Drinking Water Management System

Overall Manual

Current as of May 2019

Executive Summary

Background

Implementation of a DWMS is crucial to fulfil Kyogle Council's (KC) obligations under the NSW Public Health Act 2010 and the Public Health Regulation 2012. The Public Health Act 2010 sets out the requirement for drinking water suppliers to develop and adhere to a quality assurance program also known as a drinking water management system, consistent with the Australian Drinking Water Guidelines 2011 (ADWG) (NHMRC, NRMMC, 2011).

Document Structure

This Manual is divided into 12 sections corresponding to the 12 ADWG Elements, such that each section explains or references how Council addresses the requirement of the ADWG Framework for Drinking Water Quality Management. Individual supply DWMS Subplans are included as Appendices.

Overall DWMS Manual

The Overall DWMS Manual for KC contains or references the overarching ADWG Elements common to the different drinking water schemes. The ADWG specifies 12 Elements that should be documented and implemented to form a comprehensive DWMS.

Supply Specific DWMS Subplans

Supply specific DWMS Subplans are available for each of the drinking water supplies, as Appendices to the Overall Manual, and they form part of the overall DWMS. The individual DWMS Subplans contain supply specific information to manage the risks to that particular water scheme. The individual supply DWMS Subplans include:

- Kyogle Scheme DWMS Subplan
- Bonalbo Scheme DWMS Subplan
- Woodenbong / Muli Muli Scheme DWMS Subplan

Critical Control Points

Critical control points (CCPs) have been established for the supply schemes, as relevant, and are included in Appendix D.

Drinking Water Quality Incidents

Drinking water quality incidents are managed through the Drinking Water Quality Incident Reporting and Response Protocols (separate supporting document, discussed in Section 6).

Improvement Plan

An improvement plan forms part of the DWMS and is available as an Excel spreadsheet (separate supporting document).

Document Review

This Manual is reviewed internally at least on an annual basis when the DWMS Annual Report is prepared, or earlier upon significant system change.

Contents

Appendices

Figures

Tables

Document History and Status

Revision	Date	Reviewed by	Initials	Details
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0.2	23 Nov 12	G Kennet	GK	Kyogle Council Comments
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	23 May 19	Shane Noon	SN	Reviewed and cleared by Shane.
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Introduction

Overview

Kyogle Council (KC) has developed and is implementing a Drinking Water Management System (DWMS) to ensure consistent supply of safe, quality drinking water to its customers through a risk-based management approach.

This document is Council's DWMS Overall Manual which contains and/or references the relevant processes, procedures and systems used for the management of drinking water quality for all Council supplies to ensure safety quality of drinking water to its customers. It is structured on the 12 Elements of the Australian Drinking Water Guidelines (ADWG 2011).

This Manual, and the supporting documents referenced, demonstrate Council's compliance with the requirement of the *Public Health Act 2010* to develop a Quality Assurance Plan in line with the Framework for Drinking Water Quality Management in the ADWG.

Supply specific DWMS Subplans are available for each of the drinking water supplies as Appendices to the Manual, and they form part of the overall DWMS. The individual DWMS Subplans contain system specific information to manage the risks to that particular supply scheme.

Objective

This document provides the overall approach which is used by KC for the management of a safe drinking water product. The DWMS and its supporting documentation are living documents, which are reviewed and updated accordingly, when new processes or changes are introduced and at least annually (refer to Section 12.1) when the DWMS Annual Report is prepared.

DWMS Documents

The key documents that together form the DWMS are as follows:

- Drinking Water Quality Policy (May 2012)
- DWMS Overall Manual
- DWMS Subplans (Appendix A-C)
- Critical Control Points (Appendix D)
- Water quality risk assessment register (separate Excel document)
- Data recording spreadsheets (separate Excel spreadsheets)
- Various standard operating procedures (SOPs)
- Drinking water quality incident reporting and response protocols (separate document)
- Improvement Plan (separate Excel document)

DWMS Purpose

The *Public Health Act 2010* (NSW) ('the Act') requires drinking water suppliers to establish, and adhere to, a 'quality assurance program' (QAP) that complies with the Public Health Regulation 2012 (NSW) ('the Regulation'). The Regulation requires water suppliers to implement a QAP consistent with the *Framework for Management of Drinking Water Quality* in the *Australian Drinking Water Guidelines (ADWG) 2011* (NHMRC/NRMMC, 2011). The QAP is referred to as a Drinking Water Management System ('DWMS') for water utilities in NSW.

As stated in the *Australian Drinking Water Guidelines* (NHMRC/NRMMC, 2011):

"The most effective means of assuring drinking water quality and the protection of public health is through adoption of a preventive management approach that encompasses all steps in water production from catchment to consumer."

This is the purpose of KC's DWMS.

Scope

KC's DWMS applies to the operation and management of the following drinking water schemes:

- Kyogle
- Bonalbo
- Woodenbong / Muli Muli

Document Navigation

Within each section of this Manual corresponding to the ADWG Elements, the specific requirements of the relevant sub-component within an Element are documented. The purpose of this is to clearly communicate Council's obligations under the ADWG Framework.

Following the statement of requirements is text that describes what activities and processes Council currently has in place to address these requirements. Where Council's current activities do not fully address the requirements of the Framework, further actions to meet the requirements of the Framework are detailed in the Improvement Plan.

The DWMS is not static. It is a "living document" which is iteratively updated as required, and as new risks are identified, and other risks mitigated or eliminated.

DWMS Responsibilities and Authorities

KC employees are encouraged to participate in decisions that affect their jobs and areas of responsibility. This fosters a sense of ownership for decisions and their consequences. The main responsibilities and authorities related to the DWMS are listed in Table 1 below.

Table 1 Summary of DWMS Responsibilities and Authorities

Role	Responsibility
Councillors	• Overall responsibility for management of drinking water quality, but this responsibility is delegated to the relevant directors and supervisory staff.
Director Assets and Infrastructure	• Maintaining oversight of the DWMS • Supporting and promoting continual improvement of the DWMS • Evaluating the need for change • Reviewing and authorising the DWMS document
Urban Services Manager	• Coordinate implementation and continual improvement of the DWMS • Evaluating the need for change • Facilitate reviews, update and audits of the DWMS • Preparation of the DWMS Annual Report for submission to the PHU
Operators	• Implement the DWMS as relevant in accordance with documented procedures.
All Managers and Employees	All Managers and Employees are responsible for: • Understanding, implementing, maintaining and continuously improving the DWMS • Being aware of: o the Drinking Water Quality Policy o characteristics of the water supply system and preventive strategies in place throughout the system; o regulatory and legislative requirements; o roles and responsibilities of employees and departments; and o how their actions can impact on water quality and public health.

1. Element 1 – Commitment to Drinking Water Quality

1.1. Commitment

- Formulate a drinking water quality policy, endorsed by senior executives, to be implemented throughout the organisation.
- Ensure that the policy is visible and is communicated, understood and implemented by employees.

Kyogle Council has developed a Drinking Water Quality Policy that was adopted by Council in May 2012. The policy outlines Kyogle Council's commitment to managing its water supply effectively to provide a safe, high-quality drinking water that protects public health and consistently meets the NHMRC/NRMMC *Australian Drinking Water Guidelines*, and consumer and other regulatory requirements.

