



Drinking Water Quality Management Plan

Cloncurry Shire Council

September 2017



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1. Introduction

This is the Drinking Water Quality Management Plan (DWQMP) for Cloncurry Shire Council (CSC) water supply scheme. This plan has been developed in accordance with the requirements of Section 93(3) of the *Water Supply (Safety and Reliability) Act 2008* (the Act). The DWQMP addresses the content requirement of the *Queensland Drinking Water Quality Management Plan Guideline* (the Guideline) (DEWS 2010) and has been structured to follow the Guideline.

This plan contains or references the relevant plans, procedures and registers that are required to maintain drinking water quality for the CSC water supply scheme. This plan refers mainly to the following supporting documents:

- Drinking Water System Analysis 2017
- Risk Assessment Register 2017
- Monitoring Plan 2017
- Improvement Plan Register 2017
- Incident and Emergency Response Plan 2016

The supporting documents include information that requires regular updating hence keeping them separate helps reduce administration.

1.1. Scope of the DWQMP

The Act requires that all drinking water service providers have an approved DWQMP in place. Section 95(1) of the Act states that each service provider must prepare the plan for the service and apply to the regulator for approval of the plan. Section 95(3) requires that the plan must be prepared in accordance with the Guideline. A DWQMP must address the following mandatory requirements, as outlined in Section 95 of the Act:

- state the registered services to which the plan applies
- include details of the infrastructure for providing the services
- identify the hazards and hazardous events the drinking water service provider considers may affect the quality of water to which the services relate
- include an assessment of the risks posed by the hazards and hazardous events
- demonstrate how the drinking water service provider intends to manage the risks posed by the hazards and hazardous events
- include details of the operational and verification monitoring programs under the plan, including the parameters to be used for indicating compliance with the plan and the water quality criteria for drinking.

The Guideline specifies how the requirements of the Act are to be met through the identification of criteria that are shown in grey boxes throughout the DWQMP.

This DWQMP applies to the drinking water service provided by CSC which includes all aspects of the potable water service from catchment to tap in Cloncurry. It does not include the sewerage treatment system, nor does it include the non-potable water supply schemes for the communities at Dajarra and Kajabbi.

1.2. Registered Service Details

Criteria

The Plan must contain information on the registered service, including the:

- service provider identification number (SPID)
- service provider name and contact details – if the service provider is not the operator, then the operator's name and contact details must also be provided
- name of each scheme to which the Plan applies
- name of the communities that are supplied including the current and future (next 10 years) populations, connections and demands.

With the introduction of the *Water Supply (Safety & Reliability) Act 2008 (QLD)* water service providers are required to register as a drinking water service provider for the delivery of a drinking water service. The CSC is registered as a medium sized drinking water service provider and details are in Table 1.

Table 1 Registered service details

Service Description	Details
Service Provider Identification Number (SPID)	36
Service Provider Name and Contact Details	Cloncurry Shire Council 19 – 21 Scarr St PO Box 3 Cloncurry Qld 4824 Tel: 07 47424100 Fax: 07 47421712 Email: council@cloncurry.qld.gov.au
Scheme that the plan refers to	Cloncurry Drinking Water Supply Scheme
Current Population (approx.)	3,500
Future Population (2025)	3,800
Current Connections (approx.)	1,062
Current Demand (approx.) ML/d	2.9
Future Demand (2025) ML/d	4.3

Population estimates based on Population Profile, Office of Economic and Statistical Research, 2012.

Demand forecast based on LCJ Engineers report, 2011.

1.3. Cloncurry Shire Council

Cloncurry is a rural town, which derives its main income from the mining and pastoral industries. The town itself is nestled on the banks of the Cloncurry River and is home to approximately 3,500 people. Cloncurry also provides a full range of community facilities, including schooling to year 12, hospital and medical facilities.

In addition to potable water supply in Cloncurry township, CSC also provides non-potable supplies to Kajabbi and Dajarra.

2. Commitment to Drinking Water Quality Management

Best Practice Recommendations

The ADWG states that organisational support and long-term commitment by senior executives is the foundation to implementation of an effective system for drinking water quality management. Successful implementation requires:

- An awareness and understanding of the importance of drinking water quality management and how decisions affect the protection of public health.
- The development of an organisational philosophy that fosters commitment to continual improvement and cultivates employee responsibility and motivation.
- The on going and active involvement of senior executives to maintain and ^{SEP}reinforce the importance of drinking water quality management to all employees as well as those outside the organization.

CSC ensures that its actions and policies support the effective management of drinking water quality (e.g. appropriate staffing, training of employees, provision of adequate financial resources, active participation and reporting to the Chief Executive Officer).

2.1. Drinking Water Quality Policy

CSC has a strong commitment to Drinking Water Quality Management. This is demonstrated by having a Water Quality Policy. The policy is to be tabled at council meeting for endorsement (part of improvement plan).

2.2. Regulatory and Formal Requirements

2.2.1. Regulatory Scope

A summary of regulatory requirements is presented in section 1. Details of relevant regulatory and other formal requirements are provided in Table 2. This table is reviewed when the DWQMP is reviewed.

Table 2 Legal and Other Requirements

Requirement	Authority/ Organisation	Detail	How Addressed	Responsibility
Common Law	Commonwealth	CSC will ensure that the water service is operated with a high level of transparency and relevant items are addressed to minimise risk under common law.	CSC complies with the ADWG and has a DWQMP.	Director of Works and Environmental Services
Environmental Protection Act 1994	Environmental Protection Agency	The Act states 'a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm'. Therefore, CSC must ensure that the general environmental duty is followed, to minimise legal liability.	CSC has an Environmental Management System in place.	Director of Works and Environmental Services
Public Health Act 2005 / Regulation 2005	Queensland Health	Part 5A of the Act outlines provisions about drinking water including improvement notices and offences for supplying unsafe drinking water. The Public Health Regulation 2005 Schedule 3A outline standards for quality of drinking water.	As part of the DWQMP.	Director of Works and Environmental Services

