.001	<0.01	0.00003
2	2	2	2	2	2	13	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.1	PASS	<0.001	<0.01	<0.00001
2	2	2	2	2	2	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.4	PASS	<0.001	<0.01	0.00006
2	2	2	2	2	2	8	2	2	2
0.002	<0.005	<0.0001	<0.005	<0.002	0.7	PASS	<0.001	<0.01	0.00001
2	2	2	2	2	2	5	2	2	2
0.002	0.01	<0.0001	<0.005	<0.002	5	PASS	<0.001	<0.01	0.00015
2	2	2	2	2	2	4	2	2	2
0.002	0.2	<0.0001	<0.005	<0.002	0.3	PASS	<0.001	<0.01	0.00005
2	2	2	2	2	2	2	2	2	2
0.004	<0.005	<0.0001	<0.005	<0.002	1	PASS	<0.001	<0.01	0.00011
2	2	2	2	2	2	3	2	2	2
<0.001	**2.6**	<0.0001	<0.005	0.002	4	PASS	<0.001	<0.001	0.00011
13	13	13	13	13	13	4	13	13	13
<0.001	0.3	<0.0001	<0.005	<0.002	0.4	PASS	<0.001	<0.01	<0.00001
2	2	2	2	2	2	2	2	14	2
<0.001	0.2	<0.0001	<0.005	<0.002	0.4	PASS	<0.001	<0.01	0.00005
8	8	8	8	8	8	26	8	8	8
<0.001	0.2	<0.0001	<0.005	<0.002	2	PASS	<0.001	<0.01	0.00023
8	8	8	8	8	7	3	8	2	8
<0.001	<0.005	<0.0001	<0.005	<0.002	0.2	PASS	<0.001	<0.01	0.00002
2	2	2	2	2	2	2	2	3	2
0.002	<0.005	<0.0001	<0.005	<0.002	0.7	PASS	<0.001	<0.01	0.00005
4	4	4	4	4	4	3	4	4	4
0.005	**1.9**	<0.0001	<0.005	0.006	0.8	PASS	<0.001	<0.01	0.0001
3	3	3	3	3	3	11	2	3	2
0.003	0.03	<0.0001	<0.005	0.004	0.3	PASS	<0.001	<0.01	0.00018
3	3	3	3	3	3	5	3	2	3
<0.001	<0.005	<0.0001	<0.005	<0.002	0.3	PASS	<0.001	<0.01	<0.00001
2	2	2	2	2	2	8	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.5	PASS	<0.001	<0.01	0.00009
2	2	2	2	2	2	10	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	0.4	PASS	<0.001	<0.01	0.00008
2	2	2	2	2	2	2	2	2	2

Table 20 Drinking water quality in Northern region communities (Aesthetic and other parameters)

Numbers in **bold** exceed the guideline value

	ALUMINIUM	CHLORIDE	FREE CHLORINE (ODOUR THRESHOLD)	COPPER	COLOUR (TRUE)	HARDNESS (AS CACO3)	IRON	MANGANESE	PH	SILICA
ADWG Units	0.2 mg/L	250 mg/L	0.6 mg/L	1 mg/L	15 CU	200 mg/L	0.3 mg/L	0.1 mg/L	6.5-8.5 pH unit	80 mg/L
Community	**Aesthetic parameters – mean values**									
Acacia Larrakia	<0.02	6	**1.1**	<0.01	<2	**215**	0.06	<0.005	7.6	20
No. Samples	2	2	36	2	2	2	2	2	2	2
Angurugu	0.06	11	**1.1**	0.01	<2	3	0.02	<0.005	**5.1**	13
No. Samples	2	2	65	2	2	2	2	2	2	2
Belyuen	<0.02	5	**1.1**	<0.01	2	6	0.05	<0.005	6.6	43
No. Samples	2	2	33	2	2	2	2	2	2	2
Galiwinku	<0.02	12	**1.2**	0.02	<2	3	<0.02	<0.005	**5.5**	13
No. Samples	2	2	198	2	2	2	2	2	2	2
Gapuwiyak	0.04	11	**1.2**	0.5	<2	5	0.1	<0.005	**6.0**	12
No. Samples	2	2	150	2	2	2	2	2	2	2
Gunbalanya	0.05	5	**1.1**	0.01	<2	2	0.2	<0.005	**5.7**	10
No. Samples	2	2	152	2	2	2	2	2	2	2
Gunyangara	<0.02	13	**1.1**	0.08	<2	6	0.1	<0.005	6.9	11
No. Samples	2	2	36	1	2	2	2	2	2	2
Maningrida	<0.02	8	**1.2**	<0.01	<2	13	0.04	<0.005	**6.0**	14
No. Samples	2	2	253	2	2	2	2	2	2	2
Milikapiti	<0.02	9	**0.9**	0.05	<2	1	0.1	<0.005	**5.3**	11
No. Samples	2	2	36	2	2	2	2	2	2	2
Milingimbi	0.03	57	**1.0**	0.01	<2	22	<0.02	0.006	**5.3**	18
No. Samples	2	2	143	2	2	2	2	2	2	2
Milyakburra	0.03	76	**1.0**	0.03	<2	18	0.2	0.1	**5.7**	15
No. Samples	2	2	36	2	2	2	2	2	2	2
Minjilang	0.1	19	**1.0**	0.02	<2	3	<0.02	<0.005	**4.7**	11
No. Samples	2	2	36	2	2	2	2	2	2	2
Nauiyu	<0.02	7	**1.0**	0.01	3	120	0.2	**0.5**	7.6	36
No. Samples	6	6	48	6	6	6	6	6	6	6
Nganmarriyanga	<0.02	32	**1.0**	<0.01	6	88	**0.3**	**0.2**	7.9	38
No. Samples	2	2	33	2	2	2	2	2	2	2
Numbulwar	<0.02	43	**1.4**	0.02	2	**298**	**0.6**	**0.2**	8.1	18
No. Samples	14	11	150	14	11	11	14	14	11	11
Peppimenarti	<0.02	16	**1.1**	<0.01	2	77	0.4	0.1	7.2	33
No. Samples	8	8	36	8	8	8	8	8	8	8
Pirlangimpi	0.03	9	**1.3**	<0.01	<2	<1	0.04	<0.005	6.4	9
No. Samples	2	2	36	2	2	2	2	2	2	2
Ramingining	<0.02	9	**1.2**	0.02	<2	3	0.02	<0.005	**5.6**	15
No. Samples	3	3	196	3	3	3	3	3	3	3
Umbakumba	0.08	39	**1.1**	0.02	<2	12	1	**0.8**	**5.4**	12
No. Samples	2	2	33	2	2	2	2	2	2	2
Wadeye	<0.02	6	**1.1**	0.03		2	<0.02	0.01	**5.2**	16
No. Samples	3	3	250	3	3	3	3	3	3	3
Wurrumiyanga	<0.02	7	**1.1**	0.03	<2	<1	<0.02	<0.005	**5.1**	13
No. Samples	2	2	148	2	2	2	2	2	2	2
Warruwi	0.08	57	**1.0**	<0.01	<2	27	0.025	<0.005	**5.1**	11
No. Samples	2	2	31	2	2	2	2	2	2	2
Yirrkala	<0.02	12	**1.2**	0.06	<2	5	<0.02	<0.005	**5.9**	11
No. Samples	2	2	153	2	2	2	2	2	2	2

