



Annual Report 2017-18
Drinking Water Quality Management Plan

December 2018



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Drinking Water Quality Management Plan

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Acronyms and Abbreviations

ADWG	Australian Drinking Water Guidelines
DNRMEEWS	Department of Energy and Water Supply
DWQMP	Drinking Water Quality Management Plan
ESM	Essential Services Manager
KASC	Kowanyama Aboriginal Shire Council
n/a	Not Applicable
ND	Not Detected
NATA	National Association of Testing Authorities
OoS	Out of Specification
WSR	Water Supply Regulation
SPID	Service Provider Identification

1. Introduction

This is the Drinking Water Quality Management Plan (DWQMP) annual report for Kowanyama Aboriginal Shire Council (KASC or council) for the financial year 2017-18.

The DWQMP has been established and is being adhered to in order to protect public health through the identification and minimisation of public health related risks associated with drinking water. Council is operating under an approved DWQMP, with the approval granted by the Water Supply Regulation unit, Department of Natural Resources, Mining and Energy (WSR, DNRME).

This annual report summarises Council's drinking water quality performance for the reporting period, including progress on the implementation of the improvement plan. The report is made available to customers on Council's website and for inspection upon request at the Council office.

1.1. Scope

The report has been prepared to fulfil the legislative DWQMP reporting requirements set out in the *Water Supply (Safety and Reliability) Act 2008* (the Act).

1.2. Purpose

This annual report aims to:

- be a reference document for the Regulator, as well as customers, on Council's performance in relation to the DWQMP reporting obligations under the Act, for the reporting period
- provide a summary of Council's performance in implementing the DWQMP.

2. Drinking Water Scheme

With the introduction of the Act, water service providers are required to register as a drinking water service provider for the delivery of a drinking water service. Council is a registered drinking water service provider, with the service provider identification (SPID) number as 142.

Council manages the Kowanyama drinking water supply scheme and distributes treated water to the township of Kowanyama. The water supply scheme is comprised of multiple bore water sources, chlorination plant, service reservoirs, a pump station and distribution network.

Details of the scheme are noted in Table 1.

Table 1 Drinking Water Scheme Summary

Scheme	Water Source	Treatment Processes	Treatment Capacity	Town Supplied
Kowanyama	Great Artesian Basin – Kowanyama Bores 1 and 2	Chlorination	2 ML/d	Kowanyama

3. DWQMP Implementation

The implementation of the DWQMP is discussed in this section, and also captured in the other sections that follow.

3.1. Risk Management

The process of keeping drinking water safe is one of risk management. Through efficient operations and implementation of the DWQMP, Council has ensured effective risk management to assure safe quality of drinking water to our customers.

During the reporting period, Council supplied drinking water that complied with the water quality criteria set in the Australian Drinking Water Guidelines. There was no major incident or event that comprised Council's ability to supply safe quality drinking water to customers.

3.2. Monitoring

Council maintains comprehensive monitoring programs to ensure that the quality of water supplied to customers is safe. The monitoring programs assist to identify any issue before it becomes a significant water quality incident. The results from the verification monitoring for the reporting period are discussed in section 5.

Council also undertakes operational monitoring, which includes the planned sequence of measurements and observations to assess and confirm the performance of our preventive or control measures. Measurements are of operational parameters that indicate whether processes are functioning effectively.

To ensure timely actions on operational monitoring data, Council uses a water quality spreadsheet to track and provide weekly summaries of water quality data. Council has recently updated this spreadsheet to streamline graphical analysis of water quality data and flagging of results that trigger adjustment limits or critical limits for critical control points. These actions will provide Council with additional information to act of water quality data.

Quality assurance is important to guarantee consistently reliable and legally defensible results and ensure customers are provided with the best quality water.

Council has the following quality management systems in place:

- microbiology and chemical parameter samples are sent to the Cairns Regional Council Water Laboratory, which is a NATA accredited laboratory
- operations staff have been appropriately trained to undertake sampling.

3.3. Staff Awareness

Implementation of the DWQMP is the responsibility of the Essential Services Manager (ESM). The ESM discusses issues relating to the implementation with water (and sewer) staff using informal meetings as required. The ESM is responsible for ensuring that all staff have appropriate training and undertake appropriate procedures while implementing the DWQMP.

There were no staff changes during the reporting period.