Requirement	Authority/ Organisation	Detail	How Addressed	Responsibility
Water Act 2000	Department of Environment & Heritage Protection	This Act provides for the sustainable management of water and other resources and the establishment and operation of water authorities.	CSC is the holder of a Distribution Operations License under the Act.	Director of Works and Environmental Services
Water Supply (Safety and Reliability) Act 2008	Department of Energy and Water Supply - Queensland Water Supply Regulator	This Act requires a water service provider to develop a drinking water quality management plan.	CSC has an approved DWQMP	Director of Works and Environmental Services
Drinking Water Guidelines - Regulatory guidelines 2010	Department of Energy and Water Supply - Queensland Water Supply Regulator	Details on how to prepare a DWQMP.	CSC has an approved DWQMP.	Director of Works and Environmental Services
Australian Drinking Water Guidelines (ADWG)	NHMRC	The ADWG are intended to provide a framework for good management of drinking water supplies that, if implemented, will assure safety at point of use.	CSC DWQMP is in line with the ADWG.	Director of Works and Environmental Services
Fluoride Bill 2012 - legislative changes to Water Fluoridation Act 2008 and Regulation 2008	Department of Energy and Water Supply - Queensland Water Supply Regulator	The Fluoride Bill 2012 restores local control of fluoride management.	CSC does not fluoridate.	Director of Works and Environmental Services
Contract NWQWP - Water Supply Management Agreement	Sunwater	This agreement acts as a contract between NWQWP as the supplier and CSC as the customer. The agreement covers the water quality management services of the supplier to the customer and supersedes all earlier agreements.	Current contract.	Director of Works and Environmental Services

2.2.2. Employee Responsibilities

The Director Works and Environmental Services is responsible for coordinating the implementation of the DWQMP.

Those employees within the water supply section with responsibilities directly related to water quality management have those requirements relevant to their position reflected in their Position Description (PD).

The Drinking Water Policy provides a commitment to ensuring that managers, employees and contractors are aware of their responsibility to implement this plan. This DWQMP states where there are relevant responsibilities.

2.2.3. Identifying and Communicating Regulatory Changes

It is the responsibility of the Director Works and Environmental Services to ensure regulatory compliance. Changes to legislation and formal requirements are identified by notification from the Department of Energy and Water Supply (DEWS) through a subscription with the Queensland Parliamentary Council.

If a change in legislation requires a change in practice, the owner of the relevant procedure is notified and changes are made accordingly.

2.3. Engaging Stakeholders

The Guideline recognises the role of key stakeholders throughout the water supply system and requires that they are identified in the plan. An overview is given here.

Stakeholders are any entity that could possibly increase/decrease water quality risks. Several aspects of drinking water quality management require involvement with other agencies and stakeholders. Similarly, consultation with relevant health and other regulatory authorities is necessary for establishing many elements of a DWQMP, such as monitoring and reporting requirements, emergency response plans and communication strategies. This means establishing two-way communication paths with State Government Departments, CSC's customers, contractors and providers.

Table 3 includes the stakeholder and communication register, which identifies all stakeholders who could affect, or be affected by decisions or activities of CSC. The register lists each stakeholder's contact details, their commitment and involvement with water quality, the frequency of communication between parties and the method of communication. This register is maintained as required, and when the DWQMP is reviewed.

There are a number of stakeholders that would be classed as sensitive receptors. These include such customers as the hospital and Kindergarten/Prep School. A list of sensitive receptors with phone numbers is located at the Council office.

Table 3 Stakeholder and Communications

Organisation	Contact	Involvement	Reporting	Frequency	Method
Department of Energy & Water Supply – regulator	Sector: Queensland Water Supply Regulator Name: As advised by DEWS Email: drinkingwater.reporting@dews.qld.gov.au Phone contact: 1300 596 709	- Approve DWQMP - Ensure implementation - Incident reporting	DWQMP review	Every 2 years	Electronically
			External DWQMP audit	Every 4 years	Electronically
			Water quality incident	As required	As per the IERP
			Annual DWQMP report	120 business days from end of financial year	Electronically
Queensland Health – Public health	Sector: Tropical Public Health Unit Name: As available Contact No.: 07 4744 9100	- Setting drinking water quality standards under the Public Health Act - Issuing and enforcing public health orders	Any event likely to have an immediate effect on public health, or requiring a public health alert.	As required	Verbal communication immediately, followed by written confirmation.
SunWater – upstream bulk raw water supplier	Sector: NWQWP - Lake Julius Name: Murray Able Contact No.: (07) 4742 5187	- Individual supply contract	Upstream water quality issues	As required	Verbal communication
Cloncurry Community – public health	Sensitive Receptors - Dialysis patients Contact No: See list in Emergency Plan	This group could be easily affected by poor water quality.	Any event that could have an immediate effect on this group.	As required	Telephone as soon as possible.
	Sector: ABC Radio - North West Queensland Contact No: (07) 4744 1311	Helps disseminate water quality information	As required	As required	Telephone

3. Details of Infrastructure for Providing the Service

Criteria

The Plan must describe the details of the infrastructure for each scheme including the following:

- a schematic layout
- source details
- treatment process details for each drinking water source
- a description of any variations to process operation (for example, bypassing a process step)
- a schematic(s) representing the treatment process(es)
- any sources that do not undergo a treatment process must be identified and an explanation as to why no treatment process exists
- disinfection process(es) for each drinking water source
- any sources that do not undergo a disinfection process must be identified and an explanation as to why no disinfection process exists
- details of the distribution and reticulation system
- key stakeholders, who have been actively involved in the management of drinking water quality, and their relevance.

The Cloncurry water supply system is comprised of multiple raw water supply sources, a treatment plant, pump stations and a distribution network.

The details of infrastructure for providing the services and requirements for the criteria are presented in the *Drinking Water System Analysis Report* (2017), which is a supporting document of the DWQMP.

4. Identify Hazards and Hazardous Events

4.1. Water Quality Information

Criteria

- The Plan must include a summary of the analysis and interpretation of available and relevant water quality information.
- Where multiple providers are involved in providing the water supply, the above summary must (to the best of their knowledge) include relevant water quality information on the immediate upstream (for example, bulk supplier) and/or immediate downstream (for example, distributor) system(s).