PowerWater

SODIUM	SULFATE	TDS	TURBIDITY	ZINC	ALKALINITY (AS CACO3)	BROMINE	CALCIUM	ELECTRICAL CONDUCTIVITY	IODINE (TASTE THRESHOLD)	POTASSIUM	TIN
180 mg/L	250 mg/L	600 mg/L	5 NTU	3 mg/L	mg/L	mg/L	mg/L	µS/cm	0.15 mg/L	mg/L	mg/L
					Other parameters – mean values						
5	<0.3	244	0.9	<0.01	230	0.01	43.1	470	<0.01	1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
6	<0.3	38	2	<0.01	<20	0.02	0.4	46	<0.01	0.15	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
10	<0.3	59	0.7	0.02	26	0.01	1.4	69	<0.01	3.1	<0.01
2	2	2	1	2	2	2	2	2	2	2	2
9	0.8	31	0.5	<0.01	<20	0.02	0.15	54	<0.01	0.25	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
8	<0.3	44	1.3	0.34	<20	0.02	0.75	57	<0.01	0.55	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
3	<0.3	36	1.7	<0.01	<20	0.02	0.25	22	<0.01	0.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
8	<0.3	53	0.3	<0.01	<20	0.03	1.55	57	<0.01	0.25	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
5	<0.3	48	0.6	<0.01	<20	0.02	4	58	<0.01	1.3	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
6	<0.3	37	0.6	<0.01	<20	0.02	<0.03	41	<0.01	<0.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
2	5	12	0.4	<0.01	<20	0.11	3.1	235	<0.01	0.65	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
41	12	162	1.9	0.01	<20	0.13	2.8	285	0.03	0.45	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
11	3	41	0.4	0.09	<20	0.07	0.11	85	<0.01	<0.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
19	<0.3	186	**6.5**	<0.01	149	0.02	27.4	318	<0.01	0.75	<0.01
6	6	6	6	6	7	6	7	7	6	7	7
46	14	229	2.4	0.01	140	0.06	25.4	425	<0.01	6.55	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
35	135	481	1.7	<0.01	173	0.12	91	774	<0.01	3.23	<0.01
11	11	11	11	14	11	14	11	11	14	11	14
16	<0.3	147	4	<0.01	94	0.02	17.7	247	<0.01	3.77	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
7	<0.3	26	3.4	<0.01	<20	0.01	<0.03	39	<0.01	<0.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
7	<0.3	33	0.2	0.02	<20	0.01	0.3	47	<0.01	0.23	<0.01
3	3	3	3	3	3	3	3	3	3	3	3
23	2	103	4	0.02	<20	0.11	1.1	160	<0.01	0.7	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
5	<0.3	30	0.3	0.02	<20	0.01	0.07	32	<0.01	0.3	<0.01
3	3	3	3	3	3	3	3	3	3	3	
4	<0.3	38	0.5	<0.01	<20	0.01	<0.03	30	<0.01	<0.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
30	7	119	0.5	<0.01	<20	0.1	1.9	240	<0.01	0.15	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
7	0.9	61	0.2	<0.01	<20	0.03	1.1	58	<0.01	0.5	<0.01
2	2	2	2	2	2	2	2	2	2	2	2

Table 21 Drinking water quality in Katherine region communities (Health parameters)