3.4. Improvement Plan

Council maintains a culture of continuous improvement and are implementing the Improvement Plan of the DWQMP and making progress towards strengthening the management of the water supply. During the reporting period, Council implemented a number of actions including:

- implementation of daily, weekly and annual checklists for water quality operational tasks
- verified operational of high and low chlorine alarms

- commenced installation of an additional bore to provide additional security of supply and redundancy (to be connected to the network as funds are available)
- investigation into alternative chlorination strategy was commenced, with a replacement of existing hypochlorite plant with electrochlorination or calcium hypochlorite dosing to be actioned in 2019
- a project to investigate natural fluoride control using activated alumina has commenced, with reporting of recommendations to Council expected in 2019.

Detailed status on the Improvement Plan implementation is presented in Appendix A.

4. Reporting to the Regulator

No reportable incidents occurred in the period July 2017 to June 2018.

It is noted that natural fluoride for the Kowanyama supply is high, and the current verification monitoring programme tests for fluoride on a quarterly basis. Results for all bores are typically between 1.3 mg/L and 1.5 mg/L. Breaches of the 1.5 mg/L health guideline have occurred in the past, although none were noted in the reporting period. Council is currently investigating the installation of activated alumina plant to provide control of natural fluoride for the Kowanyama supply.

5. Compliance with Water Quality Criteria

Verification of drinking water quality provides an assessment of the overall performance of the system and the ultimate quality of the drinking water being supplied to customers. It confirms compliance with water quality criteria set by DNRME, Queensland Health and any other formal requirements. Council undertakes regular sampling and testing to assess whether water quality is complying with the DWQMP water quality criteria.

Details of data used in the report and treatments applied to the data are as follows:

- data sources: verification monitoring data
- data analysis: undertaken using Microsoft Excel software
- identified errors, if any: removed from statistical analysis, and noted at the respective place.
- <LOD and >UL: <LOD (limit of detection) was treated as LOD/2 and >UL (upper limit specified for test) was taken as UL.
- Outliers: considered in the statistical analysis, unless classed as specific error.

5.1. Source Water

The Kowanyama water treatment plant consists of chlorination only. Raw water sourced from bores is tested for a number of water chemical parameters which are unlikely to be affected by chlorination. This enables Council to keep a tab on the inherent risk present in the supply and to guide any decisions of bore selection or maintenance.

The verification monitoring program as per the current DWQMP requires monitoring of chlorates, this was not conducted during the reporting period. During a DWQMP review (occurring after the reporting period), sampling processes were reviewed and updated to ensure that monitoring of chlorates is occurring and that sampling is conducted at an appropriate location.

The source water data is shown in Table 2. No issues were noted in relation to inherent risk.

Table 2 Bore 1 Verification Data

Source	Parameter	Unit	Minimum No. Samples	Samples Taken	Min	Max	Mean
Bore 1	Aluminium	mg/L	1	4	0.0025	0.005	0.0033
	Antimony	mg/L	-	1	0.0005	0.0005	0.0005