A review of historical water quality data can assist in understanding source water characteristics and system performance both over time and following specific events such as heavy rainfall. This can aid the identification of hazards and aspects of the drinking water system that require improvement. Water quality should be reviewed and used to inform the risk assessment.

A comprehensive set of water quality data from routine and event conditions as well as complaints, exceedences and climatic information was collected and reviewed for the past 5 years during the development of the original DWQMP in 2012. This is contained in the *Water Quality Report* (2012).

Subsequently, as required water quality data has been assessed and evaluated to inform the risk assessment reviews. The analysis includes graphical representations and summary tables of the data for the scheme. The data analysis for the DWQMP review 2015 was contained in the *Drinking Water System Analysis Report* 2015.

The data analysis for the DWQMP review 2017 is contained in the *Drinking Water System Analysis Report* 2017, which is a supporting document of this DWQMP 2017.

4.2. Catchment Characteristics

Criteria

The catchment characteristics for each system's water source must be documented in the Plan. This includes a description of:

- catchment area or groundwater recharge area
- topography
- main geological features
- climatic features
- land use.

The details of the catchment characteristics are contained in the *Drinking Water System Analysis Report* 2017.

4.3. Hazard Identification

Criteria

The hazards and hazardous events (together with the sources of the hazards and hazardous events) that could adversely affect water quality must be documented in the Plan, including those affecting the:

- catchment
- sourcing infrastructure
- treatment plants
- disinfection process(es)
- distribution system.

When multiple providers are involved, the Plan must (to the best of their knowledge) include the hazards and hazardous events together with the sources of these hazards and hazardous events associated with the operations and water quality management processes of the other entities' systems which the provider considers could impact on the service.

The whole of service hazards and hazardous events and the sources of the hazards and hazardous events must be documented in the Plan.

The Plan must detail the personnel (i.e. position) responsible for the hazard identification and risk assessment process, their roles and responsibilities and how knowledge of the actual day-to-day operation of the system(s) has been included in this process.

4.3.1. Identifying and Documenting Hazards and Hazardous Events

Hazards and hazardous events are based on:

- information gathered in Section 3 – Details of Infrastructure, Treatment and Distribution
- information gathered in Section 4.1 – Water Quality Information
- information gathered in Section 4.2 – Catchment Characteristics.

The hazards and hazardous events are captured in the *Risk Register 2017*, which is a supporting document of the DWQMP 2017.

4.3.2. Hazard Identification (and Risk Assessment) Team

Details of the risk assessment outcomes and review team are included in the *Risk Register 2017*.

5. Assessment of Risks

Criteria

Details of the risk assessment results for each system's identified hazards and hazardous events must be documented in the Plan, including:

- key stakeholders who have been actively involved in the risk assessment process, their role and the rationale for inclusion
- where multiple providers are involved, the Plan must (to the best of their knowledge) explain how the relevant maximum and residual risk assessment results from other provider's service(s) have been considered.

For the purpose of the risk assessment (and reviews), hazards include microbial, physical, chemical and radiological agents. The process undertaken by CSC includes:

- assembly of the risk assessment team:
 - multi-disciplinary, including staff from relevant areas of operations
 - included at least one member with formal risk assessment training or equivalent experience or skills (facilitator)
- in a workshop or discussion meeting with the Risk Assessment Team the following steps are undertaken:
 - analysis of the process flow diagram, describing processes
 - review of background information and related work, which included the characterisation of raw water from all the Cloncurry sources
 - identification of microbial, physical, chemical and radiological hazards
 - identification of sources of contamination and hazardous events
 - assessment of maximum risk using the risk methodology
 - identification of preventive measures and the assessment of residual risk using the risk methodology
 - evaluation of significant risks and identification of required further risk treatments
 - identification of critical control points (CCPs) by assessing each of the preventive measures used to reduce risk using a CCP Decision Tree.

5.1. Methodology

In the risk assessment three different risks were identified:

- **Inherent risk** – this is the level of risk in CSC's raw water sources i.e. raw water from Chinaman Creek Dam, the North Western Pipeline and the River wells.
- **Maximum risk** – risk without existing barriers/preventive measures in place. Therefore, maximum risk is the inherent risk plus any additional sources of hazards/ hazardous events due to CSC's treatment and/or distribution network.
- **Residual risk** – the risk after current barriers and preventive measures are taken into consideration.

Figure 1 shows the relationship between the different risk levels.

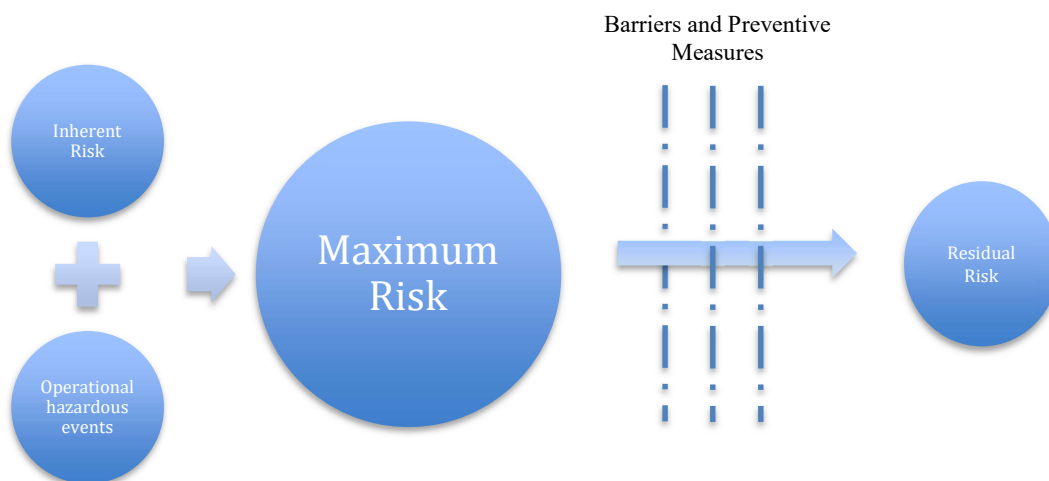


Figure 1 Risk Relationship

For the risk assessment, a risk that is high or above is deemed to be significant or unacceptable. Significant maximum risks require adequate risk mitigation to be in place and robust operational procedures. Unacceptable residual risks identify a gap in risk mitigation and require further risk treatments to bring the risk level down to acceptable.