	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	BORON	CADMIUM	CHROMIUM	COPPER	FLUORIDE
ADWG Units	0.003 mg/L	0.01 mg/L	2 mg/L	0.06 mg/L	4 mg/L	0.002 mg/L	0.05 mg/L	2 mg/L	1.5 mg/L
Community	Health parameters – 95th percentile or maximum values								
Amanbidji	<0.0002	0.002	0.2	<0.001	0.6	<0.0002	<0.005	0.01	0.34
No. Samples	2	2	2	2	2	2	2	2	6
Barunga	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.3	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Beswick	**0.008**	0.008	0.2	<0.001	0.02	<0.0002	<0.005	0.4	0.15
No. Samples	10	10	10	10	10	10	10	10	8
Binjari	<0.0002	0.002	0.2	<0.001	0.06	<0.0002	<0.005	0.03	0.45
No. Samples	4	4	4	4	4	4	4	4	4
Bulla	<0.0002	0.003	**10**	<0.001	0.2	<0.0002	<0.005	0.02	0.58
No. Samples	20	20	20	20	20	20	20	20	6
Bulman	<0.0002	<0.0005	<0.05	<0.001	0.02	<0.0002	<0.005	<0.01	0.11
No. Samples	2	2	2	2	2	2	2	2	1
Daguragu	<0.0002	0.002	0.05	<0.001	0.1	<0.0002	<0.005	<0.01	0.25
No. Samples	2	2	2	2	2	2	2	2	2
Jilkminggan	<0.0002	<0.0005	<0.05	<0.001	0.4	<0.0002	<0.005	0.01	0.50
No. Samples	2	2	2	2	2	2	2	2	2
Kalkarindji	<0.0002	0.001	0.1	<0.001	0.1	<0.0002	<0.005	0.03	0.31
No. Samples	2	2	2	2	2	2	2	2	2
Kybrook Farm	<0.0002	0.002	<0.05	<0.001	0.02	<0.0002	<0.005	0.02	0.68
No. Samples	2	2	2	2	2	2	2	2	2
Lajamanu	<0.0002	<0.0005	0.05	<0.001	0.2	<0.0002	<0.005	0.02	0.38
No. Samples	2	2	2	2	2	2	2	2	2
Manyallaluk	<0.0002	<0.0005	<0.05	<0.001	<0.02	<0.0002	<0.005	0.03	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Minyerri	<0.0002	0.003	0.35	<0.001	0.2	<0.0002	<0.005	0.09	0.36
No. Samples	9	9	9	9	9	9	9	9	8
Ngukurr	<0.0002	<0.0005	1	<0.001	0.1	<0.0002	<0.005	0.01	0.30
No. Samples	8	8	8	8	8	8	8	8	8
Pigeon Hole	<0.0002	<0.0005	<0.05	<0.001	0.1	<0.0002	<0.005	<0.01	0.27
No. Samples	2	2	2	2	2	2	2	2	2
Rittarangu	<0.0002	<0.0005	0.3	<0.001	0.04	<0.0002	<0.005	<0.01	<0.1
No. Samples	2	2	2	2	2	2	2	2	2
Robinson River	<0.0002	<0.0005	1	<0.001	0.1	<0.0002	<0.005	0.02	0.81
No. Samples	7	7	7	7	7	7	7	7	8
Weemol	<0.0002	<0.0005	<0.05	<0.001	0.04	<0.0002	<0.005	<0.01	0.14
No. Samples	2	2	2	2	2	2	2	2	1
Yarralin	<0.0002	0.001	0.4	<0.001	0.08	<0.0002	<0.005	<0.01	0.13
No. Samples	2	2	2	2	2	2	2	2	2

Numbers in **bold** exceed the guideline value.

PowerWater

LEAD	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	NITRATE	RADIOLOGICAL	SELENIUM	SILVER	URANIUM
0.01 mg/L	0.5 mg/L	0.001 mg/L	0.05 mg/L	0.02 mg/L	50 mg/L	1 mSv/yr	0.01 mg/L	0.1 mg/L	0.017 mg/L
0.002	0.4	<0.0001	<0.005	<0.002	3	PASS	<0.001	<0.01	0.0014
2	2	2	2	2	6	6	2	2	2
<0.001	0.02	<0.0001	<0.005	<0.002	0.4	PASS	<0.001	<0.01	0.0001
2	2	2	2	2	2	6	2	2	2
0.002	<0.005	<0.0001	<0.005	<0.002	0.8	PASS	<0.001	<0.01	0.00025
10	10	10	10	10	8	2	10	10	10
0.002	<0.005	<0.0001	<0.005	0.002	0.2	0.3	<0.001	<0.01	0.0014
4	4	4	4	4	4	9	4	4	4
<0.001	0.3	<0.0001	<0.005	<0.002	0.2	0.1	<0.001	<0.01	0.00005
20	20	20	20	20	6	2	20	20	20
<0.001	<0.005	<0.0001	<0.005	<0.002	0.6	PASS	<0.001	<0.01	0.00027
2	2	2	2	2	1	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	4	PASS	<0.001	<0.01	0.0018
2	2	2	2	2	2	1	2	2	2
<0.001	0.03	<0.0001	<0.005	<0.002	0.5	PASS	<0.001	<0.01	0.0094
2	2	2	2	2	2	3	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	5	PASS	<0.001	<0.01	0.0017
2	2	2	2	2	2	2	2	2	2
0.001	0.01	<0.0001	<0.005	<0.002	0.3	PASS	<0.001	<0.01	0.00046
2	2	2	2	2	2	3	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	4	PASS	<0.001	<0.01	<0.00001
2	2	2	2	2	2	5	2	2	2
0.006	<0.005	<0.0001	<0.005	<0.002	0.4	PASS	<0.001	<0.01	0.00007
2	2	2	2	2	2	2	2	2	2
0.001	**0.6**	<0.0001	<0.005	<0.002	0.3	PASS	<0.001	<0.01	0.00001
9	9	9	9	9	8	7	9	9	9
0.003	<0.005	<0.0001	<0.005	<0.002	2	PASS	<0.001	<0.01	0.00078
8	8	8	8	8	8	6	8	8	8
<0.001	<0.005	<0.0001	<0.005	<0.002	15	PASS	<0.001	<0.01	0.0018
2	2	2	2	2	2	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	1	PASS	<0.001	<0.01	0.00047
2	2	2	2	2	2	4	2	2	2
<0.001	0.02	<0.0001	<0.005	<0.002	6	PASS	<0.001	<0.01	0.0035
7	7	7	7	7	8	8	7	7	7
<0.001	<0.005	<0.0001	<0.005	<0.002	0.2	PASS	<0.001	<0.01	0.00037
2	2	2	2	2	2	2	2	2	2
<0.001	0.02	<0.0001	<0.005	<0.002	8	PASS	<0.001	<0.01	0.0029
2	2	2	2	2	2	6	2	2	2

Appendix B

Table 22 Drinking water quality in Katherine region communities (Aesthetic and other parameters)