Source	Parameter	Unit	Minimum No. Samples	Samples Taken	Min	Max	Mean
	Arsenic	mg/L	1	4	0.0005	0.001	0.000625
	Barium	mg/L	-	1	0.057	0.057	0.057
	Beryllium	mg/L	-	1	0.0005	0.0005	0.0005
	Boron	mg/L	-	1	0.416	0.416	0.416
	Cadmium	mg/L	1	4	0.00005	0.00005	0.00005
	Calcium	mg/L	1	4	0.66	0.84	0.783
	Chlorate	mg/L	1	0	n/a	n/a	n/a
	Chloride	mg/L	1	4	59	70	64
	Chromium	mg/L	-	1	0.0005	0.0005	0.0005
	Cobalt	mg/L	-	1	0.0005	0.0005	0.0005
	Copper	mg/L	1	4	0.0005	0.028	0.0085
	<i>E. coli</i>	CFU/100mL	4	8	ND	ND	ND
	Electrical Conductance	µS/cm	1	4	620	630	622.5
	Fluoride	mg/L	1	9	1.3	1.5	1.48
	Heterotrophic Plate Count	CFU/mL	-	6	5	50	19.17
	Iron	mg/L	1	4	0.005	0.096	0.05225
	Lead	mg/L	1	4	0.0005	0.002	0.001
	Magnesium	mg/L	1	4	0.64	0.76	0.71
	Manganese	mg/L	1	4	0.002	0.006	0.004
	Molybdenum	mg/L	-	1	0.0025	0.0025	0.0025
	Nickel	mg/L	-	1	0.0005	0.0005	0.0005
	Perfluoroalkyl substances (PFAS)	µg/L	-	1	0.005	0.005	0.005
	Perfluorohexane sulphonate (PFHxS)	µg/L	-	1	0.01	0.01	0.01
	Perfluorooctane sulphonate (PFOS)	µg/L	-	1	0.005	0.005	0.005
	Perfluorooctanoic acid (PFOA)	µg/L	-	1	0.005	0.005	0.005
	pH	pH units	1	4	8	8.3	8.175
	Potassium	mg/L	1	4	2	2.7	2.425
	Selenium	mg/L	-	1	0.0025	0.0025	0.0025
	Silicon	mg/ L SiO ₂	1	4	18	20	19.5
	Silver	mg/L	-	1	0.0005	0.0005	0.0005
	Sodium	mg/L	1	4	120	150	140
	Sulphate	mg/L	1	4	0.5	0.5	0.5
	Thallium	mg/L	-	1	0.0005	0.0005	0.0005
	Thorium	mg/L	-	1	0.0025	0.0025	0.0025
	Tin	mg/L	-	1	0.0005	0.0005	0.0005
	Titanium	mg/L	-	1	0.0005	0.0005	0.0005
	Total Alkalinity	mg CaCO ₃ / L	1	4	200	220	205
	Total coliforms	CFU/100mL	4	7	0.5	0.5	0.5
	Total Dissolved Solids	mg/L	1	4	350	360	357.5
	Total Hardness	mg CaCO ₃ / L	1	4	4.3	6.6	5.3
	Total Suspended Solids	mg/L	-	1	0.5	0.5	0.5
	True Colour	Pt/Co units	-	1	0.5	0.5	0.5
	Turbidity	NTU	1	4	0.1	0.1	0.1

Source	Parameter	Unit	Minimum No. Samples	Samples Taken	Min	Max	Mean
	Uranium	mg/L	-	1	0.0025	0.0025	0.0025
	Vanadium	mg/L	-	1	0.0005	0.0005	0.0005
	Zinc	mg/L	-	1	0.0025	0.0025	0.0025
Bore 2	Aluminium	mg/L	1	4	0.0025	0.005	0.0032
	Antimony	mg/L	1	1	0.0005	0.0005	0.0005
	Arsenic	mg/L	-	4	0.0005	0.001	0.000625
	Barium	mg/L	-	1	0.058	0.058	0.058
	Beryllium	mg/L	1	1	0.0005	0.0005	0.0005
	Boron	mg/L	4	1	0.422	0.422	0.422
	Cadmium	mg/L	1	4	0.00005	0.00005	0.00005
	Calcium	mg/L	1	4	0.6	0.76	0.68
	Chlorate	mg/L	-	0	n/a	n/a	n/a
	Chloride	mg/L	1	4	61	71	66.75
	Chromium	mg/L	1	1	0.0005	0.0005	0.0005
	Cobalt	mg/L	1	1	0.0005	0.0005	0.0005
	Copper	mg/L	1	4	0.0005	0.001	0.00075
	<i>E. coli</i>	CFU/100mL	-	8	ND	ND	ND
	Electrical Conductance	µS/cm	-	4	590	640	622.5
	Fluoride	mg/L	-	9	1.3	1.5	1.43
	Heterotrophic Plate Count	CFU/mL	-	6	5	30	9.17
	Iron	mg/L	-	4	0.046	0.175	0.1043
	Lead	mg/L	-	4	0.0005	0.003	0.0015
	Magnesium	mg/L	1	4	0.64	0.73	0.68
	Manganese	mg/L	1	4	0.003	0.004	0.0033
	Molybdenum	mg/L	-	1	0.0025	0.0025	0.0025
	Nickel	mg/L	1	1	0.0005	0.0005	0.0005
	Perfluoroalkyl substances (PFAS)	µg/L	-	1	0.005	0.005	0.005
	Perfluorohexane sulphonate (PFHxS)	µg/L	1	1	0.01	0.01	0.01
	Perfluorooctane sulphonate (PFOS)	µg/L	1	1	0.005	0.005	0.005
	Perfluorooctanoic acid (PFOA)	µg/L	-	1	0.005	0.005	0.005
	pH	pH units	-	4	8.1	8.3	8.225
	Potassium	mg/L	-	4	2	2.6	2.4
	Selenium	mg/L	-	1	0.0025	0.0025	0.0025
	Silicon	mg/ L SiO ₂	1	4	18	20	19.25
	Silver	mg/L	4	1	0.0005	0.0005	0.0005
	Sodium	mg/L	1	4	120	150	140
	Sulphate	mg/L	1	4	0.5	0.5	0.5
	Thallium	mg/L	-	1	0.0005	0.0005	0.0005
	Thorium	mg/L	-	1	0.0025	0.0025	0.0025
	Tin	mg/L	1	1	0.0005	0.0005	0.0005
	Titanium	mg/L	-	1	0.0005	0.0005	0.0005
	Total Alkalinity	mg CaCO ₃ / L	-	4	190	210	202.5
	Total coliforms	CFU/100mL	-	7	0.5	0.5	0.5
Total Dissolved Solids	mg/L	1	4	340	380	362.5	