It should be noted that all unacceptable residual risks are assigned additional risk treatments, and form part of the *Improvement Plan*, which is a supporting document of the DWQMP 2017.

Risk scores are assessed using a likelihood and consequence risk matrix, Table 4. The risk score is the intercept of likelihood and consequence.

Table 4 Risk Matrix

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Medium (E1)	High (E2)	Very High (E3)	Extreme (E4)	Extreme (E5)
Likely	Medium (D1)	High (D2)	Very High (D3)	Extreme (D4)	Extreme (D5)
Possible	Low (C1)	Medium (C2)	High (C3)	Very High (C4)	Extreme (C5)
Unlikely	Low (B1)	Low (B2)	Medium (B3)	High (B4)	Very High (B5)
Rare	Low (A1)	Low (A2)	Low (A3)	Medium (A4)	Medium (A5)

In assessing the risk score, the first step is to determine the consequence of the hazardous event. The consequence categories used are defined in Table 5.

Table 5 Consequence Descriptors

Level	Descriptor	Description	Example
1	Insignificant	Insignificant impact, little disruption to normal operation, low increase in normal operation costs	Isolated exceedance of aesthetic parameter with little or no disruption to normal operation
2	Minor	Minor impact for small population, some manageable operation disruption, some increase in operating costs	Local aesthetic impact or isolated exceedance of chronic health parameter (only some zones/houses are impacted)
3	Moderate	Minor impact for large population, significant modification to normal operation but manageable, operation costs increase, increased monitoring	Widespread aesthetic impact or repeated breach of chronic health parameter (all zones/houses are impacted)
4	Major	Major impact for small population, systems significantly compromised and abnormal operation if at all, high level of monitoring required	Potential acute health impact, single barrier failure and increased localised risk of pathogen contamination
5	Catastrophic	Major impact for large population, complete failure if systems	Potential acute health impact, loss of system control and the safety of a widespread area of the supply is compromised

Following the identification of the consequence, the likelihood of that consequence materialising was determined using the likelihood categories defined in Table 6. To assist in the categorisation of hazardous events, a unit is considered to be a day, e.g. a seasonal event that lasted a week was considered to happen seven times per year, hence would have been defined as possible.

The advantage of using the “likelihood of the consequence” approach is that it does not overstate risk. Calculation of the likelihood of the hazard occurring would not be a realistic representation.

Table 6 Likelihood Descriptors

Level	Descriptor	Description	Example
A	Rare	May occur only in exceptional circumstances	May occur less than or equal to once every 10 years
B	Unlikely	Could occur at some time	May occur more often than once every 10 years and up to once every 5 years
C	Possible	Might occur or should occur at some time	May occur more often than once every 5 years and up to once a year
D	Likely	Will probably occur in most circumstances	May occur more often than once per year and up to once per month
E	Almost Certain	Is expected to occur in most circumstances	May occur more often than once per month

Assessing uncertainty provides an indication of the need to undertake further work or gather more data to ensure that the risk assessment is accurate and reliable. This is addressed in risk treatment (improvements), and is included in the Improvement Plan, where relevant.

For each hazard and hazardous event assessment, the level of uncertainty in the assessment was identified using the definitions in Table 7.

Table 7 Uncertainty Descriptors

Level of Uncertainty	Definition
Certain	There is 5 years of continuous monitoring data, which has been trended and assessed, with at least daily monitoring; or The processes involved are thoroughly understood
Confident	There is 5 years of continuous monitoring data, which has been collated and assessed, with at least weekly monitoring or for the duration of seasonal events; or There is a considerable understanding of the processes involved
Reliable	There is at least a year of continuous monitoring data available, which has been assessed; or There is a good understanding of the processes involved
Estimate	There is limited monitoring data available; or There is a reasonable understanding of the processes involved
Uncertain	There is limited or no monitoring data available; or The processes are not well understood

The risk assessment is recorded in the *Risk Register 2017*.

5.2. Risk Assessment

5.2.1. Inherent Risk

The inherent risk is the risk in the raw water from the Chinaman Creek Dam, River wells and North West Pipeline. The inherent risk was calculated for each of the water sources based on water-quality data and details of the catchment.

The inherent risk was calculated for each hazard located in the left-most column of the risk register, as shown in Figure 2.

Inherent Risk												
Hazard	Impact	Source	Chinaman Creek Dam			River Wells			North West Pipeline (Lake Julius)			Notes
			Consequence	Likelihood	Risk	Consequence	Likelihood	Risk	Consequence	Likelihood	Risk	
Biological												
Bacteria	H	Cattle grazing; Recreational activities; Very low density septic tanks at Chinamans Ck Dam	Catastrophic	Almost certain	Extreme (E5)	Catastrophic	Almost certain	Extreme (E5)	Catastrophic	Possible	Extreme (C5)	The river runs turbid for 3 months a year. When the Leichhardt runs there is a little turbidity in LJ but much less than the Cloncurry source.
Cyanotoxins	H	Lake Julius; Break tank on NW Pipeline	Minor	Unlikely	Low (B2)	Minor	Unlikely	Low (B2)	Moderate	Possible	High (C3)	LJ is susceptible to BGA. Catchment makes dam susceptible to blue-green algae outbreak. Limited records of such events. No issues have been recorded in recent history.
Opportunistic Pathogens (Nagalaria & Legionella)	H	Natural sources	Major	Unlikely	High (B4)	Major	Unlikely	High (B4)	Major	Unlikely	High (B4)	The water sources can go above 25 degrees

Figure 2 Inherent Risk Calculation for the Cloncurry Scheme

For each of the hazards, potential sources were identified. Based on the information gathered, consequence and likelihood were determined, and a risk score calculated using the risk matrix for each of the water sources. Notes in relation to this risk assessment were also taken.

Details of the inherent risk assessment are presented in the *Risk Register 2017*.