	ALUMINIUM	CHLORIDE	FREE CHLORINE (ODOUR THRESHOLD)	COPPER	COLOUR (TRUE)	HARDNESS (AS CACO3)	IRON	MANGANESE	PH	SILICA
ADWG Units	0.2 mg/L	250 mg/L	0.6 mg/L	1 mg/L	15 CU	200 mg/L	0.3 mg/L	0.1 mg/L	6.5-8.5 pH unit	80 mg/L
Community	Aesthetic parameters – mean values									
Amanbidji	<0.02	115	**0.9**	<0.01	<2	**370**	0.2	**0.2**	8.0	32
No. Samples	2	6	29	2	6	6	2	2	6	6
Barunga	<0.02	6	**1.2**	0.2	**36**	4	**0.9**	0.01	**5.7**	15
No. Samples	2	2	35	2	2	2	2	2	2	2
Beswick	<0.02	7	**1.2**	0.4	<2	**305**	<0.02	<0.005	7.6	22
No. Samples	10	8	33	10	8	8	10	10	8	8
Binjari	<0.02	10	**1.0**	0.02	<2	**294**	0.03	<0.005	7.6	28
No. Samples	4	4	30	4	4	4	4	4	4	4
Bulla	0.03	41	**1.1**	<0.01	4	**199**	**0.6**	**0.2**	8.2	18
No. Samples	20	6	36	20	6	6	20	20	6	6
Bulman	<0.02	8	**1.1**	<0.01	<2	**319**	<0.02	<0.005	8.0	21
No. Samples	2	1	36	2	1	1	2	2	1	1
Daguragu	<0.02	18	**1.1**	<0.01	<2	**270**	<0.02	<0.005	7.9	25
No. Samples	2	2	24	2	2	2	2	2	2	2
Jilkminggan	0.04	235	**1.1**	<0.01	2	**596**	<0.02	0.02	7.5	44
No. Samples	2	2	36	2	2	2	2	2	2	2
Kalkarindji	<0.02	26	**1.1**	0.02	<2	**252**	<0.02	<0.005	7.8	21
No. Samples	2	2	36	2	2	2	2	2	2	2
Kybrook Farm	<0.02	12	**0.8**	0.02	3	127	0.05	0.01	7.2	38
No. Samples	2	2	33	2	2	2	2	2	2	2
Lajamanu	<0.02	42	**1.1**	0.02	<2	175	<0.02	<0.005	7.7	**93**
No. Samples	2	2	15	2	2	2	2	2	2	2
Manyallaluk	<0.02	5	**1.1**	0.03	<2	2	0.3	<0.005	**5.2**	21
No. Samples	2	2	36	2	2	2	2	2	2	2
Minyerri	<0.02	13	**1.0**	0.02	3	103	**0.8**	**0.2**	7.4	33
No. Samples	9	8	33	9	8	8	9	9	8	8
Ngukurr	<0.02	**396**	**0.9**	<0.01	<2	**637**	0.2	<0.005	7.7	23
No. Samples	8	8	147	8	8	8	8	8	8	8
Pigeon Hole	<0.02	16	**0.9**	<0.01	<2	**324**	<0.02	<0.005	7.5	50
No. Samples	2	2	36	2	2	2	2	2	2	2
Rittarangu	<0.02	27	**0.9**	<0.01	<2	**263**	<0.02	<0.005	7.9	19
No. Samples	2	2	36	2	2	2	2	2	2	2
Robinson River	<0.02	52	**1.9**	<0.01	<2	**375**	<0.02	<0.005	7.8	37
No. Samples	7	8	36	7	8	8	7	7	8	8
Weemol	<0.02	9	**1.0**	<0.01	<2	**370**	<0.02	<0.005	7.4	30
No. Samples	2	2	36	2	2	2	2	2	2	2
Yarralin	<0.02	13	**1.1**	<0.01	<2	**342**	0.03	0.01	7.6	32
No. Samples	2	2	36	2	2	2	2	2	2	2

Numbers in **bold** exceed the guideline value.

PowerWater

SODIUM	SULFATE	TDS	TURBIDITY	ZINC	ALKALINITY (AS CACO3)	BROMINE	CALCIUM	ELECTRICAL CONDUCTIVITY	IODINE (TASTE THRESHOLD)	POTASSIUM	TIN
180 mg/L	250 mg/L	600 mg/L	5 NTU	3 mg/L	mg/L	mg/L	mg/L	µS/cm	0.15 mg/L	mg/L	mg/L
					Other parameters – mean values						
153	113	**834**	2.4	0.06	440	0.36	53.9	1433	0.015	3.67	<0.01
6	6	6	6	2	6	2	6	6	2	6	2
5	<0.3	46	3.0	0.04	<20	0.01	0.7	41	<0.01	0.8	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
6	<0.3	331	0.3	0.1	315	0.02	61.3	620	<0.01	1.49	<0.01
8	8	8	8	10	8	10	8	8	10	8	10
10	3	347	0.4	0.02	310	0.02	69.1	632	<0.01	3.58	<0.01
4	4	4	4	4	4	4	4	4	4	4	4
28	<0.3	288	2.6	0.01	217	0.17	33.9	546	<0.01	3.37	<0.01
6	6	6	6	20	6	20	6	6	20	6	20
8	<0.3	323	0.3	0.02	340	0.03	64.3	630	<0.01	2.3	<0.01
1	1	1	1	2	1	2	1	1	2	1	2
30	<0.3	325	0.3	<0.01	310	0.1	53.1	640	0.01	3.9	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
150	154	**1150**	0.21	<0.01	510	0.98	105	1900	0.13	21.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
31	<0.3	321	0.5	<0.01	280	0.1	52.6	630	0.015	4.85	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
53	<0.3	289	2.0	0.05	240	0.02	22.7	510	<0.01	0.7	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
44	2	362	0.3	<0.01	210	0.31	27.2	565	0.08	5.65	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
5	<0.3	43	0.4	0.05	<20	0.02	0.15	33	<0.01	0.35	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
21	7	190	**10.2**	0.03	128	0.04	22.7	324	<0.01	4.59	<0.01
8	8	8	8	9	8	9	8	8	9	8	9
120	18	**916**	2.8	0.1	323	1.03	108	1925	<0.01	7.4	<0.01
8	8	8	8	8	8	8	8	8	8	8	8
28	<0.3	422	7.1	<0.01	345	0.09	72.5	730	<0.01	2	<0.01
2	2	2	2	2	2	2	2	2	2	2	1
16	<0.3	313	0.1	<0.01	280	0.1	49.6	605	<0.01	3.25	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
31	<0.3	470	0.3	0.02	390	0.18	51.8	894	<0.01	2.59	<0.01
8	8	8	8	7	8	7	8	8	7	8	7
9	<0.3	386	0.3	<0.01	390	0.04	71.2	735	<0.01	2.7	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
15	<0.3	381	0.7	<0.01	340	0.09	74.2	705	<0.01	2.8	<0.01
2	2	2	2	2	2	2	2	2	2	2	2