A copy of the policy is available on the Kyogle Council website (https://www.kyogle.nsw.gov.au/wp-content/uploads/2017/07/Drinking-Water-Quality-Policy.pdf). Staff are made aware of the policy through the website and during training and awareness of the DWMS ensuring that it is understood and implemented by relevant employees.

Table 2 identifies Kyogle Council's other planning documents that are relevant to the DWMS and contain relevant supporting information. These documents are available on the Kyogle Council's website.

Table 2 Kyogle Council's Planning Documents

Guideline	Planning Document	Details
NSW Water and Sewerage Strategic Business Planning Guidelines Planning and Reporting Guidelines for Local Government in NSW	Delivery Program 2012/2016 and Operational Plan 2012/2013 Community Strategic Plan Adopted Fees and Charges 2012/2013 Resourcing Strategy 2012-13 Long Term Financial Plan Workforce Management Strategy Asset Management Strategy Core Infrastructure Risk Management Plan Water Supply Asset Management Plan Plant and Emergency Equipment Asset Management Plan Stormwater and Flood Management Asset Management Plan	Documentation available on Kyogle Council's website
Integrated Water Cycle Management Framework and Guidelines NSW Office of Water	Integrated Water Cycle Management Evaluation Study and Strategy Plan	Dated August 2006 Documentation available on Kyogle Council's website

1.2. Regulatory and formal requirements

- Identify and document all relevant regulatory and formal requirements.
- Ensure responsibilities are understood and communicated to employees.
- Review requirements periodically to reflect any changes.

Kyogle Council is required to comply with a range of regulatory instruments and guidelines. Kyogle Council ensures compliance with regulation through the *Legislative Compliance Policy* (November 2007).

The regulatory and formal requirements related to the DWMS are listed in Table 3. The table is reviewed annually when the DWMS Annual Report is compiled and updated if required. Any changes are communicated to all relevant staff through memos or meetings (formal or informal).

Table 3 Regulatory and formal requirements

Regulatory or Formal Requirement	Relevance to Drinking Water Quality	Agency
NSW Legislation		
Local Land Services Act 2013	Natural resource management, from planning to operations, is to be undertaken at the catchment level. State-wide standards are to be applied. Local Strategic Plans are used to define key themes for each catchment, each with specific catchment and management targets.	Northern Tablelands Local Land Service
Environmental Planning and Assessment Act 1979	Requires that the environmental impacts of projects be studied at all stages on the basis of scale, location and performance. Under Part 3 of the Act, Local Environmental Plans (LEPs) are developed to establish what forms of development and land use are permissible and/or prohibited. LEPs ensure that drinking water quality is considered when assessing development applications. The Cootamundra LEP (2013) and the Gundagai LEP (2011) apply to all lands in Cootamundra-Gundagai Regional Council identified in the land application map.	NSW Department of Planning and Environment
Fluoridation of Public Water Supplies Act 1957 Regulation and Code of Practice	Requirements for testing and reporting where water supplies are fluoridated.	NSW Health
Local Government Act 1993	Local councils have the responsibility for the provision of water supply to consumers, in accordance to the NSW Best-Practice Management of Water Supply and Sewerage Guidelines.	NSW Government Division of Local Government
Local Government Act 1993	Requires licences for the construction or extension of regulated water treatment infrastructure. The act also requires Council to comply with directions from NSW Department of Primary Industry relating to water treatment works or emergency responses relating to public health.	NSW Department of Primary Industries
NSW Groundwater Quality Protection Policy 1998	Manages groundwater resources for sustainable economic, social and environmental uses, with a specific principle to protect town water supplies against contamination. A key recommendation is to develop wellhead protection plans.	DoI Water
Protection of the Environment (Operations) Act 1997	Requires licences for activities with potentially significant environmental impacts. Prosecution may be carried out under this act for any chemical leakage, spill, and disposal of wastes or similar.	NSW EPA

Regulatory or Formal Requirement	Relevance to Drinking Water Quality	Agency
Public Health Act 2010 Public Health Regulation 2012	Requires all water authorities to develop Drinking Water Management Systems (DWMS). Bestows certain powers on NSW Health with respect to provision of safe drinking water, including ability to enter treatment facilities, order mandatory testing or obtain information about the drinking water and powers to close a water supply. Council is required to issue public advice regarding the water supply when directed by the Chief Health Officer of Ministry of Health.	NSW Health
Water Management Act 2000	Provides the basis for water planning, the allocation of water resources and water access entitlements. The "Water Sharing Plan for the Murrumbidgee Regulated River Water Source (2003)" governs the use of groundwater, including rules for protecting the environment, extractions, managing licence holders' water accounts, and water trading in the plan area.	DoI Water
Work, Health & Safety Act 2011	Specifies conditions for storage and handling of chemicals on-site at water treatment plants.	WorkCover Authority of NSW
National and State Guidelines and Programs		
Australian Drinking Water Guidelines 2011	Ensures the accountability of drinking water managers and operators and health authorities and auditors for the supply of safe, good quality drinking water to consumers.	NSW Health National Health and Medical Research Council (NHMRC)
NSW Best-Practice Management of Water Supply and Sewerage Guidelines 2007	Provides for appropriate, affordable and cost-effective services to meet community needs while protecting public health and the environment and making best use of regional resources. Council has a "Delivery Program", "Operational Plan" and a Financial Plan and associated asset management plans. Council participates in NSW DoI Water Annual Performance reporting program. Council has an Integrated Water Cycle Management (IWCM) strategy (Oct 2013).	DoI Water
NSW Health Drinking Water Monitoring Program 2005	NSW Health provides analysis of drinking water samples for water utilities, providing an independent analysis of water at point of supply.	NSW Health
National Partnership Agreement on Water for the Future	The COAG Strategy on Water and Wastewater Services in Remote Communities in New South Wales aims to provide water infrastructure and build the capacity of the Council to improve the management and overall security of water in remote communities.	Australian Government DoI Water
Plumbing Code of Australia	Specifications for plumbing in drinking water systems, to be complied with by administrators, plumbing Licensees, developers and property owners/occupiers.	Office of Fair Trading
Other Requirements		
Circular LWU 18	Provides minimum requirements to ensure potable water supply is safe from contamination. Includes requirements for disinfection, chlorine residual and reservoir integrity.	DoI Water
Joint Water Supply Agreement with Tenterfield Shire Council (dated Sept 2012)	Joint water supply agreement between TSC and KC for the Urbenville WTP and supply of treated water to the communities of Urbenville (TSC) and Woodenbong/Muli Muli (KC).	KC and TSC

Regulatory or Formal Requirement	Relevance to Drinking Water Quality	Agency
Urbenville Muli Muli Woodenbong Water Supply Joint Water Supply Agreement.	KC distributes water supplied by TSC (Urbenville WTP) to the communities of Woodenbong and Muli Muli under the agreement with the Department of Primary Industries Water (DOI Water).	KC and DOI Water

Employees are made aware of the legal and other requirements pertaining to the DWMS through general DWMS training activities.