5.2.2. Maximum Risk

To assess maximum risk, additional sources of each hazard were identified in the treatment and distribution processes, in addition to those contributing to the inherent risk, e.g. chlorine dosing, maintenance or pipe breaks. Based on the additional sources, the maximum risk was updated if this affected the consequence and likelihood for a particular hazard. The highest risk for the hazard (from the 3 sources) either passed through

or was increased based on the additional sources. At this stage, the uncertainty of the risk assessment was determined for the inherent and maximum risk using the risk methodology. Figure 3 illustrates how maximum risk was calculated.

Details of the maximum risk assessment are present in the *Risk Register 2017*.

Inherent Risk												Maximum Risk					
Hazard	Impact	Source	Chinaman Creek Dam			River Wells			North West Pipeline (Lake Julius)			Notes	Additional sources in treatment and distribution	Consequence	Likelihood	Risk	Uncertainty
			Consequence	Likelihood	Risk	Consequence	Likelihood	Risk	Consequence	Likelihood	Risk						
Chemical																	
Aluminium	H	Natural geology	Minor	Unlikely	Low (B2)	Minor	Unlikely	Low (B2)	Minor	Unlikely	Low (B2)	There are no issues with Al Testing results from HSSA laboratory seen (Jan 2015)	Ultron dosing	Minor	Possible	Medium (C2)	Reliable
Arsenic	H	Natural geology	Minor	Rare	Low (E2)	Minor	Rare	Low (E2)	Minor	Rare	Low (E2)	No issues identified	None	Minor	Rare	Low (E1)	Reliable
Chlorine	H	None	Insignificant	Rare	Low (A1)	Insignificant	Rare	Low (A1)	Insignificant	Rare	Low (A1)	No issues identified	Addition of chlorine gas	Minor	Possible	Medium (C2)	Reliable

Figure 3 Maximum Risk Calculation

Maximum risk increases due to ultron dosing.

5.2.3. Residual Risk

Residual risk was calculated in a two-step process. A separate worksheet (which forms part of the Risk Register) was used to assess the risk of hazardous events. To assess the risk of hazardous events:

- The first step is to list components of the scheme, followed by the identification of possible hazardous events that could impact drinking water quality.
- Potential hazards are identified from the list of hazards previously identified in the inherent and maximum risk assessments. One hazard is selected as being the 'Limiting Hazard' or the hazard that carries the greatest risk.
- Preventive measures are identified for the hazardous event and any monitoring that may identify the event.
- Taking into consideration available information, such as historical performance and monitoring data, the residual risk is calculated using the risk methodology.
- Comments are captured.
- The level of uncertainty of the risk assessment is determined using the risk assessment methodology.

The hazardous event worksheet for the Cloncurry scheme is part of the *Risk Register 2017*.

The second step in the residual risk process is to assess the effectiveness of the barriers in the scheme. The barriers in the scheme are identified on the Risk Register and it is indicated which hazards are managed by each of the barriers (appropriate cell(s) are shaded).

Residual risk is then assigned to each of the hazards in the scheme risk assessment as follows:

- Each hazard is considered sequentially.
- The Hazardous Event worksheet is reviewed to determine if an event resulted in the hazard of concern being the limiting hazard. If so, the highest residual risk for that hazard post treatment is pulled from the hazardous event worksheet into the scheme risk worksheet.
- Monitoring and operational data is taken into consideration for each hazard.
- Based on the information gathered, a residual risk score is assigned for each hazard.
- Comments are captured.

Details of the residual risk assessment are present in the *Risk Register 2017*.

Figure 4 is a representation of the process that is undertaken to determine residual risk.

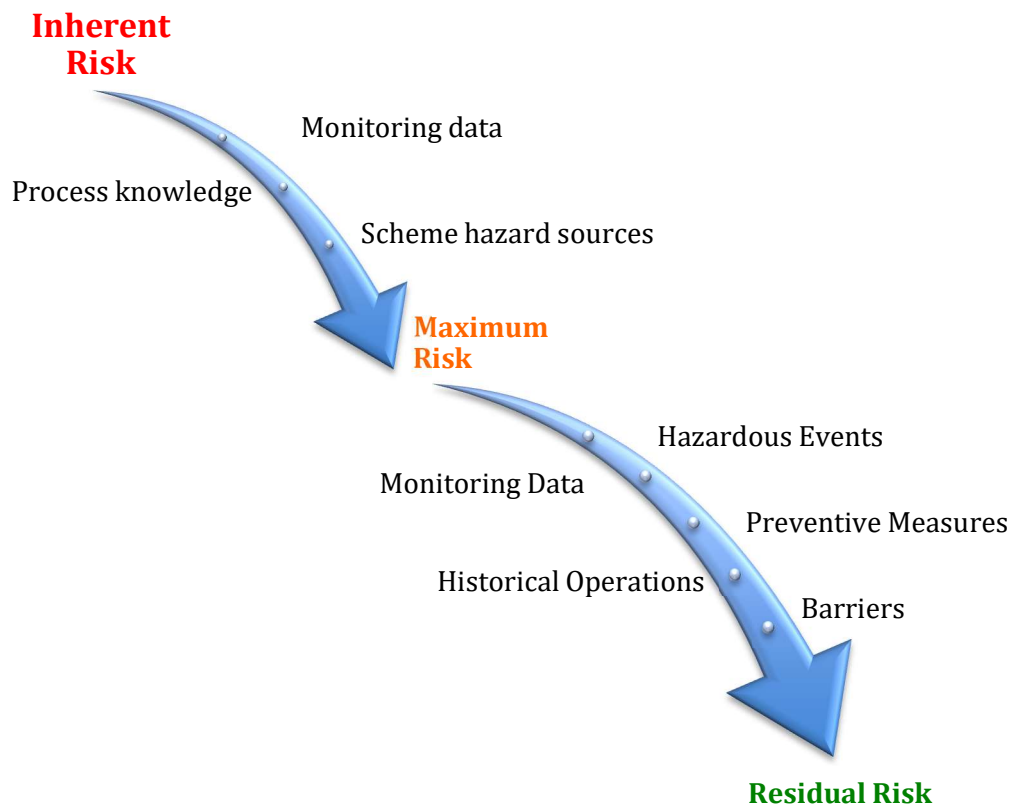


Figure 4 Residual Risk Process

6. Managing Risks

Criteria

The Plan must contain an overall list of all the existing and proposed preventive actions or measures managed by the provider to achieve acceptable residual risks in the short and longer-term.