Source	Parameter	Unit	Minimum No. Samples	Samples Taken	Min	Max	Mean
	Total Hardness	mg CaCO ₃ / L	1	4	4.1	6.6	5.03
	Total Suspended Solids	mg/L	-	1	0.5	0.5	0.5
	True Colour	Pt/Co units	-	1	2.1	2.1	2.1
	Turbidity	NTU	1	4	0.05	0.1	0.088
	Uranium	mg/L	4	1	0.0025	0.0025	0.0025
	Vanadium	mg/L	1	1	0.0005	0.0005	0.0005
	Zinc	mg/L	1	1	0.0025	0.0025	0.0025

5.2. Treated Water

The verification monitoring data for the Kowanyama scheme reticulation sites and level of compliance are discussed in Table 3.

Some issues are noted regarding the recording of verification monitoring data. *E. coli* verification monitoring was conducted weekly by council in accordance with the DWQMP in force during the reporting period, however results from internal testing were not recorded in operational spreadsheets. Operators would action positive *E. coli* results on exception in accordance with the incident response plan as recorded in the DWQMP. Some results for free chlorine, total chlorine and pH were not recorded.

A new operational spreadsheet has been developed to improve recording of data and includes recording of verification monitoring samples taken internally by council.

Table 3 Kowanyama Reticulation Verification Data

Source	Parameter	N	Min	Max	Mean	Spec	OoS	% Meeting Spec	Comments
Final Water (Water Shed)	<i>E. coli</i> (CFU/100mL)	7	ND	ND	ND	ND (H)	0	100%	Compliant with water quality criteria, which is the <i>Public Health Regulation (2018)</i> .
	Total Coliforms (CFU/100mL)	7	ND	ND	ND	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Heterotrophic Plate Count (CFU/mL)	6	5	20	7.5	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Free Chlorine (mg/L)	24	0.01	3.35	1.78	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Total Chlorine (mg/L)	24	0.01	3.32	1.74	5 (H)	0	100%	Only of health significant at high levels and are used as an indicator of system integrity and disinfection performance.
	pH	24	7.72	8.42	7.90	8.5 (A)	0	100%	Not of health significance and are used as an indicator of disinfection performance.
Airport	<i>E. coli</i> (CFU/100mL)	7	ND	ND	ND	ND	0	100%	Compliant with water quality criteria, which is the <i>Public Health Regulation (2018)</i> .
	Total Coliforms (CFU/100mL)	7	ND	ND	ND	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Heterotrophic Plate Count (CFU/mL)	6	5	10	5.83	-	-	-	Not of health significance and are