1.3. Engaging stakeholders

- Identify all stakeholders who could affect, or be affected by, decisions or activities of the drinking water supplier.
- Develop appropriate mechanisms and documentation for stakeholder commitment and involvement.
- Regularly update the list of relevant agencies.

Many 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 the DWMS, such as monitoring and reporting requirements, emergency response plans and communication strategies. This means establishing two-way communication paths with state government departments, Kyogle Council customers, contractors and other local water utilities.

Key stakeholders involved in the provision of a safe reliable drinking water supply include:

- NSW Health (PHU and the Water Unit)
- DOI Water
- Tenterfield Shire Council (for Woodenbong/Muli Muli supply)
- Aboriginal Land Council (for Muli Muli)

NSW Health Water Unit, PHU and DoI Water participated in the development of the original DWMS and are invited to participate at periodic risk review workshops, as relevant.

Contact details for key external stakeholders involved in the provision of a safe reliable drinking water supply have been identified and are listed in Table 4.

Table 4 is reviewed annually when the DWMS Annual Report is compiled and updated if required.

Table 4 Key External Stakeholders for DWMS

Name	Organisation / Position	Responsibilities	Communication mechanism	Contact Details
Water Unit	NSW Health	Overall regulatory oversight and advice	- Telephone - Emails	P: 02 9391 9030 WaterQual@health.nsw.gov.au
Anthony Kohlenberg / Paul Williamson	North Coast Area Public Health Unit. Senior Environmental Health Officer / Environmental Health Officer	Provides ongoing advice, support and response to water quality matters. Local regulatory oversight. NSW Drinking Water Monitoring Program. Review and advise on verification monitoring results. Provide technical support on health issues. Participate in four monthly meetings, as available.	- Telephone - Emails - Meetings - Invited to workshops	M: 0414 569 526 (Tony) Tony.kohlenberg@health.nsw.gov.au M: 0414 569 516 (Paul) Paul.Williamson@health.nsw.gov.au
Glenn George	DoI Water, Regional Manager Urban Water	Technical and strategic advice. Assistance on project development. W&S funding programs. Regulatory oversight.	- Telephone - Emails - Invited to workshops	P: 02 6653 0127 M: 0411 449 745 glenn.george@dpi.nsw.gov.au
Geoff Snell / Terry Call	DoI Water. Senior Project Officer / Inspector	Inspection of water supply systems. Water quality and treatment advice. Local regulatory oversight.	- Telephone - Emails - Meetings - Invited to workshops	M: 0417 470 250 (Geoff) geoff.snell@industry.nsw.gov.au M: 0419 620 990 (Terry) terry.call@dpi.nsw.gov.au
Gillian Marchant	Tenterfield Shire Council Manager Water and Waste	Manages Tenterfield Shire Council Water and Waste. Oversees the Urbenville WTP.	- Telephone - Emails - Meetings - Invited to workshops	P: (02) 6736 6000 M: 0427248273 g.marchant@tenterfield.nsw.gov.au
Craig Craigie	NSW Aboriginal Land Council	Acts as an advisor to, and negotiates with key stakeholders (Council, DoI, PHU) regarding preservation of Aboriginal land rights, as required.	- Telephone - Invited to meetings, as relevant	P: (02) 6659 1206 M: 0418 47 323

Name	Organisation / Position	Responsibilities	Communication mechanism	Contact Details
Mathew Green	Aboriginal Land Council (Muli Muli), CEO	First point of contact for all community issues. Advise Kyogle Council when an issue arises. Obtain copy of recent issues from Kyogle Council, prior to four monthly meetings. Participate in four monthly review meetings Meet with DoI Water to discuss issues and actions.	- Telephone - Meetings	P: (02) 6635 1487

2. Element 2 – Assessment of Supply Systems

2.1. Water supply system analysis

- Assemble a team with appropriate knowledge and expertise.
- Construct a flow diagram of the water supply system from catchment to consumer.
- Assemble pertinent information and document key characteristics of the water supply system to be considered.

2.1.1. System Assessment Team

Council's core water quality Risk Assessment Team consists of:

- Director Assets and Infrastructure
- Urban Services Manager
- Water and Sewer Overseer
- Water Operators

The core team is supported by NSW Health PHU and DoI Water, as well as TSC and independent consultants, as required.

Council has hosted drinking water quality risk assessment workshops to review its water supply systems, including the development of the original DWMS.

At these workshops the team reviews the process flow diagrams, water supply characteristics and risks.

The risk workshop participants and risk summary for the original workshop were captured as a report – *Risk Assessment Workshop Report* (*Viridis Consultants, 2012*).

The most recent DWMS review workshops were undertaken in October 2018 (Bonalbo and Woondebong/Muli Muli) and April 2019 (Kyogle), facilitated by Viridis Consultants P/L. The workshop participants and risk summary are included in the *Water Quality Risk Assessment Register* (Excel document).

2.1.2. Summary of Drinking Water Schemes

The assessment of the drinking water supply system is an essential prerequisite for subsequent steps in which effective strategies for prevention and control of hazards are planned and implemented. This includes understanding the characteristics of the drinking water system, what hazards may arise, how these hazards create risks, and the processes and practices that affect drinking water quality. The drinking water supply system is defined as everything from the point of collection of water to the consumer and can include:

- catchments, including groundwater systems
- source waters
- storage reservoirs and intakes
- treatment systems
- service reservoirs and distribution systems
- consumers

Water quality can be affected at each of these points, and because they are all interrelated, integrated management is essential.

Kyogle Council is located 758 km north of Sydney, 32 km north of Casino, 184 km south of Brisbane and 60 metres above sea level on the Richmond River at the base of Fairy Mount. The Council area is 3,589 square kilometres and is surrounded by the NSW / Queensland border to the north, Tenterfield Shire to the West, Clarence Valley on the south, Richmond Valley, Lismore and Tween on the east.

Kyogle is the largest population centre in the local government rea. Other villages include Woodenbong, Wiangaree, Bonalbo, Old Bonalbo, Tabulam, Mallanganee, Mummulgum, Cawongla, Homeleigh, Wadeville and Barkersvale. Urbenville is a village located in the adjoining Tenterfield Shire, which provides facilities for Kyogle Council residents in that area. The Kyogle Local Government area population, as determined from the 2016 Census, is 8,940 (Census 2016).

Kyogle Council operates three water supplies supplying around four thousand people in the township of Kyogle and the villages of Bonalbo and Woodenbong, and the aboriginal community of Muli Muli. Figure 1 provides the LGA area for Kyogle Council.

Drinking water for the Kyogle supply is sourced from the Richmond River, which is extracted from off stream storage. Water is extracted directly from the Richmond River as a backup when off stream storage is unavailable.

Bonalbo drinking water is sourced from groundwater from a bore located in Bonalbo and surface water from Peakcock Creek. Water from both these sources is stored in the off-creek storage dam and raw water is extracted from the dam to the Bonalbo WTP.

Drinking water for the Woodenbong and Muli Muli supply is provided by Tenterfield Shire Council, with bulk water being supplied from the Urbenville WTP. Drinking water is sourced from the Tooloom Creek.