Where the provider relies on an external organisation to manage a risk to their service, the Plan must document what the preventive actions or measures are, and what arrangements are in place with the external organisation to ensure the measures remain effective.

In order to ensure that hazards and hazardous events are managed effectively, measures need to be in place to eliminate or reduce the associated risk. This DWQMP addresses this through the implementation of the following:

- preventive measures that reduce the likelihood of contaminants being at a concentration which may cause harm to the consumer
- multiple barriers - a series of barriers that ensure contaminants are at an acceptable level
- critical control points - these are points in the system that can be monitored and action can be taken to prevent the process going out of control leading to a non-compliant product.

It is important that all of the identified significant maximum risks are managed appropriately and that there are barriers in place to manage them. Barriers and preventative measures are identified during the risk assessment or review workshop/meeting for the identified hazards, this can be seen in detail in the *Risk Register 2017*.

6.1. Operational Control

6.1.1. Existing Preventive Measures

Operational control is essential for the management of the drinking water supply system. In order to manage a process it must be capable of being monitored and corrective action applied to ensure processes function within the defined operational envelope.

Within a process a number of points may be identified as critical, where increased control is required to ensure a quality product. A CCP is defined as an activity, procedure or process at which control can be applied and which is essential to prevent a hazard or reduce it to an acceptable level. Not all activities are amenable to selection as critical control points. A CCP has several operational requirements, including:

- operational parameters that can be measured and for which critical limits can be set to define the operational effectiveness of the activity (e.g. chlorine residuals for disinfection)
- operational parameters that can be monitored frequently enough to reveal any failures in a timely manner (online and continuous monitoring is preferable)
- procedures for corrective action that can be implemented in response to deviation from critical limits.

The determination of CCPs was made using the decision tree in Figure 5, adapted from the ADWG (2011).

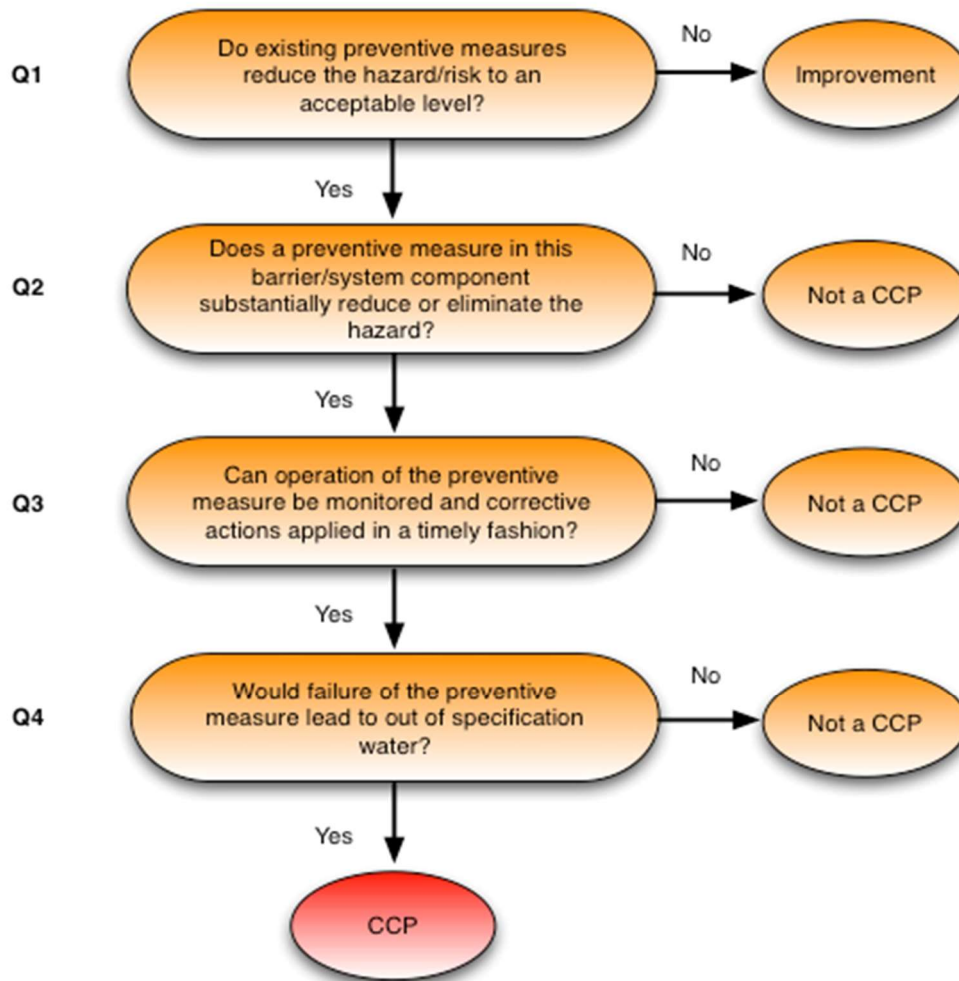


Figure 5 CCP Decision Tree

Preventive measures that manage a hazard with a significant maximum risk were assessed to determine if they were a CCP for that hazard. There could be more than one CCP for a particular hazard. The identified CCPs are recorded in Table 8 below.

CCPs are reassessed on the following triggers:

- if there is a significant change to the process
- if the risk assessment is changed
- if the review of CCP identifies the need.

For each identified CCP critical and alert limits were set, defined as follows:

- critical limit - a set point that once exceeded the treatment process is taken to be out of control, which may result in a non-compliant product and action must be taken to remedy the situation
- alert limit - a warning allowing an opportunity to take appropriate action to avert the breach of the critical limit.

