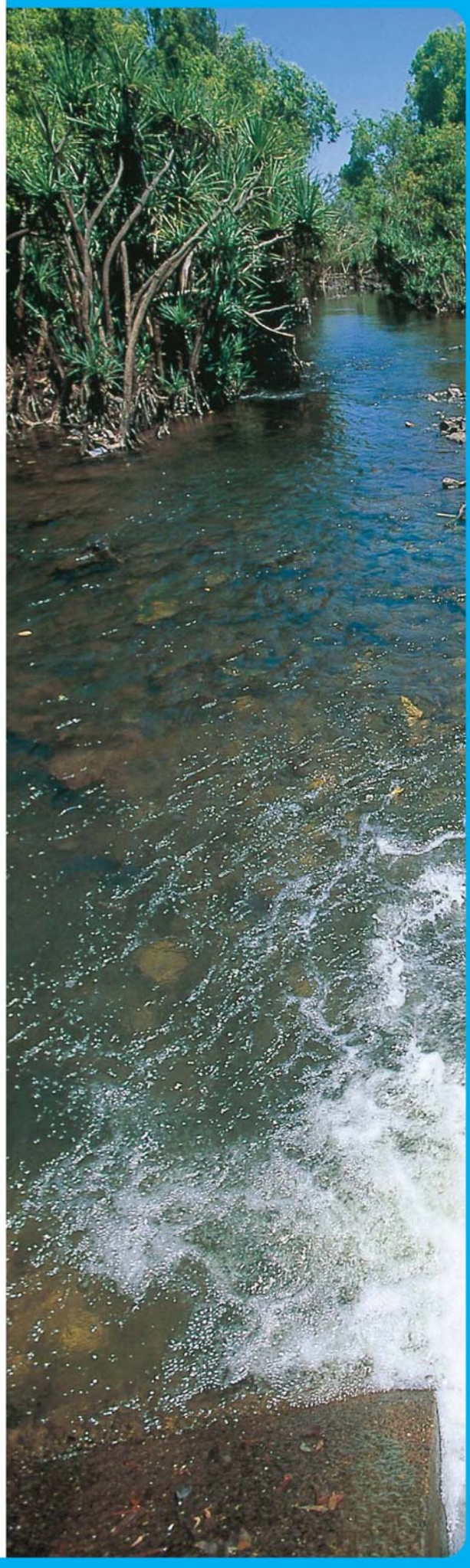
POWER AND WATER CORPORATION



Annual Drinking Water Quality Report 2006-07

Indigenous Essential Services Pty Ltd

PowerWater

Contents

1 Water services for Indigenous communities

Indigenous Essential Services (IES) was established in 2003 as a wholly owned subsidiary of Power and Water to provide electricity, water and sewerage services to the 72 nominated Indigenous Communities as part of an agreement with the Department of Planning and Infrastructure (DPI). In addition to the 72 Indigenous communities Power and Water provide water services to 7 outstations.

The provision of water services to the Indigenous communities involves commitment from a number of Government Departments:

- Department of Health and Community Services (DHCS): Under the *Water Supply and Sewerage Services Act 2000*, the DHCS Environmental Health Program has a key role in setting goals for drinking water quality and ensuring the protection of public health. Power and Water and Environmental Health work closely on these issues and have developed a monitoring program for physical, chemical, radiological and microbiological parameters in drinking water supplies operated by Power and Water that are consistent with the Australian Drinking Water Guidelines (ADWG)[1].

- Department of Primary Industries, Fisheries and Mines (DPIFM): DPIFM provides diagnostic services through the water chemistry and microbiology laboratories, which analyse the quality of the majority of Indigenous communities' drinking water and wastewater quality, playing a crucial role in reporting data for microbiological, physical and chemical quality monitoring.

- The Environment Protection Agency (EPA) of Department of Natural Resources, Environment and the Arts (NRETA): Under the *Water Act* and the *Waste Management and Pollution Control Act* the EPA are the authoritative body responsible for the regulation of environmental water quality through licensing and providing advice.

Power and Water employs around 60 people in administration, community liaison, community water planning, electrical operations, mechanical operations, planning and development, water quality and water and sewerage operation, to provide electricity, water and sewerage services to the Indigenous communities. These positions support the Essential Service Operators (ESO), which are employed by local councils and private contractors to provide the day to day operation and maintenance of the essential services within the communities.

1.1 Our commitment

Power and Water is committed to providing drinking water that is safe, reliable and of a good quality and has developed Drinking Water Quality Policy to define the services that we aim to provide. Power and Water developed Water for Healthy Communities as a strategic initiative to integrate demand management, water source sustainability, strategic asset management and the achievement of water quality objectives.

[1] Australian Drinking Water Guidelines 2004. National Health and Medical Research Council.

1.2 Water for healthy communities

Water for Healthy Communities initiative provides an integrated water solution for the provision of water services in Indigenous communities. This approach to water management focuses on the development of *Community Water Plans* for each of the individual 72 Indigenous communities serviced by Power and Water.

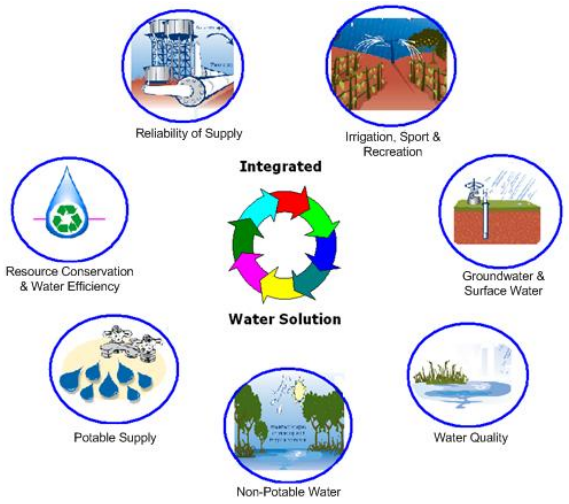


Figure 1: Water for Healthy Communities Integrated Water Solution

Community Water Plans are based on the Framework for the Management of Drinking Water Quality (Framework) incorporated as part of the ADWG[1]. The Framework guides the design of a structured and systematic approach for the management of drinking water quality from 'catchment to consumer' to assure its safety and reliability. This risk management based approach focuses on the implementation, maintenance, and monitoring of effective 'multiple barriers' to ensure robust systems can prevent contamination from entering the system to minimise the risks.

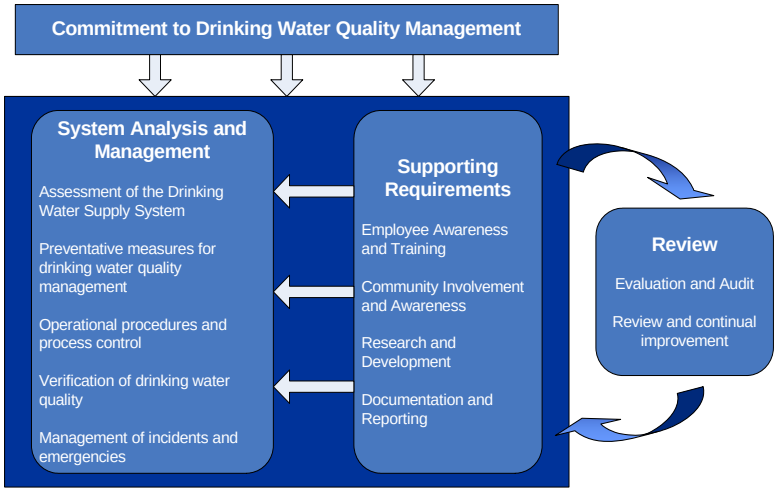


Figure 2: Framework for the Management of Drinking Water Quality[1]

[1] Australian Drinking Water Guidelines, 2004, National Health and Medical Research Council.

The Framework is comprised of 12 elements to provide a systematic and holistic approach to water management. It also provides a platform to increase community involvement in the water systems through the inclusion of the communities' needs and aspirations in water planning, diversification of source options based on end use, greater involvement in the protection of water quality and the efficient use of water to improve sustainability.

Strategy for safe water

The *Strategy for the Provision of Safe Drinking Water for Indigenous Communities 2007-2010 (Strategy for Safe Water)* was developed to specifically focus on the improvement of quality of the water supplied in Indigenous communities consistent with the ADWG by 2010-11.

- The highest priority of the *Strategy for Safe Water* in 2007-09 is to improve the microbiological security of the water supply systems. This is being carried out in conjunction with the development of *Community Water Plans* through a complete evaluation of the water supply systems and risk assessment. The risk assessment framework identifies infrastructure and operational strategies to manage the specific risks to the supply systems and improve the microbiological security including automated disinfection and continuous on-line monitoring.

- The *Strategy for Safe Water* in 2008-10 targets improving the chemical, physical and radiological quality of the water supplied. The chemical, physical and radiological quality of groundwater remains relatively stable and the analysis of this quality is conducted every couple of years. The implementation of this quality monitoring was initiated in 2007 and the results will be presented in the next version of this report for 2007-08. A risk assessment of the results of the water quality monitoring will be presented to the Chief Health Officer for endorsement of the priorities for implementation of the capital infrastructure program for the *Strategy for Safe Water*.

The *Strategy for Safe Water* is based on the guiding principals of the ADWG and the outcomes have been incorporated into the Power and Water's Statement of Corporate Intent.

1.3 Water supply systems

The Northern Territory comprises an area of 1.4 million km2 and the Indigenous communities are spread across the diverse and sparse landscape with often challenging geographic and climatic conditions. The Northern Region has a tropical climate with two official seasons, a Wet and a Dry, while the central and Southern Regions have a drier climate with cooler winters and hot dry summers. The population sizes of the communities vary significantly, ranging from approximately 50 people to almost 3000 people.

Regions

The management of water services is divided into regions based around central offices that service the communities in the area.

Northern region

The Northern Region has two central offices located in Darwin and Katherine where day to day operations of the surrounding communities are managed.