Figure 1 Map showing Council's LGA

Table 5 provides a summary of each of the water supply systems. Detailed description of each supply, including the process flow diagrams, is present in the respective DWMS Subplan (Appendices A-C)

The process flow diagrams are reviewed annually when the DWMS Annual Report is compiled and updated, as required.

Table 5 Summary of Council's Drinking Water Schemes

Supply Scheme	Source Water	Treatment
Kyogle	Surface Water, Richmond River	Alum for coagulation, PAC for removing particulates/odour and taste compounds, clarification and pressure/gravity pressure for particulate removal, caustic for pH adjustment, chlorine (sodium hypochlorite) dosing and fluoride dosing
Bonalbo	Surface and groundwater, Peakcock Creek, groundwater bore	Potassium permanganate for iron removal, ferric chloride for coagulation, dissolved air flotation (DAF) filtration for particulate removal, chlorine gas for disinfection, caustic soda for pH adjustment and fluoride dosing.
Woodenbong / Muli Muli	Bulk treated water from Tenterfield Shire Council – Urbenville WTP.	At the Urbenville WTP - Caustic soda for pH adjustment, potassium permanganate for iron removal, alum for coagulation, DAF filtration for particulate removal, caustic for pH adjustment, chlorine (sodium hypochlorite) dosing and fluoride dosing.

2.2. Assessment of the water quality data

- Assemble historical data from source waters, treatment plants and finished water supplied to consumers (over time and following specific events).
- List and examine exceedances.
- Assess data using tools such as control charts and trends analysis to identify trends and potential problems.

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.

Long term historical data was analysed prior to the original risk assessment workshop when the DWMS was first developed. This was captured in the *Risk Assessment Workshop Report* (*Viridis Consultants, 2012*).

Before a comprehensive review of the risk register, long-term data analysis is undertaken by Council. The most recent evaluation was done as part of the 2018 DWMS review workshop. This was captured in a Report – *Kyogle Council Water Quality Data Analysis (Viridis Consultants, 2018)*, and was used during the review of the Water Quality Risk Assessment Register. The evaluation examined exceedances and assessed data using scatterplots and box plots.

Council undertakes ongoing assessment of water quality (operational and verification) as part of internal and external reporting (e.g. the preparation of the DWMS Annual Report, refer to section 10.2).

2.3. Hazard Identification and Risk Assessment

- Define the approach and methodology to be used for hazard identification and risk assessment.
- Identify and document hazards, sources and hazardous events for each component of the water supply system.
- Estimate the level of risk for each identified hazard or hazardous event.
- Evaluate the major sources of uncertainty associated with each hazard and hazardous event and consider actions to reduce uncertainty.
- Determine significant risks and document priorities for risk management.
- Periodically review and update the hazard identification and risk assessment to incorporate any changes.

The risk assessment approach and methodology are included in the Risk Register (separate supporting document, Excel spreadsheet), including Council's Risk Assessment Matrix.

Both maximum and residual risks are assessed within the system.

Maximum risk:	risks that is present without preventive measures and controls
Residual risks:	risks that is present after implementing the system's preventive measures and controls
Preventive measures and controls:	are those actions, activities and processes used to prevent the identified hazards or reduce them to acceptable levels

The risk assessment results (hazards, hazardous events, risk evaluation and uncertainty) are captured in the Risk Assessment Register, for all schemes.

As part of the 2018/19 DWMS review, a comprehensive review and update of the risk register was undertaken.

The risk assessment results are captured in the Risk Register (Excel spreadsheet, supporting document).

The risk assessment is reviewed in detail periodically (every 4 years), or as advised by the PHU. A general review is undertaken annually when the DWMS Annual Report is prepared (e.g. unacceptable residual risks and/or key selected process steps), or as required (e.g. resulting from a water quality incident).

3. Element 3 – Preventive Measures

3.1. Preventative Measures and multiple barriers

- Identify existing preventive measures from catchment to consumer for each significant hazard or hazardous event and estimate the residual risk.
- Evaluate alternative or additional preventive measures where improvement is required.

An important aspect of a drinking water quality management system is a multiple barrier approach to prevent contaminants entering the potable water supply. This DWMS covers the sourcing, treatment, disinfection and distribution of potable water. Council's preventive measures are included in the Risk Register and have been documented alongside the significant risks that they address. Improvements or gaps identified in the workshops are noted and are included in the Improvement Plan.

3.2. Critical Control Points

- Assess preventive measures from catchment to consumer to identify critical control points.
- Establish mechanisms for operational control.
- Document the critical control points, critical limits and target criteria.

In quality assurance systems, monitoring plays a key role in risk management, but the focus is shifted from reliance on end product compliance testing and verification to targeted operational monitoring and processes.

A critical control point (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 critical control point 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.
- Failure of a critical limit needs to be reported to the PHU

Three different limits have been set for each CCP within Council's drinking water supply systems:

- **Target Level:** representing day to day operational limits and procedures. This is what is aimed to be achieved
- **Alert Level:** deviation to this level indicates a trend towards loss of control and corrective actions should be immediately taken to resolve the problem and restore control to the drinking water supply system
- **Critical Limit:** deviation from the critical limit indicates loss of control and the potential of unacceptable health risks. If the critical limit is exceeded, corrective actions should be immediately activated, and the PHU notified immediately.

CCPs were reviewed in October 2018 (facilitated by Viridis Consultants) with input from NSW Health PHU and are documented in Appendix D.

When CCPs are revised, these are communicated to operators through the updated DWMS Manual. Appendix D includes current CCP procedures.

4. Element 4 – Operational Procedures and Process Control

4.1. Operational Procedures

- Identify procedures required for processes and activities from catchment to consumer.
- Document all procedures and compile into an operations manual.

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 ongoing and periodic), including preventive measures, operational monitoring and verification procedures, and maintenance requirements.

Table 6 lists the existing procedures that relate to this DWMS. Formalised procedures for all operations relating to the Kyogle Council supply system are currently in the process of being developed.

Table 6 List of SOPs currently documented

Title	Status	Location	Date Last Updated
Calibration Procedure	Available	Council's Shared Network Drive	September 2015
Chemical Control	Available	Council's Shared Network Drive	September 2015
Coagulation Optimisation	Available	Council's Shared Network Drive	September 2015
Data Capture	Available	Council's Shared Network Drive	September 2015
Hygiene Disinfection	Available	Council's Shared Network Drive	September 2015
Operational and Communication Protocol	Available	Council's Shared Network Drive	September 2015

In addition, SOPs for CCPs are documented and available in Appendix D.

4.2. Operational Monitoring

- Develop monitoring protocols for operational performance of the water supply system, including the selection of operational parameters and criteria, and the routine analysis of results.
- Document monitoring protocols into an operational monitoring plan.

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.

Operational monitoring of water quality is undertaken both manually and via online instruments, where available, in the water supply systems.

The operational monitoring conducted at each supply scheme is discussed in the respective Subplans (Appendices A-C).

4.3. Corrective Actions

- Establish and document procedures for corrective action to control excursions in operational parameters.
- Establish rapid communication systems to deal with unexpected events.

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 required to control excursions for operational parameters are part of operational monitoring and are discussed in the DWMS Subplans for each scheme.