Table 23 Drinking water quality in Barkly region communities (Health parameters)

	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	BORON	CADMIUM	CHROMIUM	COPPER	FLUORIDE
DWG Units	0.003 mg/L	0.01 mg/L	2 mg/L	0.06 mg/L	4 mg/L	0.002 mg/L	0.05 mg/L	2 mg/L	1.5 mg/L
Community	Health parameters – 95th percentile or maximum values								
Ali Curung	<0.0002	<0.0005	<0.05	<0.001	0.9	<0.0002	<0.005	0.06	1.1
No. Samples	7	7	7	7	7	7	7	7	8
Alpurrurulam	<0.0002	0.002	0.1	<0.001	0.3	<0.0002	<0.005	<0.01	**1.7**
No. Samples	8	8	8	8	8	8	8	8	10
Canteen Creek	<0.0002	0.0005	0.1	<0.001	0.3	<0.0002	<0.005	0.03	0.55
No. Samples	2	2	2	2	2	2	2	2	2
Imangara	<0.0002	0.001	0.4	<0.001	0.4	<0.0002	<0.005	<0.01	0.90
No. Samples	2	2	2	2	2	2	2	2	2
Nturiya	<0.0002	<0.0005	<0.05	<0.001	0.7	<0.0002	<0.005	<0.01	0.97
No. Samples	2	2	2	2	2	2	2	2	2
Tara	<0.0002	0.001	<0.05	<0.001	0.8	<0.0002	<0.005	0.08	0.94
No. Samples	1	1	1	1	1	1	1	1	3
Willowra	<0.0002	0.002	0.05	<0.001	0.6	0.0002	<0.005	<0.01	0.83
No. Samples	8	8	8	8	8	8	8	8	6
Wilora	<0.0002	0.002	0.05	<0.001	0.9	<0.0002	<0.005	0.03	1.3
No. Samples	10	10	10	10	10	10	10	10	12
Wutunugurra	<0.0002	0.001	0.3	<0.001	0.2	<0.0002	<0.005	<0.01	0.30
No. Samples	2	2	2	2	2	2	2	2	2

Numbers in **bold** exceed the guideline value.

LEAD	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	NITRATE	RADIOLOGICAL	SELENIUM	SILVER	URANIUM
0.01 mg/L	0.5 mg/L	0.001 mg/L	0.05 mg/L	0.02 mg/L	50 mg/L	1 mSv/yr	0.01 mg/L	0.1 mg/L	0.017 mg/L
0.01	<0.005	<0.0001	<0.005	<0.002	20	PASS	<0.001	<0.01	0.0007
7	7	7	7	7	8	2	7	7	7
<0.001	<0.005	<0.0001	<0.005	<0.002	5	0.05	0.002	<0.01	0.011
8	8	8	8	8	10	8	8	8	8
<0.001	<0.005	<0.0001	<0.005	<0.002	6	0.2	0.001	<0.01	0.0029
2	2	2	2	2	2	3	2	2	2
<0.001	0.01	<0.0001	<0.005	<0.002	10	PASS	0.001	<0.01	0.016
2	2	2	2	2	2	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	50	0.05	0.003	<0.01	0.015
2	2	2	2	2	2	2	2	2	2
<0.001	0.02	<0.0001	<0.005	0.002	20	0.1	0.002	<0.01	0.017
1	1	1	1	1	3	2	1	1	1
<0.001	<0.005	<0.0001	<0.005	<0.002	40	0.1	0.004	<0.01	**0.025**
8	8	8	8	8	6	2	8	8	8
0.006	<0.005	<0.0001	<0.005	<0.002	20	0.1	0.006	<0.01	**0.022**
10	10	10	10	10	12	12	10	10	10
<0.001	<0.005	<0.0001	<0.005	<0.002	8	0.02	<0.001	<0.01	0.015
2	2	2	2	2	2	7	2	2	2

Table 24 Drinking water quality in Barkly region communities (Aesthetic and other parameters)

	ALUMINIUM	CHLORIDE	FREE CHLORINE (ODOUR THRESHOLD)	COPPER	COLOUR (TRUE)	HARDNESS (AS CACO3)	IRON	MANGANESE	PH	SILICA
ADWG Units	0.2 mg/L	250 mg/L	0.6 mg/L	1 mg/L	15 CU	200 mg/L	0.3 mg/L	0.1 mg/L	6.5-8.5 pH unit	80 mg/L
Community	Aesthetic parameters – mean values									
Ali Curung	<0.02	42	**2.0**	0.03	<2	11	<0.02	<0.005	8.1	56
No. Samples	7	8	30	7	8	8	7	7	8	8
Alpurrurulam	<0.02	193	**1.0**	<0.01	<2	**475**	<0.02	<0.005	7.7	63
No. Samples	8	10	36	8	10	10	8	8	10	10
Canteen Creek	<0.02	110	**1.0**	0.02	2	**242**	0.21	<0.005	7.5	64
No. Samples	2	2	36	2	2	2	2	2	2	2
Imangara	<0.02	37	**0.8**	<0.01	3	**264**	0.07	0.008	7.9	77
No. Samples	2	2	36	2	2	2	2	2	2	2
Nturiya	<0.02	**335**	0.8	<0.01	2	**316**	<0.02	<0.005	7.9	75
No. Samples	2	2	12	2	2	2	2	2	2	2
Tara	0.2	**347**	**1.0**	0.08	3	**335**	1.09	0.05	7.1	20
No. Samples	2	3	33	1	3	3	2	2	3	3
Willowra	<0.02	173	**1.2**	<0.01	<2	**243**	<0.02	<0.005	8.3	80
No. Samples	8	6	33	8	6	6	8	8	6	6
Wilora	<0.02	**522**	0.0	<0.01	<2	**618**	<0.02	<0.005	8.0	80
No. Samples	10	12	0	10	12	12	10	10	12	12
Wutunugurra	<0.02	62	**1.0**	<0.01	2	160	<0.02	<0.005	7.8	77
No. Samples	2	2	33	2	2	2	2	2	2	2

Numbers in **bold** exceed the guideline value.