Source	Parameter	N	Min	Max	Mean	Spec	OoS	% Meeting Spec	Comments
									used as an indicator of system integrity and disinfection performance.
	Free Chlorine (mg/L)	186	0.01	2.7	0.71	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Total Chlorine (mg/L)	186	0.01	2.72	0.67	5 (H)	0	100%	Only of health significant at high levels and are used as an indicator of system integrity and disinfection performance.
	pH	186	7.65	8.29	7.97	8.5 (A)	0	100%	Not of health significance and are used as an indicator of disinfection performance.
Council Office	<i>E. coli</i> (CFU/100mL)	7	ND	ND	ND	ND	0	100%	Compliant with water quality criteria, which is the <i>Public Health Regulation (2018)</i> .
	Total Coliforms (CFU/100mL)	7	ND	ND	ND	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Heterotrophic Plate Count (CFU/mL)	6	5	20	8.33	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Free Chlorine (mg/L)	0	n/a	n/a	n/a	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Total Chlorine (mg/L)	0	n/a	n/a	n/a	5 (H)	0	100%	Only of health significant at high levels and are used as an indicator of system integrity and disinfection performance.
	pH	0	n/a	n/a	n/a	8.5 (A)	0	100%	Not of health significance and are used as an indicator of disinfection performance.
Hospital	<i>E. coli</i> (CFU/100mL)	7	ND	ND	ND	ND	0	100%	Compliant with water quality criteria, which is the <i>Public Health Regulation (2018)</i> .
	Total Coliforms (CFU/100mL)	7	ND	ND	ND	-	-	-	Not of health significance and are used as an indicator of system integrity and

Source	Parameter	N	Min	Max	Mean	Spec	OoS	% Meeting Spec	Comments
									disinfection performance.
	Heterotrophic Plate Count (CFU/mL)	6	5	20	8.33	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Free Chlorine (mg/L)	186	0.01	2.52	0.63	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Total Chlorine (mg/L)	186	0.01	2.45	0.6	5 (H)	0	100%	Only of health significant at high levels and are used as an indicator of system integrity and disinfection performance.
	pH	186	0.12	1.24	0.42	8.5 (A)	0	100%	Not of health significance and are used as an indicator of disinfection performance.
Pindi St	<i>E. coli</i> (CFU/100mL)	4	ND	ND	ND	ND	0	100%	Compliant with water quality criteria, which is the <i>Public Health Regulation (2018)</i> .
	Total Coliforms (CFU/100mL)	3	ND	ND	ND	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Heterotrophic Plate Count (CFU/mL)	4	5	20	8.75	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Free Chlorine (mg/L)	96	0.01	3.05	1.04	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Total Chlorine (mg/L)	96	0.01	3.07	1.01	5 (H)	0	100%	Only of health significant at high levels and are used as an indicator of system integrity and disinfection performance.
	pH	96	7.61	8.14	7.91	8.5 (A)	0	100%	Not of health significance and are used as an indicator of disinfection performance.
School	<i>E. coli</i> (CFU/100mL)	7	ND	ND	ND	ND	0	100%	Compliant with water quality criteria, which is the <i>Public Health Regulation (2018)</i> .

Source	Parameter	N	Min	Max	Mean	Spec	OoS	% Meeting Spec	Comments
	Total Coliforms (CFU/100mL)	7	ND	ND	ND	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Heterotrophic Plate Count (CFU/mL)	6	5	10	5.83	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Free Chlorine (mg/L)	186	0.01	2.52	0.63	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Total Chlorine (mg/L)	186	0.01	2.45	0.6	5 (H)	0	100%	Only of health significant at high levels and are used as an indicator of system integrity and disinfection performance.
	pH	186	7.72	8.50	8.06	8.5 (A)	0	100%	Not of health significance and are used as an indicator of disinfection performance.
China Residence	<i>E. coli</i> (CFU/100mL)	2	ND	ND	ND	ND	0	100%	Compliant with water quality criteria, which is the <i>Public Health Regulation (2018)</i> .
	Total Coliforms (CFU/100mL)	2	ND	ND	ND	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Heterotrophic Plate Count (CFU/mL)	2	5	5	5	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Free Chlorine (mg/L)	186	0.1	3.6	0.88	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Total Chlorine (mg/L)	186	0.01	3.19	0.83	5 (H)	0	100%	Only of health significant at high levels and are used as an indicator of system integrity and disinfection performance.
	pH	186	7.59	8.33	7.93	8.5 (A)	0	100%	Not of health significance and are used as an indicator of disinfection performance.