The CCP procedures also include corrective actions.

A number of operational procedures are available for Council (discussed in Section 4.1), which include corrective actions relevant to those procedures.

Communication protocols for incidents and events are explained in in Section 6.2.

4.4. Equipment Capability and Maintenance

- Ensure that equipment performs adequately and provides sufficient flexibility and process control.
- Establish a program for regular inspection and maintenance of all equipment, including monitoring equipment.

The capability of equipment is an important consideration in maintaining process control. Equipment and infrastructure in a drinking water supply system need to be adequately designed and of sufficient capacity (size, volume, detention times) to handle all flow rates (peak and otherwise) without limiting performance.

Council is currently developing a full asset management plan, which will detail the integration of all pre-existing asset management systems into a single system (Authority). Authority will be utilised to maintain a comprehensive inventory of equipment including details such as maintenance history to ensure equipment is functioning optimally and within the bounds it was designed for. It also details the age of infrastructure, last service date, maintenance frequency, who is responsible for maintaining each piece of equipment and any recorded failures.

Equipment calibration is undertaken for testing equipment by Council staff and also externally every 12 months (or earlier as required). Council utilise a calibration SOP.

4.5. Materials and Chemicals

- Ensure that only approved materials and chemicals are used.
- Establish documented procedures for evaluating chemicals, materials and suppliers.

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. Council has preferred suppliers for the purchasing of products. Councils' supplier contracts include chemical quality compliance requirements.

Chemical deliveries are attended by operators to reduce risk of delivery error and a certificate of analysis is obtained.

An SOP on chemical control is utilised.

The summary of chemicals used at each supply site is included in the respective DWMS Subplans.

Council requires conformance with the following plumbing codes, regulations and standards, which guide product selection and installation:

- AS/NZS 3500.1:2003 Plumbing and drainage – Water services
- AUS-SPEC 0071 Water Supply – Reticulation and pump stations (Design)
- AUS-SPEC 1341 Water – reticulation and pump stations (Construction)

5. Element 5 – Verification of Drinking Water Quality

5.1. Drinking water quality monitoring

- Determine the characteristics to be monitored in the distribution system and in water as supplied to the consumer.
- Establish and document a sampling plan for each characteristic, including the location and frequency of sampling.
- Ensure monitoring data is representative and reliable.

Drinking water quality monitoring is a wide-ranging assessment of the quality of water in the distribution system and importantly, 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.

Kyogle Council participates in the NSW Health Drinking Water Monitoring Program, the monitoring locations are identified in the respective DWMS Subplans. The results from the NSW Health monitoring program are recorded on the NSW Health Drinking Water Database, which Kyogle Council accesses and reviews.

The weekly microbiological samples are collected by Richmond Water Laboratories (RWL) on Councils behalf and tested by both the RWL and Lismore Pathology Laboratory operated by the North Coast Area Health Service. Results are sent by e-mail to staff at Kyogle Council, Tenterfield Shire Council, and NSW Health as soon as they are available, and interim results are distributed from the Pathology Laboratory. Review of the results is undertaken by the Urban Services Manager:

- after the result of each microbiological sample is reported
- annually for trends and water quality implications as part of the DWMS Annual Report

The verification monitoring locations are designed to be representative of the system and are reviewed annually as part of the DWMS review.

Further details on the verification monitoring program, including frequency and locations are discussed in the respective DWMS Subplans.

The verification monitoring results are recorded in the NSW Health Database, which can be accessed at https://www.webapp.health.nsw.gov.au/.

When needed, new username/password is requested by contacting the NSW Health Water Unit.

5.2. Consumer Satisfaction

- Establish a consumer complaint and response program, including appropriate training of employees

Customer complaints (or compliments) are received through Council's Customer Service Centre either in person, writing (email) or by telephone. Customer complaints are managed through Authority software and the relevant Team Leader is notified, who delegates responsibilities as appropriate. Generally operational staff will go out to investigate, take water quality samples and clean mains where appropriate and/or check water treatment operation.

Customer complaints are reported externally through the NSW Water Supply and Sewerage – NSW Benchmarking Report (DoI Water) and the DWMS Annual Report.

5.3. Short Term Evaluation of Results and Corrective Actions

- Establish procedures for the daily review of drinking water quality monitoring data and consumer satisfaction.
- Develop reporting mechanisms internally, and externally, where required.

Short-term performance evaluation entails the review of drinking water quality monitoring data and consumer satisfaction, to verify that the quality of water supplied to consumers conforms to guideline values. If the quality does not conform, then immediate corrective actions and/or incident and emergency responses are undertaken.

Operators review results daily against the water quality targets as part of their operations and undertake corrective actions where required (e.g. using relevant SOPs, as required).

The Urban Services Manager also reviews the water quality data on a regular basis (refer to Section 5.1).

Review of the results for the NSW Health Drinking Water Monitoring program is undertaken by the testing laboratory and any exceedance is notified by the laboratory to relevance KC staff and the local PHU.

Water quality incidents are managed as per Section 6. The communication and reporting lines are described in the drinking water quality incident response and reporting protocols (Section 6.2).

5.4. Corrective action

- Establish and document procedures for corrective action in response to non-conformance or consumer feedback.
- Establish rapid communication systems to deal with unexpected events.

If the short-term evaluation of drinking water quality monitoring data indicates non-conformance with guideline values or other requirements, an investigation is undertaken and, if necessary, a corrective action implemented as quickly as possible. Failure to take immediate or effective action may lead to the development of a more serious situation, which could require incident and emergency response protocols to be instituted. Implementation of corrective action could also be required due to operational monitoring to optimise the process.

Corrective actions for water quality incidents and events are managed as per Section 6.2.

6. Element 6 – Management of Incidents and Emergencies

6.1. Communication

- Define communication protocols with the involvement of relevant agencies and prepare a contact list of key people, agencies and businesses.
- Develop a public and media communications strategy

Considered and controlled responses to incidents or emergencies that can compromise the safety of water quality are essential for protecting public health, as well as maintaining consumer confidence and the organisation's reputation. Although preventive strategies are intended to prevent incidents and emergency situations from occurring, some events cannot be anticipated or controlled, or have such a low probability of occurring that providing preventive measures would be too costly. For such incidents, there must be an adaptive capability to respond constructively and efficiently.

Effective communication is vital in managing drinking water quality incidents (and emergencies). In the event of a drinking water quality incident, Council follows the communication protocols described in the drinking water quality incident response and reporting protocols (separate supporting document).

Council currently communicates water quality issues or changes to treatment processes to the public and media on their website and also through their Facebook page. Customers can also contact Council's Communications Officer via email or telephone for more information on water quality issues. Council implements a project specific communication plan when major works are scheduled.

There are also formal communication procedures specific to issues such as water restrictions, drought management and service levels.

Key immediate emergency contacts for drinking water incidents are maintained as part of the Disaster Management Plan (DISPLAN) to avoid duplication. The contact list includes details for emergency service, government stakeholders, media and vulnerable customers for e.g. schools, aged care, hospitals.

There are some home dialysis patients which are managed and maintained through the rates system.