Surrounding Darwin Communities: Acacia Larrakia, Angurugu, Belyuen, Galiwinku (Elcho Island), Gapuwiyak (Lake Evella), Gunbalanya, Gunyangara (Ski Beach), Maningrida, Milikapiti (Snake Bay), Milingimbi, Milyakburra (Bickerton Island), Minjilang (Croker Island), Nauiyu Nambiyu (Daly River), Nguiu (Bathurst Island), 4 Mile Camp[1], Numbulwar, Palumpa, Peppimenarti, Pirlangimpi, Ramingining, Umbakumba, Wadeye, Warruwi, Yirrkala.

Surrounding Katherine Communities: Amanbidji (Kildurk), Barunga, Beswick, Binjari, Bulla, Bulman, Dagaragu, Jilkminggan (Duck Creek), Eva Valley (Manyallaluk), Jodetluk (Gorge Camp)[2], Kalkarindji (Wave Hill), Kybrook Farm, Lajamanu, Minyerri, Ngukurr, Pigeon Hole, Rittarangu, Robinson River, Weemol, Wulkabimirri[3], Yarralin.

Southern region

The Southern Region has two central offices located in Tennant Creek and Alice Springs where the day to day operations of the communities in the surrounding areas are managed.

Communities surrounding Tennant Creek: Ali Curung, Alpurrurulam (Lake Nash), Ampilawatja, Barunga, Canteen Creek (Orwaitilla), Imangara (Murray Downs), Nturiya (Ti Tree Station), Pmara Jutunta[4] , Tara, Willowra, Wilora, Wutunugurra (Epenarra).

Communities surrounding Alice Springs: Amoonguna[5], Areyonga, Atitjere (Hart Range), Engawala, Finke (Apatula), Haasts Bluff (Ikuntji), Hermannsburg, Imanpa (Mt Ebenezer), Kaltukatjara (Docker River), Kaporilya[6], Kintore, Laramba (Napperby), Lyilyalanama[6], Mt Liebig, Nyirripi, Papunya, Santa Teresa, Titjikala (Maryvale Station), Tjuwanpa[7], Ulpunda[6], Wallace Rockhole, Yuelamu (Mt Allan), Yuendumu.

Water sources

Across the Northern Territory, the hydrogeology varies and significantly influences the availability and natural quality of the source water used for the community water supplies. The majority of the Indigenous communities source their water from groundwater through conventional bore systems. Typically, groundwater sources in the Northern Region are relatively shallow with naturally low pH levels, while groundwater supplies in the Southern Region are located much further underground with typically high concentrations of Total Dissolved Solids (TDS). Three communities rely exclusively on surface water sources and six communities utilise a combination of groundwater and surface water sources.

[1] Outstation: water sourced from the Nguiu supply.
[2] Outstation: water sourced from the Katherine supply.
[3] Outstation: water sourced from the Ramingining supply.
[4] Water sourced from the Ti Tree supply.
[5] Water sourced from the Alice Springs supply.
[6] Water sourced from the Hermannsburg supply.
[7] Resource Centre: water sourced from the Hermannsburg supply.

Disinfection systems

The effectiveness of disinfection is well established as a barrier to protect potentially harmful microorganisms from contaminating the water supply.

The greatest risks to consumers of drinking water are pathogenic microorganisms. Protection of water sources and treatment are of paramount importance and must never be compromised.[1]

There are a number of microorganisms, including bacterial pathogens, protozoa, viruses, helminths and cyanobacteria, which have the potential to enter and contaminate the water supply. However the impact of these on the health of consumers varies significantly, the severity and distribution of infection is influenced by several factors including the number and type of pathogen present in the system, the amount of water being consumed and the susceptibility of the consumer. Disease is caused most commonly by the entry of the "classic" pathogenic organisms, from the gastrointestinal system (excreted in faeces), into the water supply. Disinfection is a fundamental component of the management of the microbiological quality as the systems destroy the microorganisms and reduces the number of waterborne pathogens that lowers the risk of illness to consumers.

Predominately chlorine is utilised as the primary disinfection barrier in the Indigenous communities due to its versatility across system sizes, effectiveness in destroying pathogenic microorganisms, ability to maintain residual protection throughout reticulation system, affordability and simplicity. In the Northern Region, the majority of community water supplies are automatically dosed (treated) with sodium hypochlorite, while in the Southern Region the majority of the community water supplies are manually treated with calcium hypochlorite. The automated sodium hypochlorite systems utilised are relatively reliable and more effective at maintaining consistent chlorine residuals compared to manual calcium hypochlorite system, which often results in fluctuating chlorine residuals.

In order to achieve effective disinfection with chlorination, chlorine residuals must be maintained continuously at adequate levels throughout the supply system. Automatic sodium hypochlorite dosing systems with continuous online monitoring of chlorine residuals are considered the most effective way to determine the effectiveness of disinfection. The implementation of the *Strategy for Safe Water* in 2007-09 will focus on the implementation of standardised automated sodium hypochlorite disinfection systems in all communities and continuous online monitoring of the water supply system.

The use of chlorination to provide disinfection can produce certain disinfection-by-products, which are produced from a reaction between chlorine and organic matter that may be associated with some cancers. Consistent with the ADWG Power and Water actively reduce the potential for the formation of disinfection-by-products through filtration of surface water supplies that typically contain higher concentrations of natural organic matter than groundwater supplies and routine flushing of reticulation water mains to control the amount of organic matter in the supply systems.

[1] Australian Drinking Water Guidelines, 2004, National Health and Medical Research Council.

Ultra Violet (UV) disinfection is also utilised in a number of Indigenous communities, which involves exposing water to radiation from UV light to disrupt the microorganisms. Currently, these systems are predominantly located in communities in the Southern Region with relatively small reticulation systems with limited dead ends that have a lower risk of ingress into the system and have secure groundwater sources. Through the implementation of the Strategy for Safe Water additional UV systems may be installed in communities that have been identified as having a high risk of pathogens in the source water supplies. The UV systems in these communities will be utilised as the primary disinfection to destroy the majority of pathogens and will be followed by a sodium hypochlorite system to maintain residual disinfection to control pathogens throughout the reticulation system.

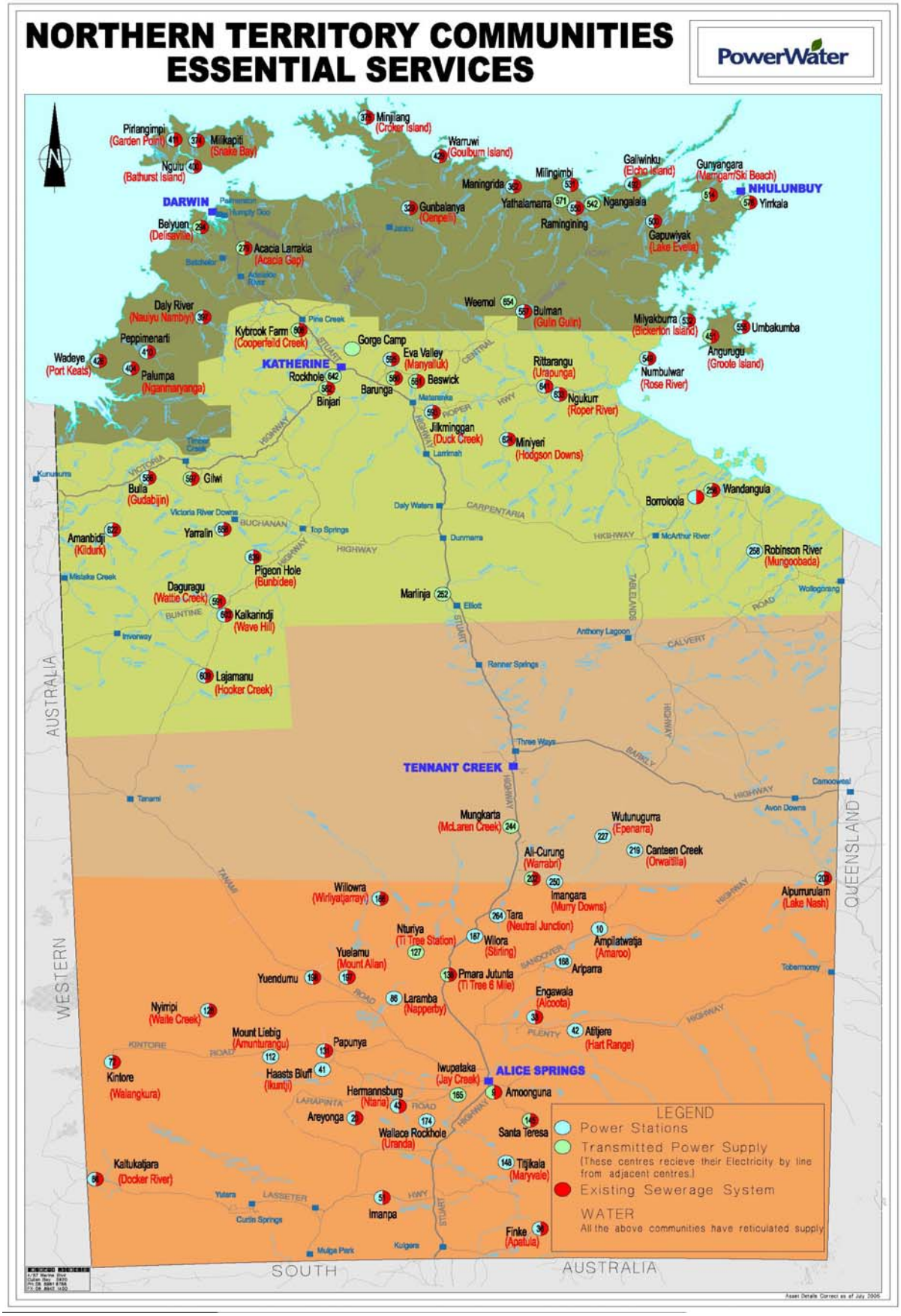


Figure 3: Communities with water services provided under the Indigenous Essential Services Program