Source	Parameter	N	Min	Max	Mean	Spec	OoS	% Meeting Spec	Comments
Trudy Residence	<i>E. coli</i> (CFU/100mL)	2	ND	ND	ND	ND	0	100%	Compliant with water quality criteria, which is the <i>Public Health Regulation (2018)</i> .
	Total Coliforms (CFU/100mL)	2	ND	ND	ND	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Heterotrophic Plate Count (CFU/mL)	2	5	5	5	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Free Chlorine (mg/L)	185	0.01	3.22	0.87	-	-	-	Not of health significance and are used as an indicator of system integrity and disinfection performance.
	Total Chlorine (mg/L)	185	0.01	3.16	0.84	5 (H)	0	100%	Only of health significant at high levels and are used as an indicator of system integrity and disinfection performance.
	pH	185	7.56	8.35	7.93	8.5 (A)	0	100%	Not of health significance and are used as an indicator of disinfection performance.

ND - not detected

n/a - not applicable

spec - specification (ADWG guideline value)

OoS - out of specification

A - aesthetic guideline value

H - health guideline value

6. Customer Complaints

There were no water quality related customer complaints recorded for the reporting period.

7. DWQMP Review

The DWQMP was not reviewed during the reporting period.

A review was conducted after the reporting period, with amendment application and approval of the revised DWQMP to be finalised in FY2018/2019.

8. DWQMP Audit

No DWQMP audit was conducted during the reporting period.

9. References

KASC. (2017). Drinking Water Quality Management Plan. Council Office.

NHMRC & NRMCC (2011). National Water Quality Management Strategy: Australian Drinking Water Guidelines (ADWG). 6th Ed. National Health and Medical Research Council and Natural Resource Management Ministerial Council. Australian Government, Canberra.

Public Health Regulation 2018. Queensland Government.

Water Supply (Safety and Reliability) Act 2008. Queensland Government.

Glossary

Disinfection	The process designed to kill most microorganisms in water, including essentially all pathogenic (disease-causing) bacteria. There are several ways to disinfect, with chlorine being most frequently used in water treatment.
<i>E. coli</i>	Bacterium found in the gut, used as an indicator of faecal contamination of water.
Hazard	A biological, chemical, physical or radiological agent that has the potential to cause harm.
Hazardous event	An incident or situation that can lead to the presence of a hazard (what can happen and how).
Risk	The likelihood of a hazard causing harm in exposed populations in a specified time frame, including the magnitude of that harm.
Source water	Water in its natural state, before any treatment to make it suitable for drinking.
Total coliforms	Group of bacteria whose presence in drinking water can be used as an indicator for operational monitoring.