6.2. Incident and Emergency Response Protocols

- Define potential incidents and emergencies and document procedures and response plans with the involvement of relevant agencies
- Train employees and regularly test emergency response plans
- Investigate any incidents or emergencies and revise protocols as necessary

The requirements for this component are addressed in the drinking water quality incident response and reporting protocols (separate supporting document), including incident de-briefs. Incident and emergency response protocols are regarded as a priority. These are largely based on the NSW Health Response Protocols.

Water quality incidents and emergencies are reported to the local PHU and DoI Water, as required. The need to issue (and withdraw) a boil water alert is assessed in consultation with the local PHU.

Management of emergencies is covered by Council's Local DISPLAN.

7. Element 7 – Employee Awareness and Training

7.1. Employee Awareness and Involvement

- Develop mechanisms and communication procedures to increase employee awareness of and participation in drinking water quality management

Council aims to provide an environment of equal opportunity in its workplace and is committed to the development of skilled, knowledgeable and dedicated staff.

An understanding of drinking water quality management is essential for empowering and motivating employees to make effective decisions. Employees responsibilities in relation to the DWMS is included in Table 1.

Employee participation in drinking water quality management is encouraged by Council. The water team meet regularly to discuss any issues e.g. toolbox meetings every morning for Kyogle and the overseer visits the Bonalbo and Woodenbong/Muli Muli operators every two weeks.

Employee awareness of DWMS is increased through regular contact by the local PHU and visits by the DoI Water inspector, as well as through internal/external reviews of the DWMS.

The most recent external review was facilitated by Viridis Consultants Pty Ltd in 2018/19, where staff involvement in DWMS awareness and implementation was undertaken.

7.2. Employee Training

- Ensure that employees, including contractors, maintain the appropriate experience and qualifications
- Identify training needs and ensure resources are available to support training programs
- Document training and maintain records of all employee training

Employees and contractors must be appropriately skilled and trained in the management and operation of water supply systems, as their actions can have a major impact on drinking water quality and public health.

All relevant staff receive ongoing on-the-job training in order to fulfil their role and additional training needs are identified and addressed during the annual performance appraisal. The annual appraisal includes:

- review of position description
- assessment of competencies
- review and revise training plan for the following year.

All water operators have a minimum qualification of Certificate III in Water Operations. Council's Human Resources team maintains records of all staff training including: licenses, ticket numbers and expiry dates. Examples of training undertaken by operators include:

- DoI Water training courses (i.e. WTP Processes – Part 1 and 2, Certificates 2 and 3)
- Construction Green Card
- Occupational Health and Safety Induction
- Fluoride training courses

Water staff are encouraged to participate at relevant water conferences and workshops to maintain awareness and knowledge on industry practices and advancements with water quality management.

Contractors used are mostly electricians. Contractors are selected based on their skills and knowledge in working on water supplies to ensure that the work undertaken does not adversely impact operations and water quality. Qualified contractors are hired to ensure no adverse effects on water quality.

8. Element 8 – Community Involvement and Awareness

8.1. Community Consultation

- Assess requirements for effective community involvement.
- Develop a comprehensive strategy for community consultation.

Decisions on drinking water quality made by a drinking water supplier and the relevant regulatory authorities must be aligned with the needs and expectations of consumers. Therefore, the community and appropriate industry sectors should be consulted and involved during decision-making processes.

Council has a comprehensive *Community Strategic Plan (July 2012-2025)*. In addition, Council is currently developing its integrated water cycle management (IWCM).

Kyogle Council encourages community consultation through a range of mediums, including:

- customer service team
- newsletters
- ratepayer surveys
- public meetings
- targeted consultation with community groups
- media coverage
- councillor workshops

Council newsletters and planning reports are made publicly available through the website.

With regards to the Aboriginal community of Muli Muli, the CEO of the Local Aboriginal Land Council, in consultation with Kyogle Council, is responsible for all community consultation and communication and is the 'First Point of Contact' for the community. Upon receipt of an issue, the CEO notifies Council which records and responds to the issues within its area of responsibility.

The Local Aboriginal Land Council – CEO obtains a list of recent issues from Kyogle Council and presents the list for review at the 4-monthly meetings. DOI Water is responsible for organising the meetings.

8.2. Communication

- Develop an active two-way communication program to inform consumers and promote awareness of drinking water quality issues.

Effective communication to increase community awareness and knowledge of drinking water quality issues and the various areas of responsibility is essential. Communication helps consumers to understand and contribute to decisions about the service provided by a drinking water supplier. A thorough understanding of the diversity of views held by individuals in the community is necessary to satisfy community expectations.

Kyogle Council communicates potential water quality issues to the public in a variety of ways depending on the severity and scope of the issue. Methods for communicating with customers include:

- Public notification through print media and local radio
- Letter box drop
- Council website
- Individual notification for special requirements (e.g. dialysis patients, hospitals)
- Social media (e.g. Facebook)
- Moveable road signs

The above means are also used for communication for water quality incidents, if needed.

In addition, when response teams go out to investigate customer complaints, the consumer is informed and made aware of water quality issues, as relevant.

Council does not operate any non-potable schemes. Caravan parks are supplied by reticulated water supply.

9. Element 9 – Research and Development

9.1. Investigative studies and research monitoring

- Establish programs to increase understanding of the water supply system.
- Use information to improve management of the water supply system.

Investigative studies and research monitoring include strategic programs designed to increase understanding of a water supply system, to identify and characterise potential hazards, and to fill gaps in knowledge. Improved understanding of the factors affecting water quality characteristics allows suppliers to anticipate periods of poor water quality and respond to them in an effective way.

Council accesses investigative or research monitoring programs through in-house budget, as well as through the *NSW Health Drinking Water Monitoring Program* in consultation/discussion with the local PHU.

Kyogle Council undertakes a broad range of research and investigation in relation to water quality issues. Recent investigations include:

- *Water quality data investigation for Bonalbo and Woodenbong/Muli Muli for TOC and DBPs, February 2018 (Viridis engaged through NSW Health)*
- *Kyogle Water Treatment Plant Upgrade, 2017-18*

The risk assessment process is used as one of the means to initiate or undertake investigative activities or research, as necessary. These are identified when a risk workshop is undertaken and delivered through the implementation of the Improvement Plan respective action. The results from the investigation are used during the risk assessment review.

Recent / current investigative projects are included and tracked through the Improvement Plan.

In addition, chlorination C.*t* has been calculated for the schemes, shown in the respective DWMS Subplans.

9.2. Validation of processes

- Validate processes and procedures to ensure that they are effective at controlling hazards.
- Revalidate processes periodically or when variations in conditions occur.

Validation involves evaluating scientific and technical information available on processes and then undertaking investigations, where necessary, to validate system-specific operational procedures, critical limits and target criteria. The aim of process validation is to ensure effective operation and control.

Validation of new or upgraded processes and equipment is undertaken in-house or through external consultants, as required. DoI Water provides advice on this as required.

Council validates key processes through CCP implementation, data analysis and CCP reviews, as part of DWMS implementation.

The assessment of CCP performance annually assists with revalidation and ensures that CCP limits remain appropriate.

Reporting on CCP performance is part of the DWMS Annual Report.