Table 1: Water supply systems in the Northern region communities 2007/2008

Community Name	Water Supply Source			Disinfection Type				Comments and *Stategy for Safe Water*
	Surface Water	Groundwater	Combination	Calcium Hypochlorite	Sodium Hypochlorite	Chlorine Gas	Ultra Violet Disinfection	
Acacia Larrakia		✔			✔			
Amanbidji (Kildurk)		✔			✔			
Angurugu			✔		✔			Gemco provides disinfection
Barunga	✔					✔		Additional UV proposed in 2007-08
Belyuen		✔			✔			
Beswick		✔			✔			
Binjari		✔		✔				Sodium hypochlorite proposed in 2008-09
Bulla			✔		✔			Additional UV proposed in 2008-09
Bulman		✔			✔			
Daguragu		✔			✔			
Eva Valley (Manyallaluk)		✔		✔				Sodium hypochlorite proposed in 2008-09
Galiwinku (Elcho Island)		✔			✔			
Gapuwiyak (Lake Evella)		✔			✔			
Gunbalanya			✔		✔			Additional UV proposed in 2007-08
Gunyangara (Ski Beach)		✔			✔			Alcan provides disinfection
Jilkminggan (Duck Creek)		✔			✔			
Jodetluk (Gorge Camp)		✔			✔			
Kalkarindji (Wave Hill)		✔			✔			
Kybrook Farm			✔		✔			
Lajamanu		✔			✔			
Maningrida		✔		✔				Additional UV proposed in 2007-08
Milikapiti (Snake Bay)		✔			✔			
Milingimbi		✔			✔			
Milyakburra (Bickerton Island)		✔			✔			

Table 1 continued

Community Name	Water Supply Source			Disinfection Type				Comments and *Stategy for Safe Water*
	Surface Water	Groundwater	Combination	Calcium Hypochlorite	Sodium Hypochlorite	Chlorine Gas	Ultra Violet Disinfection	
Minjilang (Croker Island)		✔			✔			
Minyerri		✔			✔			
Nauiyu Nambiyu (Daly River)		✔			✔			
Nguiu (Bathurst Island)		✔			✔			
Ngukurr			✔			✔		Additional UV proposed in 2008-09
Numbulwar		✔			✔			
Palumpa		✔			✔			
Peppimenarti		✔			✔			
Pigeon Hole		✔			✔			
Pirlangimpi	✔				✔			Additional UV proposed in 2007-08
Ramingining		✔			✔			
Rittarangu		✔			✔			
Robinson River			✔		✔			Additional UV proposed in 2008-09
Umbakumba		✔			✔			
Wadeye		✔			✔			
Warruwi		✔			✔			
Weemol		✔			✔			
Wulkabimirri		✔			✔			Water sourced from the Ramingining supply
Yarralin		✔			✔			
Yirrkala		✔			✔			
4 Mile Camp		✔			✔			Water sourced from the Nguiu supply

Table 2: Water supply systems in the Southern region communities 2006/2007

Community Name	Water Supply Source			Disinfection Type				Comments and *Stategy for Safe Water*
	Surface Water	Groundwater	Combination	Calcium Hypochlorite	Sodium Hypochlorite	Chlorine Gas	Ultra Violet Disinfection	
Ali Curung		✔		✔				Sodium hypochlorite proposed in 2007-08
Alpurrurulam (Lake Nash)		✔		✔				Sodium hypochlorite proposed in 2007-08
Amoonguna		✔				✔		Water sourced from the Alice Springs supply
Ampilawatja		✔					✔	
Areyonga		✔		✔				
Atitjere (Hart Range)		✔		✔				Sodium hypochlorite proposed in 2008-09
Canteen Creek (Orwaitilla)		✔		✔				UV proposed in 2008-09
Engawala		✔		✔				Sodium hypochlorite proposed in 2008-09
Finke (Apatula)		✔		✔				Sodium hypochlorite proposed in 2007-08
Haasts Bluff (Ikuntji)		✔		✔				UV proposed in 2008-09
Hermannsburg		✔		✔				Sodium hypochlorite proposed in 2007-08
Imangara (Murray Downs)		✔		✔				UV proposed in 2008-09
Imanpa		✔		✔				Sodium hypochlorite proposed in 2008-09
Kaporilya		✔		✔				Water sourced from the Hermannsburg supply
Kaltukatjara (Docker River)		✔		✔				Sodium hypochlorite proposed in 2008-09
Kintore		✔					✔	
Laramba (Napperby)		✔		✔				Sodium hypochlorite proposed in 2008-09
Lyilyalanama		✔				✔		Water sourced from the Alice Springs supply
Mt Liebig		✔		✔				
Nturiya (Ti Tree Station)		✔					✔	

Table 2 continued

Community Name	Water Supply Source			Disinfection Type				Comments and *Stategy for Safe Water*
	Surface Water	Groundwater	Combination	Calcium Hypochlorite	Sodium Hypochlorite	Chlorine Gas	Ultra Violet Disinfection	
Nyirripi		✔		✔				Sodium hypochlorite proposed in 2007-08
Papunya		✔		✔				Sodium hypochlorite proposed in 2008-09
Pmara Jutunta		✔			✔			Water sourced from Ti Tree Supply
Santa Teresa		✔		✔				Sodium hypochlorite proposed in 2008-09
Tara		✔		✔				Additional UV proposed in Strategy 2008-09
Titjikala (Maryvale Station)		✔		✔				Sodium hypochlorite proposed in 2008-09
Tjuwanpa		✔		✔				Water sourced from the Hermannsburg supply
Ulpunda		✔				✔		Water sourced from the Alice Springs supply
Wallace Rockhole		✔		✔				
Willowra		✔		✔				Sodium hypochlorite proposed in 2007-08
Wilora		✔					✔	
Wutunugurra (Epenarra)		✔		✔				Sodium hypochlorite proposed in 2007-08
Yuelamu (Mt Allan)	✔						✔	
Yuendumu		✔		✔				Sodium hypochlorite proposed in 2007-08

2 Microbiological drinking water quality

2.1 Monitoring

Verification and operational

Verification and operational monitoring is used to assess the performance of a water system over time by providing important information to assist in the identification of emerging problems and trends, evaluating the need for upgrades and identifying opportunities for improvement[1]. It is also used for compliance with regulatory requirements and provides an assessment of quality for communication and benchmarking.

Verification of the water quality supplied by Power and Water is monitored through the *Drinking Water Operational and Verification Monitoring Program 2006-2009 (Water Quality Monitoring Program)* that is endorsed by the Chief Health Officer. Power and Water maintain, implement and routinely revise the program to assist in the management of the systems through quality assurance, system performance testing and verification testing of system integrity. The program is based on the ADWG with the frequency of microbiological monitoring of the water supply systems based on the population of the community. Typically communities with populations of less than 1000 people are monitored monthly, while those communities with populations greater than 1000 people are monitored on a weekly basis.

Source water monitoring

Monitoring of the raw source water provides evidence based information on the hazards that threaten the quality of a water supply and the challenges faced when trying to provide consumers with a water supply that is safe to drink. Information obtained through ongoing source water monitoring sets the foundations for effective strategic management and better interpretation of system performance by providing a better understanding of catchment and reservoir characteristics in varying conditions[2].

The current *Water Quality Monitoring Program* concentrates on the monitoring of the treated drinking water supplied to consumers, however raw source water quality monitoring will be implemented in all communities 2008-09. The inclusion of this monitoring is consistent with the 'multiple barrier' approach and provides valuable information on the potential health risks to the consumers and our operational management. For the past year raw source water quality monitoring was carried out in the communities in the Southern Region, which identified occasions where the groundwater source contained microbiological contamination and the disinfection system effectively prevented the contamination from reaching the consumers.

[1] Australian Drinking Water Guidelines, 2004, National Health and Medical Research Council.
[2] Strategic Water Quality Monitoring for Drinking Water Safety Research Report 37: Strategic Water Quality Monitoring. Cooperative Research Centre for Water Quality and Treatment 2007.

Indicator organisms

Microbiological indicator organisms are routinely monitored within each community water supply system as a final check to verify water quality. The Indigenous community water supply systems are monitored for the following microbiological indicators:

- ***Escherichia coli* (*E. coli*)** – an indicator of recent faecal contamination, any detection of *E. coli* in drinking water requires immediate action.
- **Total Coliforms** – an indicator of disinfection performance and system integrity, analysis of long-terms trends can provide information on the operational performance.
- **Heterotrophic Plate Count (HPC)** – an indicator of system performance, high counts can indicate treatment failure or water stagnation.

2.2 Performance

Verification monitoring of drinking water systems

The ADWG recommend that a drinking water systems performance can be regarded as satisfactory if results over a 12 month period show that:

a) The number of required routine samples have been tested for *E. coli*; and

b) At least 98% of scheduled samples do not test positive for *E. coli*.

This guideline allows for water supply systems to positively identify *E. coli* in one in fifty samples and remains compliant with the recommendations; this does not include repeat or special purpose sampling.

Table 3: system performance of communities against the ADWG

Region	Total number of communities[1]	Monitoring results compliant with 98% samples <1 *E. coli* (org/100mL)		Monitoring results non-compliant with 98% samples <1 *E. coli* (org/100mL)	
		Total number of communities	Percent of communities	Total number of communities	Percent of communities
Northern Region	42	36	86%	6	14%
Southern Region	28	18	64%	10	36%
All Regions	70	54	77%	16	23%

[1] Excludes Yuelamu which was supplied with packaged water during 2006/2007 and the following communities that source water from a commercial supply (Amoonguna, Jodetluk, Kaporilya, , Lyilyalanama, Tjuwanpa, Ulpunda, Wulkabimirri, 4 Mile Camp) please refer to Tables 1 and 2..

The majority of the Indigenous communities have populations less than 1000 people and verification monitoring of the treated drinking water is carried out on a monthly basis as recommended in the ADWG. The verification monitoring, reveals that 16 communities identified *E. coli* present in one or more samples in 2006-07 (Table 3) including the specific communities and the number of times this occurred throughout 2006-07 (Figure 3 and 4). In many of the communities less than 50 water samples are analysed and a single positive *E. coli* detection will appear not to comply with the guideline, even though it may potentially comply if more samples where taken or it could perform even poorer.

The identification of *E. coli* through the verification monitoring prompts an immediate response to ensure the protection of public health. Non-compliance and in particular repeat non-compliance indicates that the system has an inherent weakness and requires detailed investigation[1]. Investigations into the incidences in the Indigenous communities revealed that a number were due to weaknesses of system infrastructure such as non-operational chlorination systems, rising main breaks and non-secure source supplies. However in a number of the incidences the contamination may have been attributed to human error rather than contamination of the water supply such as incorrect sampling procedures, delays in transport or contamination during transport.