PowerWater

SODIUM	SULFATE	TDS	TURBIDITY	ZINC	ALKALINITY (AS CACO3)	BROMINE	CALCIUM	ELECTRICAL CONDUCTIVITY	IODINE (TASTE THRESHOLD)	POTASSIUM	TIN
180 mg/L	250 mg/L	600 mg/L	5 NTU	3 mg/L	mg/L	mg/L	mg/L	µS/cm	0.15 mg/L	mg/L	mg/L
					Other parameters – mean values						
75	3	271	0.7	0.02	120	0.17	1.8	426	0.08	12.8	<0.01
8	8	8	8	7	8	7	8	8	7	8	7
140	68	**918**	0.3	<0.01	460	0.71	62.2	1600	0.09	7	<0.01
10	10	10	10	8	10	8	10	10	8	10	8
111	26	**607**	3.4	<0.01	315	0.28	33.8	1000	0.09	12.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
43	<0.3	489	0.9	0.03	350	0.14	36.7	835	0.06	29.9	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
241	169	**1155**	0.3	0.06	210	2.82	78.4	1900	**0.18**	22.6	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
228	136	**1027**	0.2	0.09	200	2.03	38.0	1867	**0.28**	27	<0.01
3	3	3	3	2	3	2	3	3	2	3	2
135	64	**763**	0.3	0.02	245	0.65	49.5	1267	0.14	28.8	<0.01
6	6	6	6	8	6	8	6	6	8	6	8
324	193	**1640**	2	0.07	382	3.2	97.7	2767	**0.22**	56.8	<0.01
12	12	12	12	10	12	10	12	12	10	12	10
54	8	384	0.4	0.02	175	0.14	32.5	600	0.06	8.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2

Table 25 Drinking water quality in Southern region communities (Health parameters)

	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	BORON	CADMIUM	CHROMIUM	COPPER	FLUORIDE
ADWG Units	0.003 mg/L	0.01 mg/L	2 mg/L	0.06 mg/L	4 mg/L	0.002 mg/L	0.05 mg/L	2 mg/L	1.5 mg/L
Community	Health parameters – 95th percentile or maximum values								
Amoonguna	<0.0002	<0.0005	0.1	<0.001	0.1	<0.0002	<0.005	0.06	0.49
No. Samples	3	3	3	3	3	3	3	3	3
Ampilatwatja	<0.0002	<0.0005	<0.05	<0.001	0.3	<0.0002	<0.005	<0.01	1.2
No. Samples	2	2	2	2	2	2	2	2	2
Areyonga	<0.0002	<0.0005	0.1	<0.001	0.2	<0.0002	<0.005	<0.01	0.40
No. Samples	2	2	2	2	2	2	2	2	2
Atitjere	<0.0002	<0.0005	0.05	<0.001	0.1	<0.0002	<0.005	<0.01	0.63
No. Samples	2	2	2	2	2	2	2	2	2
Engawala	<0.0002	<0.0005	0.2	<0.001	0.2	<0.0002	<0.005	<0.01	0.66
No. Samples	2	2	2	2	2	2	2	2	2
Finke	<0.0002	0.002	0.2	<0.001	0.08	<0.0002	<0.005	0.01	0.20
No. Samples	2	2	2	2	2	2	2	2	2
Haasts Bluff	<0.0002	<0.0005	<0.05	<0.001	0.4	<0.0002	<0.005	0.01	0.50
No. Samples	2	2	2	2	2	2	2	2	2
Hermannsburg	<0.0002	<0.0005	<0.05	<0.001	0.2	<0.0002	<0.005	<0.01	0.33
No. Samples	2	2	2	2	2	2	2	2	2
Imanpa	<0.0002	<0.0005	<0.05	<0.001	0.9	<0.0002	0.005	0.01	0.95
No. Samples	10	10	10	10	10	10	10	10	10
Kaltukatjara	<0.0002	<0.0005	<0.05	<0.001	0.2	<0.0002	<0.005	0.02	0.44
No. Samples	2	2	2	2	2	2	2	2	2
Kintore	<0.0002	<0.0005	<0.05	<0.001	0.4	<0.0002	<0.005	<0.01	0.49
No. Samples	10	10	10	10	10	10	10	10	10
Laramba	<0.0002	0.0005	0.3	<0.001	0.4	<0.0002	<0.005	0.1	1.3
No. Samples	10	10	10	10	10	10	10	10	10
Mt Liebig	<0.0002	<0.0005	0.05	<0.001	0.3	<0.0002	<0.005	0.01	1.2
No. Samples	2	2	2	2	2	2	2	2	2
Nyirripi	<0.0002	0.002	0.1	<0.001	0.4	<0.0002	<0.005	<0.01	**1.9**
No. Samples	10	10	10	10	10	10	10	10	10
Papunya	<0.0002	0.0005	0.1	<0.001	0.3	<0.0002	<0.005	0.01	0.99
No. Samples	2	2	2	2	2	2	2	2	3
Pmara Jutunta	<0.0002	0.001	0.05	<0.001	0.4	<0.0002	<0.005	<0.01	0.78
No. Samples	2	2	2	2	2	2	2	2	2
Santa Teresa	<0.0002	<0.0005	0.5	<0.001	0.06	<0.0002	<0.005	0.01	0.23
No. Samples	4	4	4	4	4	4	4	4	4
Titjikala	<0.0002	0.002	0.3	<0.001	0.1	<0.0002	<0.005	0.02	0.60
No. Samples	4	4	4	4	4	4	4	4	4
Wallace Rockhole	<0.0002	0.001	<0.05	<0.001	0.4	<0.0002	0.04	0.01	0.80
No. Samples	2	2	2	2	2	2	2	2	2
Yuelamu	<0.0002	<0.0005	<0.05	<0.001	1.4	<0.0002	<0.005	0.3	**1.9**
No. Samples	12	12	12	12	12	12	12	12	12
Yuendumu	<0.0002	<0.0005	0.05	<0.001	0.3	<0.0002	<0.005	0.02	<0.1
No. Samples	2	2	2	2	2	2	2	2	2