9.3. Design of equipment

- Validate the selection and design of new equipment and infrastructure to ensure continuing reliability.

The selection and design of new equipment and infrastructure must be validated. Validation is also required to confirm design changes necessary to improve plant performance and control systems. To fulfil this requirement all new equipment installed is thoroughly validated.

Council uses in-house expertise and/or engages external consultants and experienced contractors for any upgrade works to ensure new or modified treatment works are suitable.

A DOI - Water section 60 approval for upgrade works also ensures validation of new equipment and infrastructure.

Council's asset management system (currently being integrated) ensures continued reliability of existing infrastructure.

10. Element 10 – Documentation and Reporting

10.1. Management of documentation and records

- Document information pertinent to all aspects of drinking water quality management.
- Develop a document control system to ensure current versions are in use.
- Establish a records management system and ensure that employees are trained to fill out records.
- Periodically review documentation and revise as necessary.

The DWMS documents (e.g. DWMS Manual, Subplans, CCPs, SOPs, Excel spreadsheets) contain information pertinent to all aspects of drinking water quality management for Councils drinking water schemes. The DWMS is a living document and is maintained in-line with actual operations and management. Any changes to the drinking water supply system is updated and documented within the relevant DWMS document.

This DWMS identifies all documents and records that are required for the management of drinking water quality. Council maintains the DWMS document on Council's shared network drive. Operators are also provided with hard copies of the DWMS Overall Manual and supporting documents. The Urban Services Manager ensures that any hard copies available with operators/overseer are current. Council handles customer complaints through Authority software, as mentioned in Section 5.2.

Water quality incidents/events (e.g. CCP and ADWG exceptions) are recorded and stored in Council's shared network drive, along with any associated reporting/correspondence and documentation of investigations.

Reservoir inspection records are kept as hard copies which are then scanned and saved into Council's shared network drive.

Operators enter monitoring results from the hard copy records (diary/worksheets) into the respective water quality operational recording Excel spreadsheets, at least weekly. Council will shortly be implementing historian software to record operational data going forward.

The NSW Health Drinking Water Database is used as a records management system for Council's water quality results that are collected as a part of that program.

Employees are trained in records management as part of their general duties. The Urban Services Manager is responsible for maintaining and distributing DWMS documents and records to ensure currency of documents being used. Responsibility for review and update of DWMS documents is also with the Urban Services Manager.

10.2. Reporting

- Establish procedures for effective internal and external reporting.
- Produce an annual report to be made available to consumers, regulatory authorities and stakeholders.

Kyogle Council monitors water quality performance in accordance with statutory requirements and as outlined in this DWMS.

Council has informal and formal communication lines between treatment plant operators and team leaders. Any water quality exceedances and/or issues with the plant is communicated directly to the Overseer and externally, in line with CCP procedures.

The plant operator also communicates upwardly to the Overseer on a daily basis (and/or as needed). The Overseer communicates upwardly to the Urban Services Manager, as required and provides water quality related information at regular team meetings.

Council undertakes reporting as required. Some relevant reports which are produced include:

- Monthly Report
- Annual Report: available electronically on Council's website
- NSW Water Supply and Sewerage Performance Monitoring Report: Council's water supply service performance is detailed in this report annually. The report is available for public access from DoI Water website.
- DWMS Annual Report - summarising the implementation of the DWMS and water quality performance for the past 12 months. This is submitted to the local PHU.

Council also maintains and summits records and reports on fluoridation data to NSW Health Water Unit as required by the Fluoridation Code of Practice.

11. Element 11 – Evaluation and Audit

11.1. Long term evaluation of results

- Collect and evaluate long-term data to assess performance and identify problems.
- Document and report results.

Water quality is assessed as part of the risk assessment process and is reviewed on an annual basis as part of the DWMS Annual Report. The DWMS Annual Report provides the opportunity to assess the performance of the DWMS and identify any issues or improvements required.

The DWMS Annual Report is submitted to the local PHU (see Section 10.2).

The long-term evaluation of results includes:

- critical control point performance
- water quality verification data results
- levels of service, e.g. customer complaints

11.2. Audit of drinking water quality management

- Establish processes for internal and external audits.
- Document and communicate audit results.

Auditing is the systematic evaluation of activities and processes to confirm that objectives are being met. It includes assessment of the implementation and capability of management systems. Auditing provides valuable information on those aspects of the system that are effective, as well as identifying opportunities for improvement.

External audits of the DWMS will be undertaken upon advice from the local PHU. The external audit will be carried out by an independent auditor approved by NSW Health.

In addition, internal audits of the DWMS implementation are highly recommended for continuous improvement. There is an action to investigate and establish an internal DWMS implementation audit process (part of Improvement Plan).

The audit findings will be communicated with senior executives through the Auditor's report and the audit findings will also be included in the DWMS Annual Report when relevant. Long-term improvements identified through the audit, if any, will be included in the Improvement Plan, and implemented.

12. Element 12 – Review and Continual Improvement

12.1. Review by senior executive

- Senior executive review of the effectiveness of the management system.
- Evaluate the need for change.

Senior executive support, commitment and ongoing involvement are essential to the continual improvement of the organisation's activities relating to drinking water quality. Senior executive should regularly review its approach to drinking water quality management, develop action plans and commit the resources necessary to improve operational processes and overall drinking water quality performance.

The Urban Services Manager (or delegate) is responsible for reviewing the effectiveness of the management system, its implementation and for keeping the DWMS current, in discussions and consultation with relevant staff (e.g. water operators, foremen, coordinators).

The following are reviewed annually and, where relevant, included in the DWMS Annual report:

- any changes to the regulatory and formal requirements table (Section 1.2)
- any changes to the stakeholders/emergency contact list (within the DISPLAN)
- supply system details, including schematics (in each scheme's Subplan). The schematic will be updated, if required
- drinking water quality performance (Section 5)
- CCP performance (implementation of CCPs and documented response to any exceedances)
- outcomes of drinking water quality incidents and emergencies
- any changes to the risk assessment
- customer complaints
- audit outcomes (Section 11)
- improvement plan progress (Section 12)
- any concerns from NSW Health and DoI Water

If the DWMS is changed as a result of this review, then the updated DWMS is submitted to the PHU.

A complete review of the risk register is undertaken periodically (every 4 years), also refer to Section 2.3.

12.2. Drinking water quality management improvement plan

- Develop a drinking water quality management improvement plan.
- Ensure that the plan is communicated and implemented, and that improvements are monitored for effectiveness.

An Improvement Plan has been developed to ensure continual improvement and is maintained as a separate supporting document (Excel spreadsheet).

It is the responsibility of the Urban Services Manager (or delegate) to ensure that the Improvement Plan is implemented, up-to-date and communicated to relevant water staff.

Progress against the Improvement Plan is reviewed/updated by the Urban Services Manager as required (informally every couple of months), and at least annually when the DWMS Annual Report is compiled (refer to Section 11.1). This ensures that actions are implemented and closed out, and new actions are added to it as necessary, from outcomes of audits, reviews, incident management and advice from PHU/DoI Water. The effectiveness of the improvement action is assessed when the risk assessment is comprehensively reviewed.