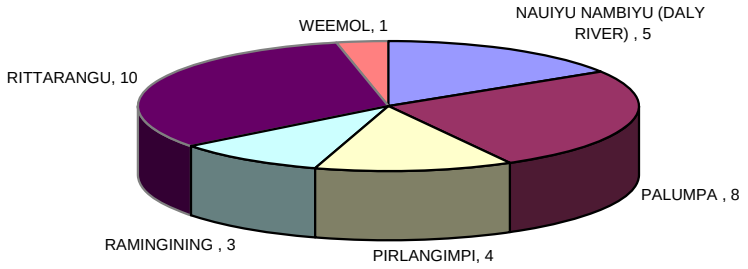


Figure 3: Number of E. coli *failures communities in Northern region 2006-07*

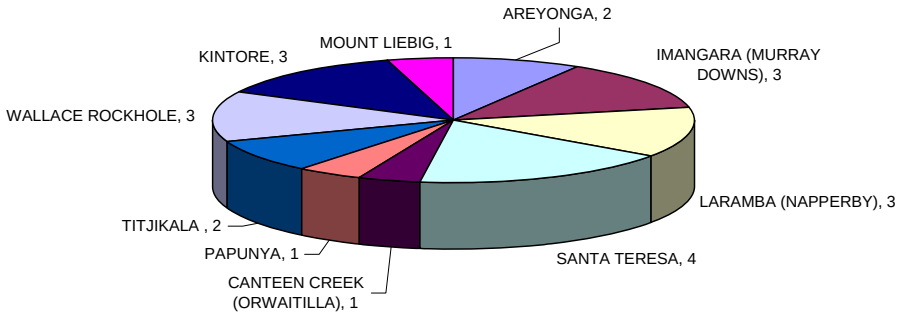


Figure 4: Number of E. coli *failures communities in Southern region 2006-07*

[1] Australian Drinking Water Guidelines, 2004, National Health and Medical Research Council.

Monthly verification monitoring

The frequency of verification monitoring in the Indigenous communities presents both logistic and economic difficulties as the water samples require delivery to Darwin or Alice Springs water laboratories for analysis within 12-24 hours of collection. Currently the monitoring is carried out by collecting 200ml water samples from 3-4 locations throughout each community and delivering to the laboratories using specially chartered flights, which fly 8 routes to 69 communities each month. Thus monthly verification monitoring is relatively infrequent and the laboratory analysed samples represent a small proportion of the continuous delivery of drinking water. The detection of *E. coli* with this monitoring will predominately identify reoccurring or widespread contamination and doesn't effectively detect intermittent and short lived contamination events.

Therefore the results of this verification monitoring provides a limited level of confidence in the microbiological security of a drinking water supplied, as the data gained over a 12 month period is insufficient to suitably interpret the systems overall performance. However, more regular monitoring of the supplies is not economically sustainable due to the sheer number of communities, large distances, restrictive transportation requirements and current resources. The analysis of the historical data over a number of years can provide greater understanding of the system performance and provides an effective mechanism to prioritise detailed investigations into the supply systems (Appendix 2). These detailed investigations will be carried out in conjunction with the development of *Community Water Plans* and implementation of the *Strategy for Safe Water*.

When the verification monitoring positively identifies *E. coli* within the system the degree of confidence in the microbiological security of the systems is significantly reduced and a greater number of samples are required to statistically evaluate the results.

Weekly verification monitoring

Based on the ADWG the *Water Quality Monitoring* Program identifies that those Indigenous communities with a population of greater then 1000 require weekly microbiological monitoring including Maningrida, Nguiu, Gunbalanya, Wadeye, Galiwinku, Milingimbi, Numbulwar and Yuendumu. Weekly verification monitoring provides a greater level of confidence that the water supply is free of faecal contamination as there is increased water quality data to statistically interpret the results although the level of confidence varies with the number of samples analysed over the 12 month period.

The challenges of successfully carrying out regular weekly sampling in these remote locations and transporting them to Darwin or Alice Springs resulted in a number of the communities not achieving the weekly sampling target (Figure 5). Numbulwar collected the least number of samples of the communities on the program and there is limited confidence in the microbiological quality of the water even though *E. coli* was not identified in the supply system. The highest level of confidence in the microbiological quality of the drinking water supplies is in Wadeye (Port Keats), the other communities performed relatively satisfactorily.

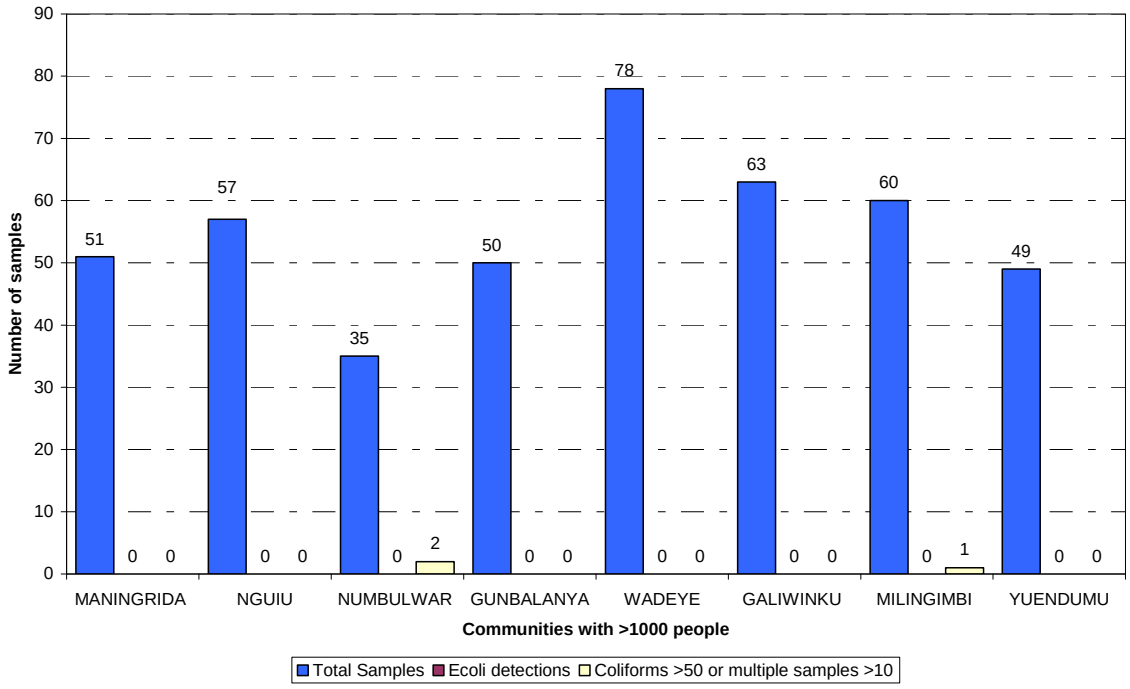


Figure 5: total number of samples and the number of samples that indicated faecal contamination from communities with populations of >1000 in 2006-07

Yuendumu has an estimated population of 1150, is located in the Southern Region and as such is the single community on the program for weekly monitoring that includes regular monitoring of the raw source water supply. Yuendumu sources its water supply from deep groundwater bores drilled to depths of 100-300m, monitoring of these bores indicates the system is relatively secure with low levels of total coliforms and heterotrophic plate counts from bore samples. Predominately reticulation samples indicated very low counts of total coliforms and HPC and there were no detections of *E. coli* throughout the Yuendumu during this period.

Gunbalanya has an estimated population of 1170 and is the single community on the program for weekly monitoring that sources the water supply from a combination of groundwater and a surface water. The surface water is sourced from a man-made weir and the groundwater is extracted from 13 shallow bores drilled to depths of 10-40m. There were no positive detections for *E .coli* and HPCs were continually low with only 2 samples taken from the reticulation indicating counts of >1000 / 100mL sample. The susceptibility of Gunbalanya's source waters to microbiological contamination is relatively high due to the shallow depth of the bores, seasonal recharge of the groundwater, the accessibility of the weir to animals and the monsoon activity that regularly floods the borefield. Heavy monsoonal rains led to flooding in Gunbalanya in late February 2007, which inundated sewage pump stations and the borefield. Consequently a Boil Water Alert was issued although analysis of the water samples did not detect *E. coli*. Gunbalanya currently has a sodium hypochlorite system in place and additional UV disinfection is proposed as part of the *Strategy for Safe Water* in 2007-08.

Numbulwar has an estimated population of 1110 and is located 400km east of Katherine on the western coast of the Gulf of Carpentaria. Sampling frequency is severely limited at Numbulwar by the access to the community as the road requires a 4WD vehicle, can be inaccessible during the wet season and there are no regular air charters to the community. Verification monitoring is limited to monthly monitoring and as such there is insufficient water quality data to confidently interpret the results for the community.

The results of the verification monitoring for **Maningrida** indicates that the levels of total coliforms and HPC have been continuously low throughout the year 2006-07. One sample detected total coliforms of >10/100mL, the highest HPC count was >500 /100mL and *E. coli* was not detected. Maningrida has a population of around 2261 people and is high on the priority due to the absence of an automated continuous disinfection system and the implementation of the system is being proposed as part of the *Strategy for Safe Water* in 2008-09.

Monitoring data of the treated drinking water supply in **Nguiu (Bathurst Island)** indicate that *E. coli* was not detected in the system and there were limited identifications of other indicator bacteria present throughout the year. Nguiu has an estimated population of 1582 and sources the water supply from bores drilled to depths of around 40-60m utilising a sodium hypochlorite system for disinfection. Due to water demand of the community six new bores were drilled this year within the existing borefield, these have been included on capital works program to implement the new bores by late 2007 following upgrades to 3km of the rising main to accommodate the increased flow.

Wadeye has an estimated population of 2550 and collected the greatest number of water samples of all the communities. The verification monitoring indicates very low counts of total coliforms occurring infrequently, *E. coli* was not detected and HPC counts remained low (usually below 10) with only one sample showing HPC to be >1000 cfu/100mL. The water supply is sourced from production bores that are from 40m to 126m deep and utilises sodium hypochlorite disinfection for the Wadeye system and Manthape, which has a ground level tank that is included in the monitoring program.