Appendix A

Improvement Plan Progress

Kowanyama Council Improvement Plan

Action No.	Area	Hazard	Hazardous event	Improvement Action or Follow up Action	Priority	Responsibility	Due/Review date set	Status	Comments	Date completed
1	Catchment and source infrastructure	Flouride	Natural geology	Approve and distribute factsheet to community members	Medium	ESM, Council, QH	Completed, this item is removed from the improvement plan due to ongoing nature.	Completed	Developed and distributed	N/A
2	Catchment and source infrastructure	Iron	Natural iron bacteria blocking bore screens and equipment	Shock treatment of bores planned to prevent growth of iron oxidizing bacteria (with Blue Block product)	Medium	ESM	Cleared in 2012, improvement plan item removed due to ongoing nature.	Completed	Removed	2012
3	Catchment and source infrastructure	All	Significant change to scheme setup when third bore becomes operational	Update plan when operational E.g. schematic, risk assessment; monitoring and resubmit plan to DNRME	High	ESM, Council	Suspended until further notice, significant issues with department of local government and planning who over saw the initial project	To Start	To be updated on connection of new bore.	
4	Catchment and source infrastructure	Pathogens	Bore contamination	Implement on-going monitoring of the bore sites including a check of the integrity of the bore heads and any damage and potential sources of ingress of contaminants.	High	ESM, Council	Late 2020	Completed	Added to checklists in 2017 update	2017
5	Catchment and source infrastructure	Insufficient Water Supply	Generator failure for pressure pump set at bore 1, Switchboard Failure	Investigate the risk of generator failure for the pressure pump set at bore 1, with a more suitable generator being installed if required. Consideration should also be given to installing a suitable emergency generator to operate the bore 2 pump set. Replace bore 2 switchboard and investigate back up power options. Investigate addition of alarms for power failure to the alarm list if not already present.	Medium	ESM, Council	Late 2019	Ongoing	Added to DWQMP in 2017 update	
6	Catchment and source infrastructure	Insufficient Water Supply	Output of current bores declining	KASC should confirm whether bore outputs are declining over the long term and why, to ascertain the likely need for an additional water source. KASC should assess risk and options for meeting water demand over the long term, including the use of water restriction, any upgrades needed to current bores, increased metering and future use of bore 3. Analyses of bore 3 should be carried out, whilst ensuring the bore is adequately flushed each time to obtain a representative sample, and the results used to confirm its suitability as a drinking water source.	Medium	ESM, Council	Completed	Completed	Bore 3 under construction, to be commissioned as funding is available.	2018
7	Catchment and source infrastructure	Pathogens, Carcogenic Chemicals	Unauthorised access to bores	Repair the bore fencing to prevent unauthorised access by humans and animals	Medium	ESM, Council	Late 2019	Ongoing	Replacement of fencing planned as a part of infrastructure upgrade (ICCP funding).	
8	Catchment and source infrastructure	Pathogens	Supply of unchlorinated water	Remove the connection between bore 2 and the dog pound as the supply to this property is not chlorinated. If this is not a feasible option, or in the interim, taps at the property must be marked as 'non-potable water'	Extreme	ESM, Council	1-Jan-19	Completed	Investigation found that the connection was chlorinated potable water. RPZD and signage installed for backflow prevention.	
9	Catchment and source infrastructure	Insufficient Water Supply	Output of current bores declining	If the irrigation bore is commissioned, monitor electrical conductivity and bore levels to ascertain whether the irrigation bore will likely effect water supply.	Medium	ESM	Unknown	Completed	EC not monitored, however KASC have installed a new bore (Bore 3). Bore 3 to be commissioned and connected to the network as required and as funding is available.	2018
10	Disinfection Process	Pathogens	Insufficient mixing of chlorine	Solar bee mixers have been installed and reconfigured pipework back to original design	High	ESM	Completed, reconfigured original reservoir pipework back to engineers design	Completed	Done	2017
11	Disinfection Process	Pathogens	Underdosing of chlorine	Determine if degassing impacts on disinfection efficacy, if this is the case, investigate options to ensure correct dose of chlorine	High	ESM	Late 2018	Completed	Degassing not found to be a major issue, although replacement of the hypochlorite system with an electrochlorination system has been recommended for continuity of supply/chlorate control, pending ICCP funding.	
12	Disinfection Process	Pathogens	Underdosing of chlorine	Implement a more intuitive control system for the control of chlorine dose rates. Consider automation of dosing. Investigate adding a calibration cylinder should be to the system to enable visual verification of the chemical dose rate.	High	ESM	Mid 2019	Ongoing	Replacement electrochlorination system to include calibration tubes and loop control for chlorine.	