Table 8 Cloncurry Operational Controls

Preventive measure	What is the operational monitoring parameter?	How is it monitored?	Where is it monitored?	When is it monitored?	Who is responsible?	Target value for optimal performance	Is it a Critical Control Point?	Early warning limit for loss of control	Critical limit for unacceptable public health risk (if applicable)	Procedure
Alternate supply	Turbidity	Grab sample	WTP intake	Daily	Operator	<30 NTU	No	n/a	n/a	Raw water extraction SOP
Potassium permanganate dosing	Manganese	Grab sample	Filter out	Daily	Operator	<0.05 mg/L	Yes	>0.1 mg/L	>0.5 mg/L	CCP procedure
Coagulation	Floc formation	- Jar test - Visual	Clarifier	Daily	Operator	Good floc formation	No	n/a	n/a	n/a
Filtration	Turbidity	Online / grab	Individual filters	Continuous / Daily	Operator	<0.2 NTU	Yes	>0.3 NTU	>0.5 NTU	CCP Procedure
Disinfection	Chlorine	Online / grab	CWT	Continuous / Daily	Operator	2.0-2.5 mg/L	Yes	<1.5 or >3.0 mg/L	<1.0 or >3.5 mg/L	CCP Procedure
Chlorine residual	Chlorine	Grab sample	Reticulation	Daily	Operator	>0.5 mg/L	No	n/a	n/a	n/a

6.1.2. Proposed Preventive Measures

Proposed preventive measures are included in the *Improvement Plan 2017* (supporting document) along with timeframes and responsibilities for their implementation.

6.1.3. Operation and Maintenance Procedures

Criteria

The Plan must contain, for each existing preventive measure identified in the risk assessment as a measure for achieving the documented residual risk, a list of the documented operation and maintenance (or other) procedures that are required to ensure the integrity of the measures, including:

- title
- date last revised
- the process used for maintaining the documented procedures
- the process for implementing the procedures.

Operational procedures formalise the activities that are essential to ensure the provision of consistently good quality water. Detailed procedures are required for the operation of all processes and activities (both on-going and periodic), including preventive measures, operational monitoring and verification procedures, and maintenance requirements.

Operation and maintenance procedures for CSC are mainly managed through the Cloncurry WTP Operations and Maintenance Manual (O&M Manual). The O&M Manual was developed in 2014 as a result of the WTP upgrade, superseding the old O&M Manual. The Manual will be revised as required to ensure its accuracy and currency, that is if major changes occur.

It is the responsibility of the Water and Sewerage Specialist to ensure that the procedures are understood and implemented by operational staff. The Specialist does site inspections to check that procedures are being followed and to identify any emerging issues. Staff members are trained in procedures relevant to their role through induction and on the job training.

Table 9 lists the set of procedures which are in place to reduce risks.

Table 9 List of Procedures

SOP Reference	Procedure	Date revised
W001	Towns Pumps – Manual Operation	Aug 2014
W002	Flood Harvest Pumps – Manual Operation	Aug 2014
W003	Changing Intakes	Aug 2014
W004	Dam Inspections and Maintenance	Aug 2014
W005a	Pot Perm Make Up	Aug 2014
W005b	Pot Perm Dosing Pump	Aug 2014
W006a	Coagulant Make Up	Aug 2014
W006b	Coagulant Dosing Pump	Aug 2014
W007a	Soda Ash Make Up	Aug 2014
W007b	Soda Ash Dosing Pump	Aug 2014
W008a	Poly Make Up	Aug 2014
W008b	Poly Dosing Pump	Aug 2014
W009	Cleaning Vacuum Chamber Probes	Aug 2014
W010	Cleaning Filters	Aug 2014
W011	Manual Filter Backwash	Aug 2014

SOP Reference	Procedure	Date revised
W012	Generator Operation	Aug 2014
W013	Chlorine Changeover	Aug 2014
W014	Sample Analysis – pH, Temperature, Turbidity	Aug 2014
W015	Sample Analysis – Chlorine	Aug 2014
W016	Sample Analysis – Iron	Aug 2014
W017	Sample Analysis – Manganese	Aug 2014
W018	Sample Analysis – Jar Test	Aug 2014
O&M Tasks	Appendix F of O&M Manual	Aug 2014
CCP1	CCP for Manganese Control	May 2017
CCP2	CCP for Filtration	May 2017
CCP3	CCP for Disinfection	May 2017
SOP	Raw Water Extraction Framework	May 2017

During the DWQMP review 2017, it was agreed that a SOP document list/register, based on process control steps, will be compiled to identify if any key procedure needs to be developed and/or revised, for example, the PAC dosing procedure needs to be developed. This has been included in the *Improvement Plan 2017*.

6.1.4. Materials and Chemicals

The selection of materials and chemicals used in water systems is an important consideration as they have the potential to adversely affect drinking water quality.

The chemicals used at the WTP are mentioned on the treatment schematic. Generally, at least two quotations are sought from companies well known in dealing with chemicals (e.g. Nalco) and the chemical procured based on best price.

Procedures exist for handling the chemicals including refilling, calculating dose rates, maintenance of dose pumps and person responsible for these tasks.

However, a procedure to ensure chemical quality is maintained, for example, obtaining the certificate of analysis (quality assurance) from the supplier, needs to be developed (part of the Improvement Plan).

6.2. Management of Incidents and Emergencies

Criteria

The process for managing drinking water incidents and emergencies must be described in the Plan, including:

- incidents and emergencies
- the level of emergency (for example, green, amber, red or level 1, 2)
- summary of action(s) taken for each level including emergency contacts
- internal and external communication processes and protocols including those with other key stakeholders that are actively involved
- responsible positions.

When multiple providers are involved in providing drinking water, the Plan must explain how incidents and emergencies are managed between the entities.

The process for managing drinking water incidents and emergencies is described in the Drinking Water Incident and Emergency Response Plan DW IERP (May 2016), supporting document of this DWQMP.

The water operators have been made aware of the water quality incident response protocols including implementing CCPs and reporting processes.

Verification monitoring data is reviewed by CSC as soon as possible. Where water quality does not meet the water quality criteria, investigations are undertaken to find the cause of the problem and rectify it. Resamples are also undertaken.

The incidents are reported to the regulator within 3 hours of becoming aware and appropriate reporting forms required by the regulator are filled and submitted.