Galiwinku (Elcho Island) is a community of approximately 1720 people and is located on the southern end of Elcho Island. The raw data shows that the treated water samples indicate that *E. coli* was not detected or total coliforms over the 12 months. The HPCs were also very low with the highest count being 34/100mL from a reticulation point. Galiwinku sources water from production bores drilled to depths ranging from 28m to 50m and the current disinfection system in place is sodium hypochlorite.

Milingimbi is also an island community located just off the north coast of central Arnhem Land and has a population of around 1500 people. Water is sourced from shallow bores drilled to depths from 22m to 24.6m. Milingimbi did not identify *E. coli* during the 12 months and one sampling event where total coliforms were detected at values of >10 cfu/100mL and the HPC was also higher than usual in these samples the highest count being 620 cfu/100mL.

2.3 Management of incidents and emergencies

Incident response

The detection of *E. coli* in a water supply system represents an incident that requires an immediate response. Power and Water's response is based on an established protocol endorsed by the Chief Health Officer, which ensures the risks to public health are minimised. In most situations, the detection of *E. coli* in the system can be managed effectively through operational procedures to remove the potential contamination. However on some occasions, Environmental Health identifies that the microbiological results pose a potential risk to the health of consumers and issue a precautionary advice for drinking water ("Boil Water Alert"), which is only lifted when the contamination is removed from the system.

Boil water alerts

On occasions Environmental Health identify that the microbiological monitoring indicates an unacceptable risk to public health and issue a precautionary advice in the form of a 'Boil Water Alert' which is then only lifted once the contamination is evidently removed from the system. In 2006-07 five Boil Water Alerts were issued (Table 4).

Table 4: Boil Water Alert Incidents in all communities in 2006-07

Date of issue	Community	Water quality Failure	Description of the Incident
18 - 22 August 2006	Nauiyu Namibiyu (Daly River)	High levels of total coliforms found throughout the reticulation system and low *E. coli* count from one reticulation point	Prior to the water quality failure repair work had been undertaken on equipping a new production bore and fixing a break in the rising main. The community demand was not being met by the bore supply, the ESO decided to extract from the river directly into the storage tank without liaising with Power and Water, which introduced contaminated water into the supply. Remedial action involved disconnection of the river pump and a water management procedure was put in place for the Daly River community.
14 - 16 February 2007	Nauiyu Namibiyu (Daly River)	High level of both total coliforms and *E. coli* in a sample taken from the Health Clinic.	Investigation into the incident found the source of contamination to be a private 5KL storage tank supplying the Health Clinic. The storage tank was disconnected and the Health Clinic connected directly to the Power and Water reticulation.
21 - 23 February 2007	Rittarangu	High number of total coliforms and high number of *E. coli* detected throughout the reticulation system.	Site investigation found the chlorinator not operational. The remedial actions included reinstating the chlorination system was reinstated, the system was flushed

Date of issue	Community	Water quality Failure	Description of the Incident
17 - 20 March 2007	Rittarangu	High count of *E. coli* from three water samples	Following the previous incident a sanitary survey was conducted comprising of site inspections and further sampling. The further samples detected contamination, the source of contamination was isolated from one production bore which was disconnected, disinfected and flushed. The bore was also lifted and the cap replaced. Further sampling of the bore indicated the contamination was removed.
13 - 16 April 2007	Pirlangimpi	High counts of both total coliforms and *E. coli* from all samples taken in the reticulation system.	Site visit identified that the chlorination system was not operational. The disinfection systems was reinstated and flushing program was undertaken on the entire system and further samples indicated water was free of faecal contamination.

2.4 Consumer satisfaction

Community consultation

In 2007 Power and Water engaged market research company Synovate Pty Ltd to undertake research on the quality of the provision of services supplied to remote communities as perceived by a large number of stakeholders in remote communities. The stakeholders involved were school principles, health clinic managers and council Chief Executive Officers (CEO). Data was obtained through phone surveys conducted in August 2007. A total of 129 stakeholders participated in the survey from 70 communities.

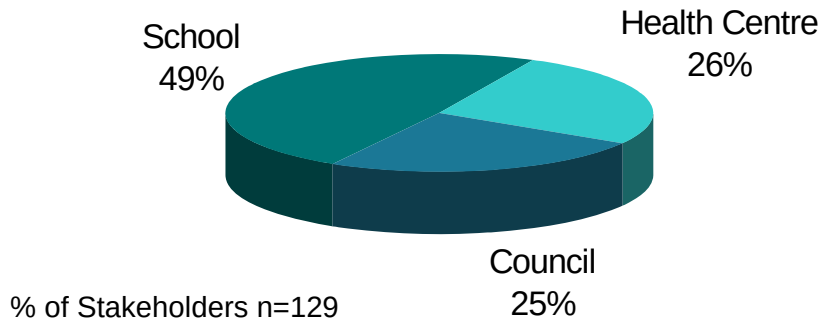


Figure 7: Proportion of respondent stakeholders surveyed by Synovate Pty Ltd in August 2007[1].

[1] Synovate Remote Community Consultation Report, September 2007.

Overall the majority of stakeholders agreed that the maintenance of facilities and services are satisfactory and perceive Power and Water to be reliable and responsive, overall the majority were satisfied with services provided by Power and Water and ESOs. Satisfaction with water quality was almost equal between stakeholders with nearly two thirds of respondents rating it as good or excellent. Expressions of dissatisfaction were mostly from school principles rating poor to fair.

The main driver of dissatisfaction with water quality was the calcium/mineral content. Stakeholders expressed concerns for health from consuming water with high levels of calcium/minerals, frustration at the effects of scaling on appliances and displeasure at the taste. There were some comments made from a minority of participants regarding microbiological quality expressing concerns for health perceiving the presence of *Giardia* in the water to be responsible for some infections/as a general risk.

3 System management support

3.1 Training and awareness

Essential service operators

Essential Service Officers (ESO) are fundamental to maintaining the day to day provision of water, sewerage and power services to the majority of PWC managed Indigenous communities and capacity building has always been an important part of their training. Local councils and private contractors are contracted by Power and Water to recruit and manage the ESO position. The employment of the ESO external of Power and Water results in limited influence in the selection of the ESO and direct supervision of the ESO duties and priorities.

There are a number of national competences in the delivery of essential services that the ESO may elect to undertake, which are delivered through Charles Darwin University (CDU) and Group Training Northern Territory (GTNT).

Power and Water provides training to ESOs to help develop an understanding of the facilities at the community and equipment used to undertake their daily duties and responsibilities. This training is carried out through site visits and an annual training course which provides further training and information on all areas of work including electricity, water and sewerage, occupational health and safety, water quality issues, operational targets and water sampling techniques. These courses are coordinated in a structured practical and theoretical environment and provide an effective forum for ESOs to meet and discuss issues.

Power and Water employees

Power and Water are committed to protecting public health and as such have systems in place to ensure staff can develop and maintain skills and awareness of issues related to the provision of safe and reliable drinking water to the Indigenous communities. Safety training courses include remote area driving, first aid, confined space entry training, cross-cultural awareness and handling dangerous good and chemicals.

Communication is fundamental to the successful management of water quality issues in the 72 Indigenous communities, strategies to ensure internal and external awareness and robust management include weekly meetings of managers, regular monthly water quality meetings with DHCS and periodic meetings between internal sections such as water quality, community liaison, and water and sewerage operations.

4 Review and improvement

4.1 Microbiological monitoring

Microbiological verification monitoring of raw source water will be initiated in 2008-09 and weekly microbiological monitoring will be extended to four other communities that are approaching populations of >1000 people.

Due to the challenges faced and limitations of monthly monitoring investigation into appropriate on-site testing for faecal indicators is being considered for future use in selected smaller communities. Pilot studies on the reliability of results and applicability in the community environment will be undertaken to assess the suitability of including these into a monitoring program.

4.2 Microbiological risk assessment

The highest priority of *Strategy for Safe Water* in 2007-09 is to improve the microbiological security of the water supply systems. This is being carried out in conjunction with the development of *Community Water Plans* through a complete evaluation of the water supply systems and risk assessment. The risk assessment framework, based on the Power and Water Corporate Risk Assessment, identifies infrastructure and operational strategies to manage the specific risks to the supply systems.

4.3 System performance

Consistent with the Power and Water annual report on water quality published in the urban centres, the performance of water supplies in Indigenous communities is provided in this *Annual Drinking Water Quality Report 2006-07*. The systematic approach being applied through the Strategy for Safe Water provides an effective mechanism to increase confidence in the water supply systems, which will allow the production of a similar public report for the Indigenous communities. The *Annual Drinking Water Quality Report 2007-08* will include the chemical, physical and radiological quality based on the results of the most recent monitoring. Reporting Indigenous community water quality systems performance is an important element of the continuous improvement by highlighting issues, challenges, limitations, achievements and strategic directions.