13	Whole of Service	Insufficient Water Supply	SCADA failure	Constantly up grading, system over hauled in 2014 so SCADA systems better communicate with each other	Medium	ESM	Removed due to ongoing nature.	Completed	Removed	N/A
14	Whole of Service	Pathogens, Carcogenic Chemicals	Increase relevant staff qualifications	Identify opportunities to upgrade staff skills (e.g. from Cert II to Cert III in Water & Sewerage).	High	ESM	Removed due to ongoing nature.	Completed	Skills register spreadsheet developed during 2017 update	2017
15	Whole of Service	Pathogens, Carcogenic Chemicals	Operation and maintenance procedures #filling large chlorine tank up from drums #E.coli testing #daily water sampling #other procedures as required	Include document control on procedures and records, including adding version identifiers on procedures/checklists.	High	ESM	Mid 2018	Ongoing	Version Control Register developed during 2018 update	
16	Whole of Service	Pathogens, Carcogenic Chemicals	Preventive measures not undertaken per DWQMP	Review to see that all maintenance activities and procedures are documented (as per preventive measures). Ensure these are accessible to staff.	Medium	ESM	Late 2019	Ongoing	Checklists produced, although update required to match current plan	
17	Whole of Service	Insufficient Water Supply	Incident and Emergency response in event of cyclone etc.	Prepare community alert templates in preparation (e.g. obtain Qld Health templates), to ensure measures are in place in event of an emergency	Medium	ESM	Late 2018	To Start	Viridis to supply a template boil water notice.	
18	Whole of Service	Pathogens, Carcogenic Chemicals	Insufficient disinfection, chlorate formation	Develop a sodium hypochlorite management procedure, including a written agreement with the chemical supplier to supply the newest stock available, onsite stock rotation to ensure oldest stock is used first and the application of relevant Australian Standards.	High	ESM	Mid 2019	Ongoing	Implemented with supplier, although this has not resolved the age of hypochlorite issue. An upgrade is planned to convert the hypochlorite system to electrochlorination.	
19	Whole of Service	Carcogenic Chemicals	Chemical leakage	Bunding around the chlorine dosing tanks should be improved to allow for the capture of leaks at the side of the tank as per AS3780	High	ESM	Mid 2019	Ongoing	80% Fill in short term, longer term solution to replace system with electrochlorination.	
20	Whole of Service	Pathogens, Carcogenic Chemicals	Insufficient disinfection, chlorate formation	Chlorate concentration in treated water should be regularly monitored to determine the current extent of the formation of this chemical.	High	ESM	Mid 2019	Completed	Added to draft checklist/complete water analysis	2018
21	Whole of Service	Pathogens, Carcogenic Chemicals	Insufficient disinfection, over dosing of chlorine	Check the function of the maximum chlorine alarm to confirm it is active. Consider the need for bore shutdown capabilities on the triggering of low chlorine alarm to minimise the risks of supplying water without adequate disinfection - since there is a large volume of storage, shutdown may not be required, however this should be confirmed	Medium	ESM	Early 2020	Completed	Maximum alarm confirmed as working.	2018
22	Whole of Service	Pathogens	Equipment degrading with age	Investigate the need for solar bee mixers under the current operational arrangement and safely decommission if not needed. If they are needed, develop procedure to ensure good working condition.	Low	ESM	Late 2024	Completed	Not required, removed.	2017
23	Whole of Service	Pathogens, Carcogenic Chemicals	Reservoir integrity breach	Repair rust damage to both reservoirs and replace the rubber seals on the roofs, which have been attacked by birds	High	ESM	Early 2019	Ongoing	Run inside the roof structure, to be repaired early 2019.	
24	Whole of Service	Pathogens, Carcogenic Chemicals	Misinterpretation of schematics	Find/develop drawings for critical parts of the system as required. Improve labelling of valves, sample points and dosing points to increase ease of operation, particularly for staff who are less familiar with the equipment/system.	Low	ESM	Early 2020	Ongoing	To be rectified with the chlorination upgrade.	
25	Whole of Service	Pathogens	Erroneous sampling results	Plan dedicated laboratory area, away from general office area.	Medium	ESM	Early 2021	To Start	20ft container request ICCIP funding, to be confirmed in 2019.	
26	Whole of Service	Pathogens, Carcogenic Chemicals	Insufficient resourcing	Ensure current staff complete their already commenced training. Develop a register to identify ongoing training needs.	Medium	ESM	Late 2017	Completed	Register template developed, although training records are maintained by HR	2017
27	Whole of Service	Pathogens, Carcogenic Chemicals	Erroneous sampling results	Ensure cleanliness of water service refrigerator and provide dedicated refrigerator with temperature control between 1 degree celsius and 5 degrees celsius, equip with a thermometer.	Medium	ESM	Late 2020	Completed	Not used for standards or sample storage - thermometer to required,	2017
28	Whole of Service	Pathogens, Carcogenic Chemicals	Preventive measures not undertaken per DWQMP	Implement Updated DWQMP Task Checklist	Medium	ESM	Late 2019	Ongoing	Checklists produced, although update required to match current plan	
29	Whole of Service	All Hazards	All Hazards	Consider detailed recommendations per DEWS report "Report on the assessment of the Kowanyama Aboriginal Shire Council Drinking Water Service (September 2017)"	N/A	ESM	Late 2025	Completed	Actions incorporated into improvement plan as outstanding and applicable.	2018
30	Whole of Service	All Hazards	All Hazards	Undertake training on incident and emergency management. This should include working through a scenario.	Medium	ESM	Early 2020	To Start	Viridis to provide information.	
31	Disinfection Process	Pathogens Chemical Hazard	Degradation of hypochlorite	Upgrade chlorination plant to reduce issues with degrading hypochlorite.	High	ESM	Late 2019	Ongoing	Quotations for new plant received, currently working through ICCIP funding budget.	



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