The reporting protocol is included in the DW IERP - Communication Register (DEWS). The Environmental Health Technical Officer or the Water and Sewerage Specialist will report the incident to DEWS (levels 3-5 of the DW IERP, where an ADWG health-related parameter is exceeded).

The emergency contacts list is also included in the DW IERP. External stakeholders are contacted as per Table 3 in this DWQMP document (section 2.3).

6.3. Risk Management Improvement Plan

Criteria

The Plan, through the program, must describe the management measures proposed for each unacceptable residual risk. The process for providing the relevant information to the regulator must also be described. The description must include:

- measures, actions, strategies or processes
- priority for implementation
- timeframe
- other factors, for example, responsibilities between the provider and third parties and/or other stakeholders.

An Improvement Plan (excel register) has been developed to ensure continual improvement of the CSC drinking water supply system. The plan addresses the need to improve the quality of the system through improvements to the system that were identified as a result of the risk assessment or review, and improvements to the management of the system, identified by comparison of existing documents to requirements for the guidelines.

The Improvement Plan 2017 is a supporting document and will be updated based on internal and external audit results, plan reviews, non-conformances, incident and emergency feedback and future risk assessments.

It is the responsibility of the Director Works and Environmental Services to ensure that the Improvement Plan actions are implemented.

The progress against the Improvement Plan actions is discussed between the Environmental Health Technical Officer and the Water and Sewerage Specialist at regular intervals (3 monthly meetings), and recorded in the Improvement Plan register. The progress is also reported to DEWS through the DWQMP Annual Report.

6.4. Information Management

Criteria

The Plan must describe the information management, record keeping and reporting processes relevant to drinking water quality management, including how they address:

- accessibility
- currency.

Record retention requirements.

This DWQMP contains and identifies all documents and records that are required for the management of drinking water quality. All employees receive on-the-job training to ensure that they understand operating procedures, document management and record keeping requirements in accordance with this DWQMP.

The management of the records for water quality information is explained in the Monitoring Plan 2017 (supporting document). The Water and Sewerage Specialist is responsible for revision of procedures. Revisions are prompted if procedures are changed or need to be upgraded. The Specialist and Supervisor is responsible for ensuring operators are aware of and implement revised procedures.

The CSC's documents and records are stored on InfoXpert, which is accessible to all CSC employees with a log in password. All scanned water quality reports are stored on this database. The Council's Record Manager is responsible for record retention and currency (version control). Five year old data are archived through Council system.

The use of InfoXpert will be enhanced to improve document management to ensure that documents (e.g. DWQMP, procedures) are accessible and are reviewed regularly to ensure currency (part of Improvement Plan).

7. Operational and Verification Monitoring Programs

The monitoring plan outlines the parameters to be tested, the locations for monitoring and the frequency. Monitoring has been rationalised to ensure costs are achievable. The plan has been developed to ensure all areas of the water supply and distribution system are represented, including areas of short and long detention times and dead ends. The revised ADWG 2011 makes clear that monitoring for small remote supplies, the primary advice is that the emphasis should be on operational monitoring and barrier performance, not solely the verification of water quality. The ADWG also states that short term evaluation performance approach is applied, that is, the response is more important than the detection.

7.1. Operational Monitoring

Criteria

The Plan must contain details of the operational monitoring program, including:

- a link to the process step or operational function
- the parameter being tested
- location of monitoring
- frequency
- summary of how excursions are managed and/or corrective action is taken.

The Plan must describe why the operational monitoring program is appropriate to confirm and maintain the effective operation of the existing preventive measures.

Operational monitoring includes the planned sequence of measurements and observations to assess and confirm the performance of preventive measures. Measurements are of operational parameters that will indicate whether processes are functioning effectively.

The *Monitoring Plan* (2017) is a supporting document of the DWQMP that specifies the operational monitoring that is required to manage the drinking water supply system.

7.2. Corrective Action

Procedures are essential for immediate corrective action required to re-establish process control following failure to meet target criteria or critical limits. The procedures should include instructions on required adjustments, process control changes and additional monitoring. Responsibilities and authorities, including communication and notification requirements, should be clearly identified.

Corrective actions for non-conformances with CCP alert and critical limits are described in the CCP procedures present in the Monitoring Plan (2017). Corrective actions for non-CCP operational monitoring are detailed in relevant operational procedures.

7.3. Verification Monitoring

Criteria

The Plan must contain details of the verification monitoring program including:

- the parameter being tested
- location of monitoring
- frequency
- summary of how excursions are managed and/or corrective action is taken.

The Plan must also describe why the verification monitoring program is appropriate to confirm that the

drinking water complies with the water quality criteria for drinking water (including the rationale for the choice of the parameters).

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'. Verification incorporates monitoring drinking water quality as well as assessment of consumer satisfaction.

Drinking water quality monitoring is a wide-ranging assessment of the quality of water as supplied to the consumer. It includes regular sampling and testing to assess whether water quality is complying with guideline values, any regulatory requirements or agreed levels of service.

Under the *Water Supply (Safety and Reliability) Act 2008* mandatory monitoring began on 1 January 2009. In addition, the *Public Health Act 2005* and *Public Health Regulation 2005* has mandatory monitoring requirements. Monitoring must be undertaken for *Escherichia coli* in the reticulation system, at the frequency specified by Queensland Health in the *Public Health Regulation 2005*. Schedule 3A of the *Public Health Regulation* outlines the testing requirements.

The *Monitoring Plan* (2017) is a supporting document of the DWQMP that specifies the verification monitoring that is required to manage the drinking water supply system.

Monitoring of consumer comments and complaints can provide valuable information on potential problems that may not have been identified by performance monitoring of the water supply system. Consumer satisfaction with drinking water quality is largely based on a judgment that the aesthetic quality of tap water is 'good', which usually means that it is colourless, free from suspended solids and has no unpleasant taste or odour.

Complaints to CSC are recorded on a Service Request Form with a Document Identification number, details of the person making the complaint and details of the complaint including the location. These are saved and filed by year on the Council InfoXpert database. A summary of recent past complaints is present in the *Drinking Water System Analysis* (2017).

8. References

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