Appendix 1:
Microbiological monitoring results for all communities 2006-07

Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Acacia Larrakia	**85**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Ali Curung	**500**						
E coli (<1 org/100ml)		12	4	12	48	0	100.0%
Total coliforms (<10 org/100ml)		12	4	12	48	8	83.3%
Plate Count (<1000 cfu/100ml)		12	4	12	48	0	100.0%
Alpurrurulum	**720**						
E coli (<1 org/100ml)		12	4	9	35	0	100.0%
Total coliforms (<10 org/100ml)		12	4	9	35	4	88.6%
Plate Count (<1000 cfu/100ml)		12	4	9	35	2	94.3%
Amanabidji (Kildurk)	**90**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Ampilatwatja	**360**						
E coli (<1 org/100ml)		12	4	8	32	0	100.0%
Total coliforms (<10 org/100ml)		12	4	8	32	0	100.0%
Plate Count (<1000 cfu/100ml)		12	4	8	32	0	100.0%
Angurugu	**800**						
E coli (<1 org/100ml)		12	3	11	33	0	100.0%
Total coliforms (<10 org/100ml)		12	3	11	33	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	11	33	0	100.0%
Areyonga	**230**						
E coli (<1 org/100ml)		12	4	12	47	2	95.7%
Total coliforms (<10 org/100ml)		12	4	12	47	15	68.1%
Plate Count (<1000 cfu/100ml)		12	4	12	47	9	80.9%

Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Atitjere (Hart Range)	**135**						
E coli (<1 org/100ml)		12	4	10	40	0	100.0%
Total coliforms (<10 org/100ml)		12	4	10	40	0	100.0%
Plate Count (<1000 cfu/100ml)		12	4	10	40	3	92.5%
Barunga	**440**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Belyuen	**240**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Beswick	**500**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Binjari	**265**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	1	97.2%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Bulla	**130**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Bulman	**155**						
E coli (<1 org/100ml)		12	3	11	33	0	100.0%
Total coliforms (<10 org/100ml)		12	3	11	33	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	11	33	2	93.9%

Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Canteen Creek (Orwaitilla)	**130**						
E coli (<1 org/100ml)		12	4	10	44	1	97.7%
Total coliforms (<10 org/100ml)		12	4	10	44	9	79.5%
Plate Count (<1000 cfu/100ml)		12	4	10	44	0	100.0%
Daguragu	**200**						
E coli (<1 org/100ml)		12	3	12	24	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	24	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	24	0	100.0%
Engawala	**190**						
E coli (<1 org/100ml)		12	4	10	39	0	100.0%
Total coliforms (<10 org/100ml)		12	4	10	39	6	84.6%
Plate Count (<1000 cfu/100ml)		12	4	10	39	0	100.0%
Eva Valley (Manyallaluk)	**100**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	3	91.7%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Finke (Apatula)	**250**						
E coli (<1 org/100ml)		12	4	11	44	0	100.0%
Total coliforms (<10 org/100ml)		12	4	11	44	2	95.5%
Plate Count (<1000 cfu/100ml)		12	4	11	44	5	88.6%
Galiwinku (Elcho Island)	**1720**						
E coli (<1 org/100ml)		52	3	52	63	0	100.0%
Total coliforms (<10 org/100ml)		52	3	52	63	0	100.0%
Plate Count (<1000 cfu/100ml)		52	3	52	63	0	100.0%
Gapuwiyak (Lake Evella)	**900**						
E coli (<1 org/100ml)		12	3	12	38	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	38	1	97.4%
Plate Count (<1000 cfu/100ml)		12	3	12	38	0	100.0%

Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Gunbalanya	**1170**						
E coli (<1 org/100ml)		12	3	12	50	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	50	1	98.0%
Plate Count (<1000 cfu/100ml)		12	3	12	50	3	94.0%
Gunyangara (Ski Beach)	**285**						
E coli (<1 org/100ml)		12	3	11	33	0	100.0%
Total coliforms (<10 org/100ml)		12	3	11	33	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	11	33	0	100.0%
Haasts Bluff (Ikunjti)	**125**						
E coli (<1 org/100ml)		12	4	11	43	0	100.0%
Total coliforms (<10 org/100ml)		12	4	11	43	3	93.0%
Plate Count (<1000 cfu/100ml)		12	4	11	43	2	95.3%
Hermannsburg	**650**						
E coli (<1 org/100ml)		12	4	11	44	0	100.0%
Total coliforms (<10 org/100ml)		12	4	11	44	2	95.5%
Plate Count (<1000 cfu/100ml)		12	4	11	44	5	88.6%
Imangara (Murray Downs)	**50**						
E coli (<1 org/100ml)		12	4	9	38	3	92.1%
Total coliforms (<10 org/100ml)		12	4	9	38	11	71.1%
Plate Count (<1000 cfu/100ml)		12	4	9	38	0	100.0%
Imanpa	**195**						
E coli (<1 org/100ml)		12	4	10	40	0	100.0%
Total coliforms (<10 org/100ml)		12	4	10	40	3	92.5%
Plate Count (<1000 cfu/100ml)		12	4	10	40	5	87.5%
Jilkminggan (Duck Creek)	**220**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Kalkarindji (Wave Hill)	**360**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%

Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Kaltukatjara (Docker River)	**400**						
E coli (<1 org/100ml)		12	4	12	48	0	100.0%
Total coliforms (<10 org/100ml)		12	4	12	48	6	87.5%
Plate Count (<1000 cfu/100ml)		12	4	12	48	0	100.0%
Kintore	**450**						
E coli (<1 org/100mL)		12	4	11	44	3	93.2%
Total coliforms (<10 org/100ml)		12	4	11	44	11	75%
Plate Count (<1000 cfu/100ml)		12	4	11	44	0	100%
Kybrook	**75**						
E coli (<1 org/100ml)		12	3	12	34	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	34	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	34	3	91.2%
Lajamanu	**880**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Laramba (Napperby)	**200**						
E coli (<1 org/100ml)		12	4	11	47	3	93.6%
Total coliforms (<10 org/100ml)		12	4	11	47	10	78.7%
Plate Count (<1000 cfu/100ml)		12	4	11	47	1	97.9%
Maningrida	**2135**						
E coli (<1 org/100ml)		12	3	52	51	0	100.0%
Total coliforms (<10 org/100ml)		12	3	52	51	2	96.1%
Plate Count (<1000 cfu/100ml)		12	3	52	51	0	100.0%
Milikapiti (Snake Bay)	**490**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	1	97.2%
Plate Count (<1000 cfu/100ml)		12	3	12	36	1	97.2%
Milingimbi	**920**						
E coli (<1 org/100ml)		52	3	52	60	0	100.0%
Total coliforms (<10 org/100ml)		52	3	52	60	4	93.3%
Plate Count (<1000 cfu/100ml)		52	3	52	60	1	98.3%

Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Milyakburra (Bickerton Island)	**220**						
E coli (<1 org/100ml)		12	3	11	32	0	100.0%
Total coliforms (<10 org/100ml)		12	3	11	32	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	11	32	1	96.9%
Minjilang (Croker Island)	**270**						
E coli (<1 org/100ml)		12	3	12	39	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	39	5	87.2%
Plate Count (<1000 cfu/100ml)		12	3	12	39	0	100.0%
Minyerri	**395**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Mount Leibig	**270**						
E coli (<1 org/100ml)		12	4	8	33	1	97.0%
Total coliforms (<10 org/100ml)		12	4	8	33	3	90.9%
Plate Count (<1000 cfu/100ml)		12	4	8	33	0	100.0%
Nauiyu Nambiyu (Daly River)	**445**						
E coli (<1 org/100ml)		12	3	12	54	5	90.7%
Total coliforms (<10 org/100ml)		12	3	12	54	7	87.0%
Plate Count (<1000 cfu/100ml)		12	3	12	54	5	90.7%
Nguiu (Bathurst Island)	**1410**						
E coli (<1 org/100ml)		52	3	52	57	1	98.2%
Total coliforms (<10 org/100ml)		52	3	52	57	2	96.5%
Plate Count (<1000 cfu/100ml)		52	3	52	57	1	98.2%
Ngukurr	**995**						
E coli (<1 org/100ml)		12	3	12	38	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	38	3	92.1%
Plate Count (<1000 cfu/100ml)		12	3	12	38	6	84.2%

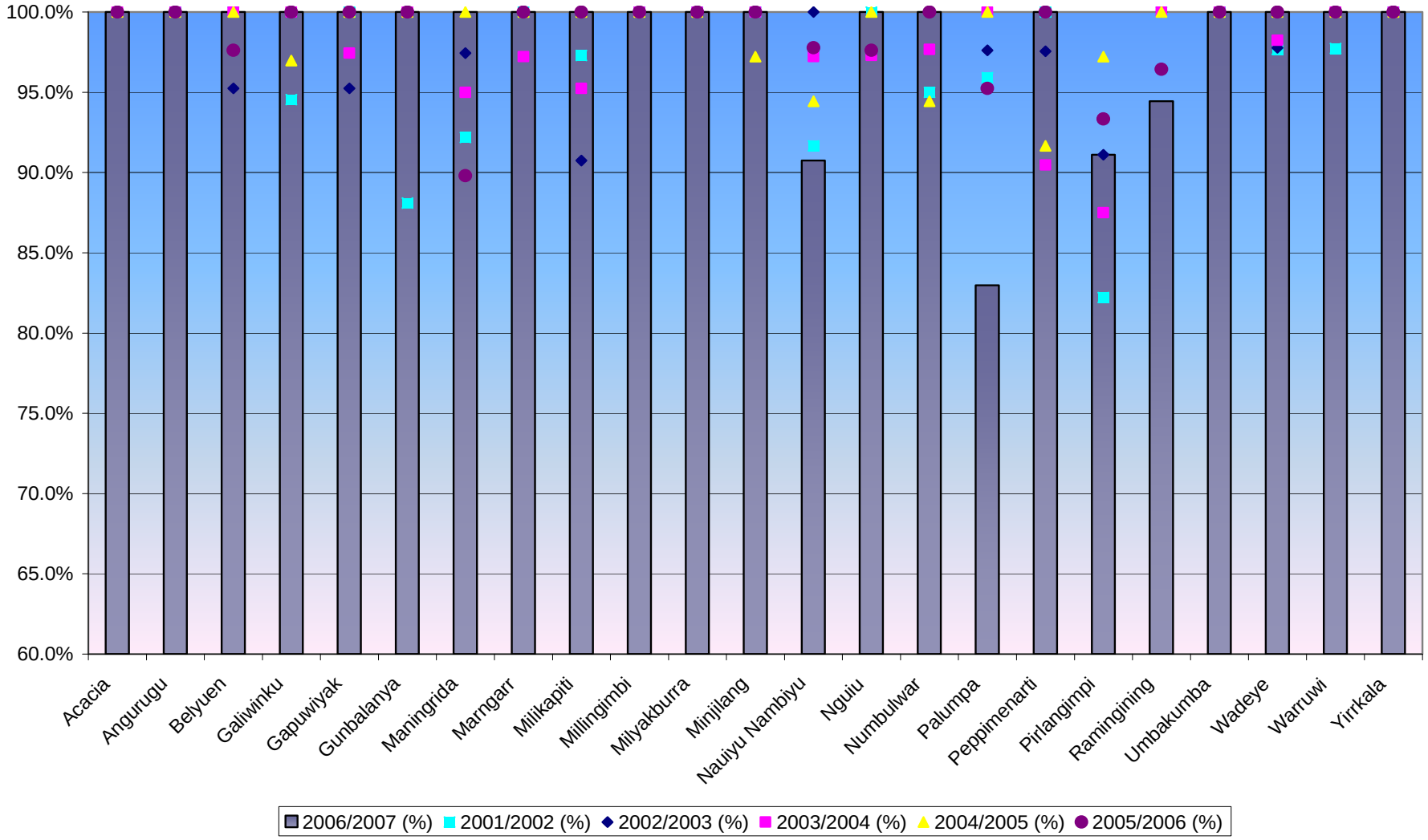
Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Nturiya	**60**						
E coli (<1 org/100ml)		12	4	12	48	0	100.0%
Total coliforms (<10 org/100ml)		12	4	12	48	7	85.4%
Plate Count (<1000 cfu/100ml)		12	4	12	48	0	100.0%
Numbulwar	**1120**						
E coli (<1 org/100ml)		12	3	12	35	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	35	4	88.6%
Plate Count (<1000 cfu/100ml)		12	3	12	35	15	57.1%
Nyirripi	**303**						
E coli (<1 org/100ml)		12	4	11	47	0	100.0%
Total coliforms (<10 org/100ml)		12	4	11	47	12	74.5%
Plate Count (<1000 cfu/100ml)		12	4	11	47	2	95.7%
Palumpa	**485**						
E coli (<1 org/100ml)		12	3	12	47	8	83.0%
Total coliforms (<10 org/100ml)		12	3	12	47	10	78.7%
Plate Count (<1000 cfu/100ml)		12	3	12	47	0	100.0%
Papunya	**340**						
E coli (<1 org/100ml)		12	4	10	39	1	97.4%
Total coliforms (<10 org/100ml)		12	4	10	39	8	79.5%
Plate Count (<1000 cfu/100ml)		12	4	10	39	2	94.9%
Peppimenarti	**230**						
E coli (<1 org/100ml)		12	3	12	37	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	37	1	97.3%
Plate Count (<1000 cfu/100ml)		12	3	12	37	0	100.0%
Pigeon Hole	**130**						
E coli (<1 org/100ml)		12	3	12	42	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	42	6	85.7%
Plate Count (<1000 cfu/100ml)		12	3	12	42	2	95.2%