Numbers in **bold** exceed the guideline value.

PowerWater

LEAD	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	NITRATE	RADIOLOGICAL	SELENIUM	SILVER	URANIUM
0.01 mg/L	0.5 mg/L	0.001 mg/L	0.05 mg/L	0.02 mg/L	50 mg/L	1 mSv/yr	0.01 mg/L	0.1 mg/L	0.017 mg/L
0.003	0.09	<0.0001	<0.005	<0.002	8	0.1	0.001	<0.01	0.0085
3	3	3	3	3	3	3	3	3	3
<0.001	<0.005	<0.0001	<0.005	<0.002	30	0.03	0.002	<0.01	0.0090
2	2	2	2	2	2	4	2	2	2
<0.001	<0.005	<0.0001	<0.005	0.006	8	0.1	0.001	<0.01	0.013
2	2	2	2	2	2	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	30	PASS	0.003	<0.01	0.0069
2	2	2	2	2	2	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	30	PASS	0.002	<0.01	0.0040
2	2	2	2	2	2	4	2	2	2
0.003	0.06	<0.0001	<0.005	<0.002	9	PASS	<0.001	<0.01	0.0030
2	2	2	2	2	2	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	0.004	6	0.03	0.002	<0.01	0.011
2	2	2	2	2	2	3	2	2	2
<0.001	0.02	<0.0001	<0.005	<0.002	5	PASS	<0.001	<0.01	0.0044
2	2	2	2	2	2	3	2	2	2
0.001	0.01	<0.0001	<0.005	0.004	30	0.2	0.004	<0.01	0.013
10	10	10	10	10	10	10	10	10	10
<0.001	0.01	<0.0001	<0.005	<0.002	0.1	PASS	<0.001	<0.01	<0.00001
2	2	2	2	2	2	4	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	20	PASS	<0.001	<0.01	0.00022
10	10	10	10	10	10	3	10	10	10
0.006	<0.005	<0.0001	<0.005	<0.002	50	0.1	0.004	<0.01	**0.048**
10	10	10	10	10	10	8	10	10	10
<0.001	<0.005	<0.0001	<0.005	<0.002	20	PASS	0.002	<0.01	0.0064
2	2	2	2	2	2	2	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	30	PASS	0.002	<0.01	0.010
10	10	10	10	10	10	2	10	10	10
<0.001	<0.005	<0.0001	<0.005	<0.002	20	PASS	0.005	<0.01	0.0095
2	2	2	2	2	3	3	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	50	PASS	0.002	<0.01	0.0066
2	2	2	2	2	2	4	2	2	2
<0.001	<0.005	<0.0001	<0.005	<0.002	10	0.1	0.003	<0.01	0.0047
4	4	4	4	4	4	3	4	4	4
0.001	<0.005	<0.0001	<0.005	<0.002	20	PASS	0.001	<0.01	0.0038
4	4	4	4	4	4	2	4	4	4
<0.001	<0.005	<0.0001	<0.005	0.002	20	0.2	0.004	<0.01	0.0059
2	2	2	2	2	2	2	2	2	2
0.001	<0.005	<0.0001	<0.005	<0.002	20	0.5	<0.001	<0.01	0.0062
12	12	12	12	12	12	2	12	12	12
<0.001	<0.005	<0.0001	<0.005	<0.002	<0.1	0.04	0.002	<0.01	**0.020**
2	2	2	2	2	2	5	2	2	2

Table 26 Drinking water quality in Southern region communities (Aesthetic and other parameters)