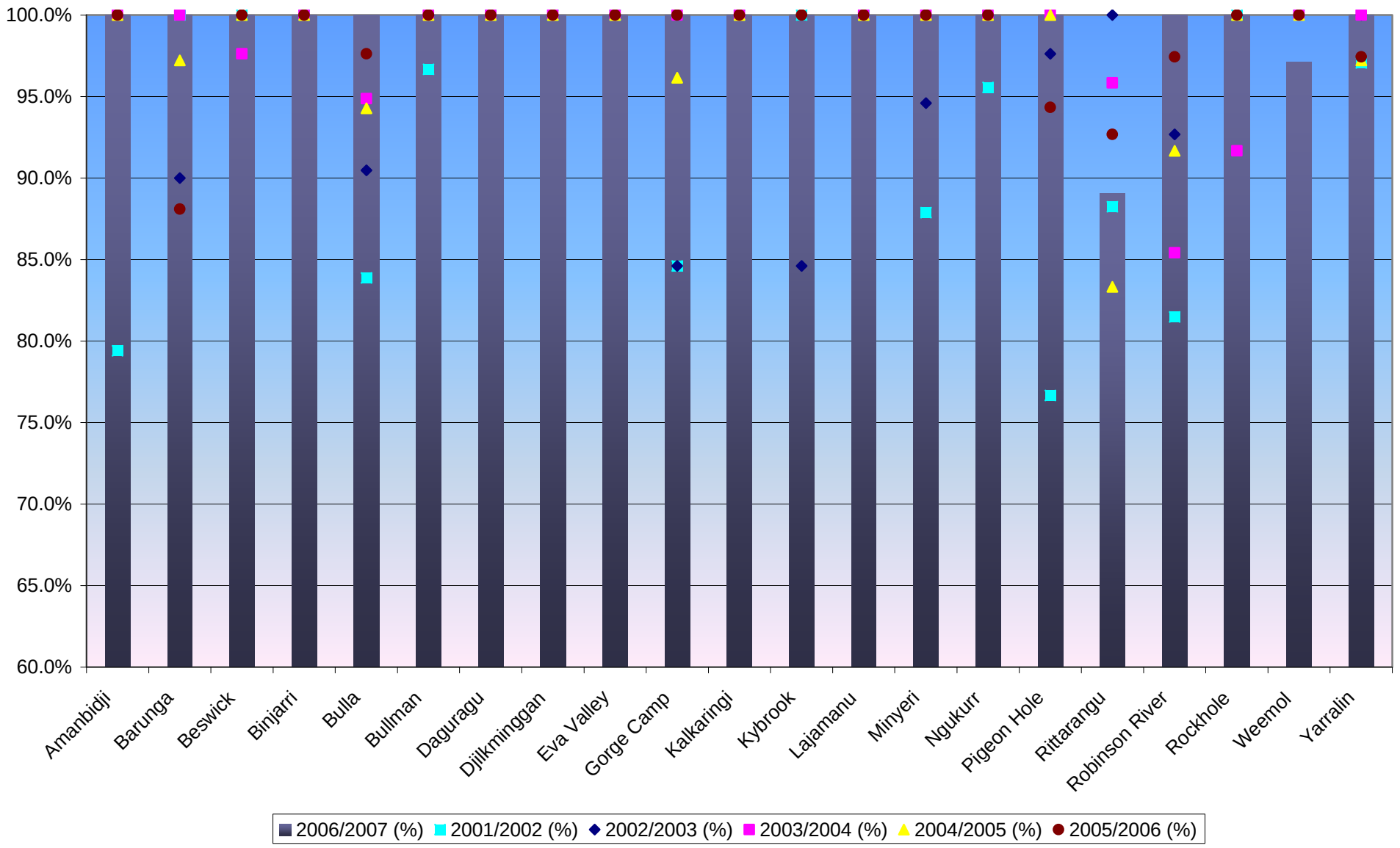
Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Pirlangimpi	**230**						
E coli (<1 org/100ml)		12	3	12	45	4	91.1%
Total coliforms (<10 org/100ml)		12	3	12	45	4	91.1%
Plate Count (<1000 cfu/100ml)		12	3	12	45	9	80.0%
Pmara Jutunta	**260**						
E coli (<1 org/100ml)		12	4	12	48	0	100.0%
Total coliforms (<10 org/100ml)		12	4	12	48	1	97.9%
Plate Count (<1000 cfu/100ml)		12	4	12	48	0	100.0%
Ramingining	**675**						
E coli (<1 org/100ml)		12	4	12	54	3	94.4%
Total coliforms (<10 org/100ml)		12	4	12	54	9	83.3%
Plate Count (<1000 cfu/100ml)		12	4	12	54	0	100.0%
Rittarangu	**90**						
E coli (<1 org/100ml)		12	3	12	64	10	84.4%
Total coliforms (<10 org/100ml)		12	3	12	64	11	82.8%
Plate Count (<1000 cfu/100ml)		12	3	12	64	3	95.3%
Robinson River	**145**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Santa Teresa	**600**						
E coli (<1 org/100ml)		12	4	10	44	4	90.9%
Total coliforms (<10 org/100ml)		12	4	10	44	2	95.5%
Plate Count (<1000 cfu/100ml)		12	4	10	44	0	100.0%
Tara	**45**						
E coli (<1 org/100ml)		12	4	10	44	0	100.0%
Total coliforms (<10 org/100ml)		12	4	10	44	1	97.7%
Plate Count (<1000 cfu/100ml)		12	4	10	44	4	90.9%

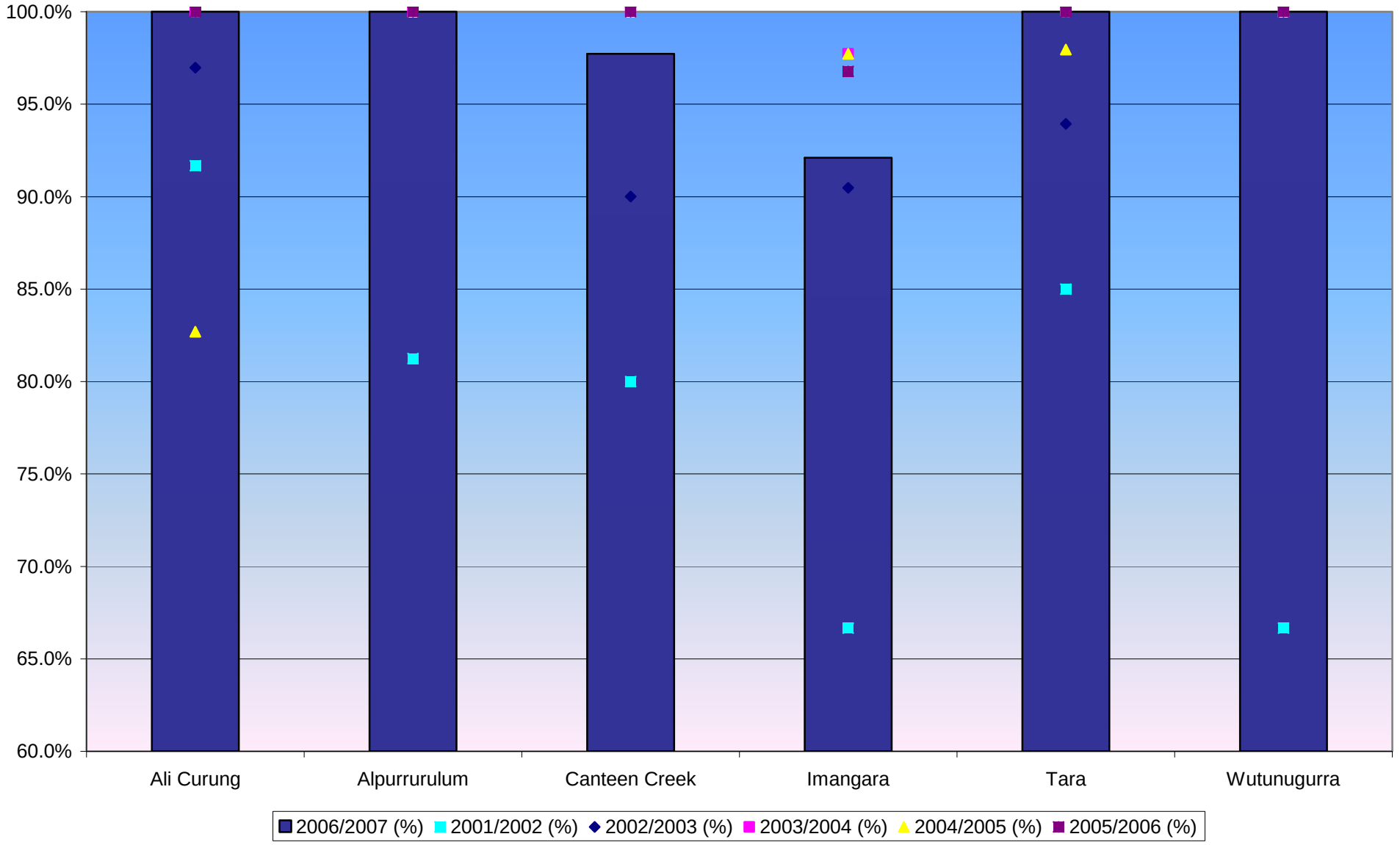
Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Titjikala	**270**						
E coli (<1 org/100ml)		12	4	12	48	2	95.8%
Total coliforms (<10 org/100ml)		12	4	12	48	7	85.4%
Plate Count (<1000 cfu/100ml)		12	4	12	48	1	97.9%
Umbakumba	**445**						
E coli (<1 org/100ml)		12	3	11	33	0	100.0%
Total coliforms (<10 org/100ml)		12	3	11	33	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	11	33	3	90.9%
Wadeye	**2550**						
E coli (<1 org/100ml)		52	4	52	78	0	100.0%
Total coliforms (<10 org/100ml)		52	4	52	78	2	97.4%
Plate Count (<1000 cfu/100ml)		52	4	52	78	2	97.4%
Wallace Rockhole	**160**						
E coli (<1 org/100ml)		12	4	12	48	3	93.8%
Total coliforms (<10 org/100ml)		12	4	12	48	12	75.0%
Plate Count (<1000 cfu/100ml)		12	4	12	48	1	97.9%
Warruwi	**370**						
E coli (<1 org/100ml)		12	3	12	36	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	36	3	91.7%
Plate Count (<1000 cfu/100ml)		12	3	12	36	0	100.0%
Weemol	**80**						
E coli (<1 org/100ml)		12	3	11	35	1	97.1%
Total coliforms (<10 org/100ml)		12	3	11	35	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	11	35	0	100.0%
Willowra	**200**						
E coli (<1 org/100ml)		12	4	11	43	0	100.0%
Total coliforms (<10 org/100ml)		12	4	11	43	2	95.3%
Plate Count (<1000 cfu/100ml)		12	4	11	43	5	88.4%

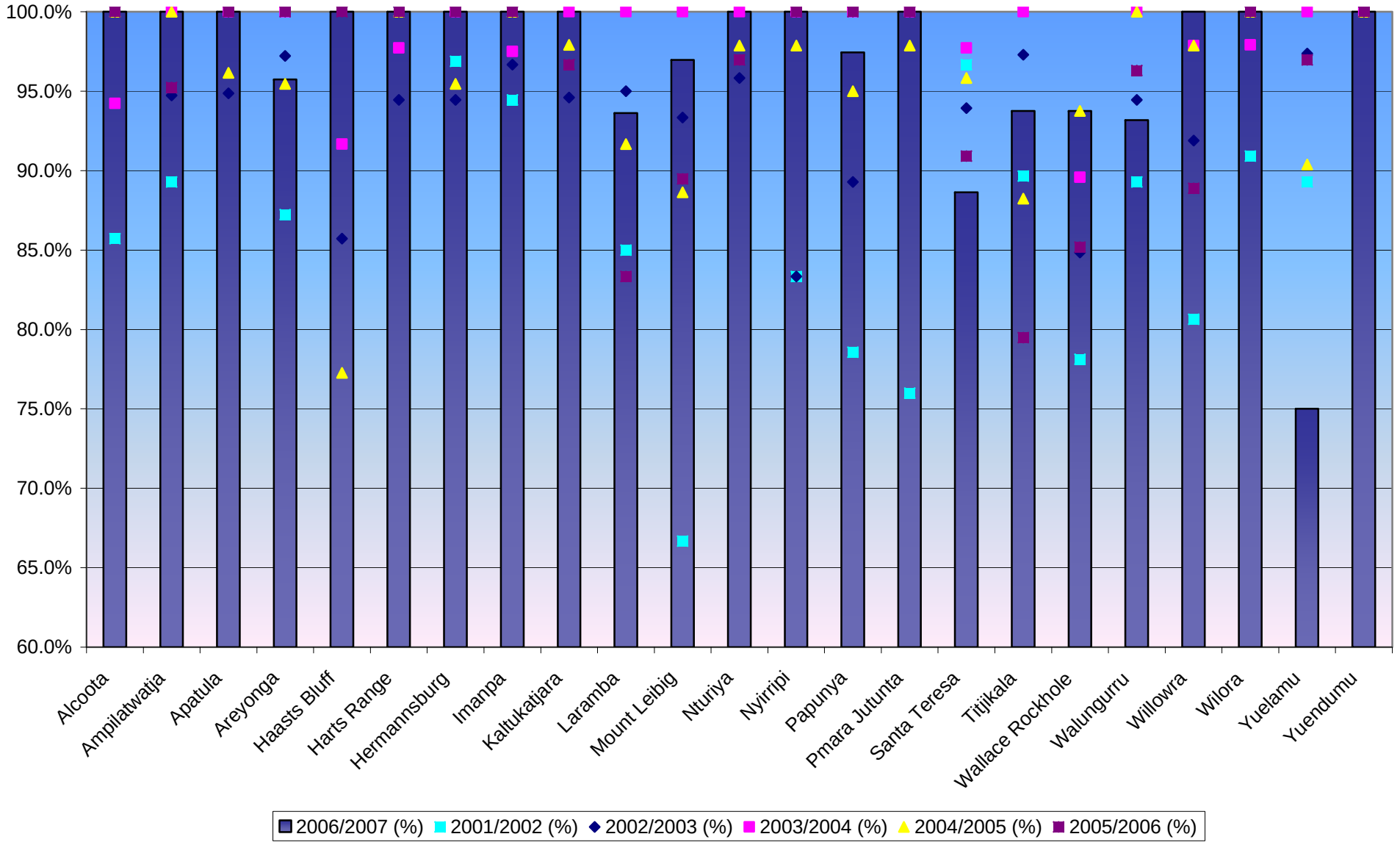
Location, Parameter and Target Level	Estimated Population	Target Number Scheduled Sample Collections (2004 Guidelines)	Total Number Samples per Scheduled Collection	Total Number Scheduled Collections Taken	Total Number of Samples	Total Number Exceeding PWC Trigger Levels	Samples Passing Trigger Level (%)
Wilora	**150**						
E coli (<1 org/100ml)		12	4	12	48	0	100.0%
Total coliforms (<10org/100ml)		12	4	12	48	3	93.8%
Plate Count (<1000 cfu/100ml)		12	4	12	48	0	100.0%
Wutunugurra (Epenarra)	**130**						
E coli (<1 org/100ml)		12	4	10	38	0	100.0%
Total coliforms (<10 org/100ml)		12	4	10	38	8	78.9%
Plate Count (<1000 cfu/100ml)		12	4	10	38	5	86.8%
Yarralin	**200**						
E coli (<1 org/100ml)		12	3	12	39	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	39	2	94.9%
Plate Count (<1000 cfu/100ml)		12	3	12	39	4	89.7%
Yirrkala	**900**						
E coli (<1 org/100ml)		12	3	12	41	0	100.0%
Total coliforms (<10 org/100ml)		12	3	12	41	0	100.0%
Plate Count (<1000 cfu/100ml)		12	3	12	41	0	100.0%
Yuelamu (Mt Allan)	**230**						
E coli (<1 org/100ml)		12	4	N/A	N/A	N/A	N/A
Total coliforms (<10 org/100ml)		12	4				
Plate Count (<1000 cfu/100ml)		12	4				
Yuendumu	**1150**						
E coli (<1 org/100ml)		12	4	12	49	0	100.0%
Total coliforms (<10 org/100ml)		12	4	12	49	1	98.0%
Plate Count (<1000 cfu/100ml)		12	4	12	49	2	95.9%

Appendix 2:
Historical performance of communities 2001-07




100.0%
95.0%
90.0%
85.0%
80.0%
75.0%
70.0%
65.0%
60.0%
Amanbidji
Barunga
Beswick
Binjarri
Bulla
Bullman
Daguragu
Djilkminggan
Eva Valley
Gorge Camp
Kalkaringi
Kybrook
Lajamanu
Minyeri
Ngukurr
Pigeon Hole
Rittarangu
Robinson River
Rockhole
Weemol
Yarralin
2006/2007 (%)
2001/2002 (%)
2002/2003 (%)
2003/2004 (%)
2004/2005 (%)
2005/2006 (%)


100.0%
95.0%
90.0%
85.0%
80.0%
75.0%
70.0%
65.0%
60.0%
Ali Curung
Alpurrurulum
Canteen Creek
Imangara
Tara
Wutunugurra
2006/2007 (%)
2001/2002 (%)
2002/2003 (%)
2003/2004 (%)
2004/2005 (%)
2005/2006 (%)


100.0%
95.0%
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85.0%
80.0%
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65.0%
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Alcoota
Ampilatwatja
Apatula
Areyonga
Haasts Bluff
Harts Range
Hermannsburg
Imanpa
Kaltukatjara
Laramba
Mount Leibig
Nturiya
Nyirripi
Papunya
Pmara Jutunta
Santa Teresa
Titjikala
Wallace Rockhole
Walungurru
Willowra
Wilora
Yuelamu
Yuendumu
2006/2007 (%)
2001/2002 (%)
2002/2003 (%)
2003/2004 (%)
2004/2005 (%)
2005/2006 (%)