	ALUMINIUM	CHLORIDE	FREE CHLORINE (ODOUR THRESHOLD)	COPPER	COLOUR (TRUE)	HARDNESS (AS CACO3)	IRON	MANGANESE	PH	SILICA
ADWG Units	0.2 mg/L	250 mg/L	0.6 mg/L	1 mg/L	15 CU	200 mg/L	0.3 mg/L	0.1 mg/L	6.5-8.5 pH unit	80 mg/L
Community	Aesthetic parameters – mean values									
Amoonguna	0.06	73	**0.9**	0.05	2	191	0.2	0.04	7.4	17
No. Samples	3	3	43	3	3	3	3	3	3	3
Ampilatwatja	<0.02	165	**1.0**	<0.01	3	**464**	<0.02	<0.005	8.0	37
No. Samples	2	2	36	2	2	2	2	2	2	2
Areyonga	<0.02	120	**1.3**	<0.01	2	**472**	<0.02	<0.005	7.7	19
No. Samples	2	2	36	2	2	2	2	2	2	2
Atitjere	<0.02	98	**1.1**	<0.01	<2	**252**	<0.02	<0.005	8.1	35
No. Samples	2	2	36	2	2	2	2	2	2	2
Engawala	<0.02	125	**1.1**	<0.01	<2	**371**	<0.02	<0.005	7.8	66
No. Samples	2	2	36	2	2	2	2	2	2	2
Finke	0.05	160	**0.9**	<0.01	2	**218**	**0.9**	0.03	7.9	15
No. Samples	2	2	36	2	2	2	2	2	2	2
Haasts Bluff	<0.02	**375**	0.9	<0.01	3	**595**	0.03	<0.005	7.8	40
No. Samples	2	2	23	2	2	2	2	2	2	2
Hermannsburg	<0.02	115	**0.9**	<0.01	3	**260**	0.09	0.009	8.0	15
No. Samples	2	2	30	2	2	2	2	2	2	2
Imanpa	<0.02	**423**	**1.1**	<0.01	9	**515**	0.03	0.007	8.1	25
No. Samples	10	10	36	10	10	10	10	10	10	10
Kaltukatjara	<0.02	96	**1.1**	0.02	3	**287**	0.05	0.006	7.9	13
No. Samples	2	2	36	2	2	2	2	2	2	2
Kintore	<0.02	42	**1.0**	<0.01	<2	85	<0.02	<0.005	7.7	**83**
No. Samples	10	10	36	10	10	10	10	10	10	10
Laramba	<0.02	121	**1.1**	0.02	<2	**326**	<0.02	<0.005	7.7	**86**
No. Samples	10	10	36	10	10	10	10	10	10	10
Mt Liebig	<0.02	125	**1.0**	<0.01	4	**282**	0.03	<0.005	7.7	46
No. Samples	2	2	33	2	2	2	2	2	2	2
Nyirripi	<0.02	90	**1.0**	<0.01	<2	**226**	<0.02	<0.005	8.1	**82**
No. Samples	10	10	30	10	10	10	10	10	10	10
Papunya	<0.02	220	**1.0**	<0.01	3	**259**	<0.02	<0.005	8.1	59
No. Samples	2	2	33	2	2	2	2	2	2	2
Pmara Jutunta	<0.02	69	**1.0**	<0.01	<2	**207**	<0.02	<0.005	7.9	**92**
No. Samples	2	2	30	2	2	2	2	2	2	2
Santa Teresa	<0.02	10	**1.2**	<0.01	<2	**265**	<0.02	<0.005	7.8	18
No. Samples	4	4	36	4	4	4	4	4	4	4
Titjikala	0.03	32	**1.1**	0.01	2	**229**	<0.02	<0.005	7.6	32
No. Samples	4	4	36	4	4	4	4	4	4	4
Wallace Rockhole	0.1	140	**1.0**	<0.01	3	**281**	0.06	<0.005	7.7	12
No. Samples	2	2	30	2	2	2	2	2	2	2
Yuelamu	<0.02	63	**0.8**	0.03	<2	53	<0.02	<0.005	7.9	73
No. Samples	12	12	33	12	12	12	12	12	12	12
Yuendumu	<0.02	**305**	**1.0**	0.02	3	**541**	0.03	<0.005	7.9	16
No. Samples	2	2	36	2	2	2	2	2	2	2

Numbers in **bold** letter exceed the guideline value.

PowerWater

SODIUM	SULFATE	TDS	TURBIDITY	ZINC	ALKALINITY (AS CACO3)	BROMINE	CALCIUM	ELECTRICAL CONDUCTIVITY	IODINE (TASTE THRESHOLD)	POTASSIUM	TIN
180 mg/L	250 mg/L	600 mg/L	5 NTU	3 mg/L	mg/L	mg/L	mg/L	µS/cm	0.15 mg/L	mg/L	mg/L
					Other parameters – mean values						
79	39	456	4	0.02	240	0.24	42.7	813	0.04	4.8	<0.01
3	3	3	3	3	3	3	3	3	3	3	3
121	210	**986**	0.2	<0.01	300	0.37	97.1	1500	0.09	20.8	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
65	83	**702**	0.4	0.04	370	0.31	87.6	1250	0.06	7.0	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
88	95	**606**	0.8	<0.01	220	0.27	40.4	995	0.05	7.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
68	41	**697**	0.6	0.05	330	0.42	67.9	1200	0.07	5.9	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
96	54	497	**9**	0.03	120	0.22	64.2	930	0.02	6.8	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
167	228	**1205**	0.4	0.02	230	0.79	116	2000	0.12	20.0	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
68	46	552	1	<0.01	230	0.34	51.3	950	0.06	5.7	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
284	252	**1360**	0.8	0.02	208	1.73	103.4	2310	**0.32**	27.8	<0.01
10	10	10	10	10	10	10	10	10	10	10	10
66	56	504	0.8	0.05	250	0.49	54.6	910	0.11	11.0	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
70	<0.3	334	0.4	<0.01	166	0.34	14.1	504	0.04	2.2	<0.01
10	10	10	10	10	10	10	10	10	10	10	10
54	22	**650**	0.3	<0.01	289	0.49	65.1	1100	**0.18**	36.2	<0.01
10	10	10	10	10	10	10	10	10	10	10	10
100	92	**648**	0.5	<0.01	260	0.48	61.8	1100	0.10	11.8	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
86	24	572	0.4	<0.01	283	0.21	44.6	928	0.10	23.7	<0.01
10	10	10	10	10	10	10	10	10	10	10	10
230	64	**963**	0.2	<0.01	430	1.01	53.9	1600	0.13	11.1	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
62	28	525	0.2	<0.01	210	0.20	46.4	795	0.07	15.5	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
8	2	287	0.2	<0.01	253	0.05	68.6	550	<0.01	3.7	<0.01
4	4	4	4	4	4	4	4	4	4	4	4
32	8	335	2	0.03	220	0.12	66.7	593	0.02	3.8	<0.01
4	4	4	4	4	4	4	4	4	4	4	4
97	56	569	4	0.05	230	0.20	66.6	1100	0.08	8.3	<0.01
2	2	2	2	2	2	2	2	2	2	2	2
81	5	325	0.7	0.3	128	0.561	19.6	490	**0.20**	0.7	<0.01
12	12	12	12	12	12	12	12	12	12	12	12
141	129	**1015**	0.4	0.03	325	0.51	109.0	1800	**0.17**	19.2	<0.01
2	2	2	2	2	2	2	2	2	2	2	2

PowerWater