Glossary

NOTATION	DESCRIPTION
ADWG	Australian Drinking Water Guidelines
CCP	Critical Control Point
C.*t.*	Used to indicate disinfection efficiency (concentration x time)
DoI	NSW Department of Industry
DWMS	Drinking Water Management System
KC	Kyogle Council
PHU	NSW Health Public Health Unit
QAP	Quality Assurance Program
SOP	Standard Operating Procedure
WTP	Water Treatment Plant

Appendix A – Kyogle Supply System DWMS Subplan

Kyogle Water Supply

DWMS Subplan

May 2019

Executive Summary

The Drinking Water Management System (DWMS) demonstrates Kyogle Council's compliance with the *NSW Public Health Act 2010* requirement to develop a Quality Assurance Plan in accordance with the Framework for Management of Drinking Water Quality in the *Australian Drinking Water Guidelines 2011* (ADWG).

DWMS Overall Manual

The Overall DWMS Manual contains or references the overarching elements common to the management of drinking water quality for all Kyogle Council supplies.

DWMS Subplan – Kyogle Supply Scheme

This document is the Kyogle Supply DWMS Subplan. It contains system specific information to manage the risks to the Kyogle water supply.

Critical Control Points

Kyogle water supply CCPs and CCP procedures are included in Appendix D of the Overall DWMS Manual, including corrective actions for managing CCP breaches.

Incidents and Emergencies

Drinking water quality incidents and emergencies are managed through Council's Incident Response and Reporting Protocols, which is a separate complementary document.

Improvement Plan

An improvement plan forms part of the DWMS and is available as a separate excel spreadsheet.

Document Review

This document is reviewed internally at least on an annual basis when the DWMS Annual Report is prepared, or earlier upon significant system change.

Contents

Figures

Tables

1. Introduction

This DWMS Subplan applies to the management and operation of the Kyogle drinking water supply scheme and forms part of Kyogle Council's DWMS.

The Element of the Australian Drinking Water Guidelines (ADWG) Framework which the section relates to is identified in the headings. Not all Elements are relevant for this Subplan.

2. Element 2 - Assessment of the Supply Scheme

2.1. Overview

Kyogle Council manages the Kyogle township drinking water supply system. The Kyogle Water Treatment Plant (WTP) consists of a flocculation/sedimentation/gravity sand filters train, flocculation/clarification/pressure filter train working in parallel, then fluoridation and chlorination.

The plant is located within the township of Kyogle, on Plant St. The Kyogle WTP treats water from the Richmond River and distributes it through a network of three reservoirs and reticulation to approximately 3,200 customers. Figure 1 shows the overall Kyogle water supply scheme layout.

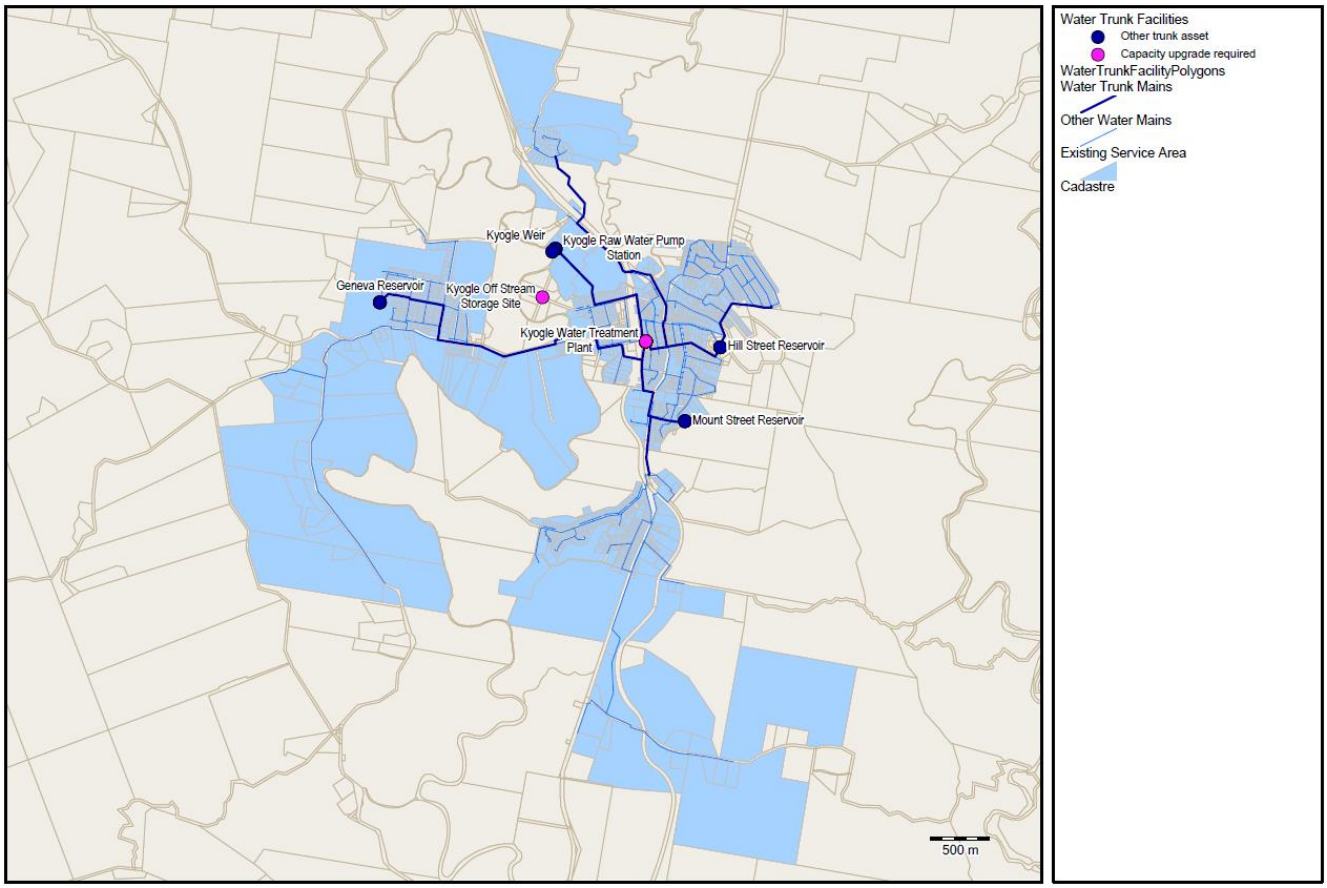


Figure 1 Kyogle Drinking Water Supply Layout

Table 1 Overview of the Kyogle Drinking Water Supply System

Category	Detail
Water Source	Richmond River
Treatment Processes	Kyogle WTP (3 ML/day): • First treatment train - flocculation, sedimentation, gravity sand filters • Second treatment train - flocculation, clarification, pressure filters • Fluoridation • Chlorination
Reservoirs	Three (3) reservoirs totalling 4.8 ML
Customers	Township of Kyogle Population of 3,200 (approx.)

2.2. Process Flow Diagram

The process flow diagram (PFD) or schematic of the Kyogle drinking water supply scheme is shown in Figure 2.

The schematic is reviewed annually when the DWMS Annual Report is compiled and updated if required.

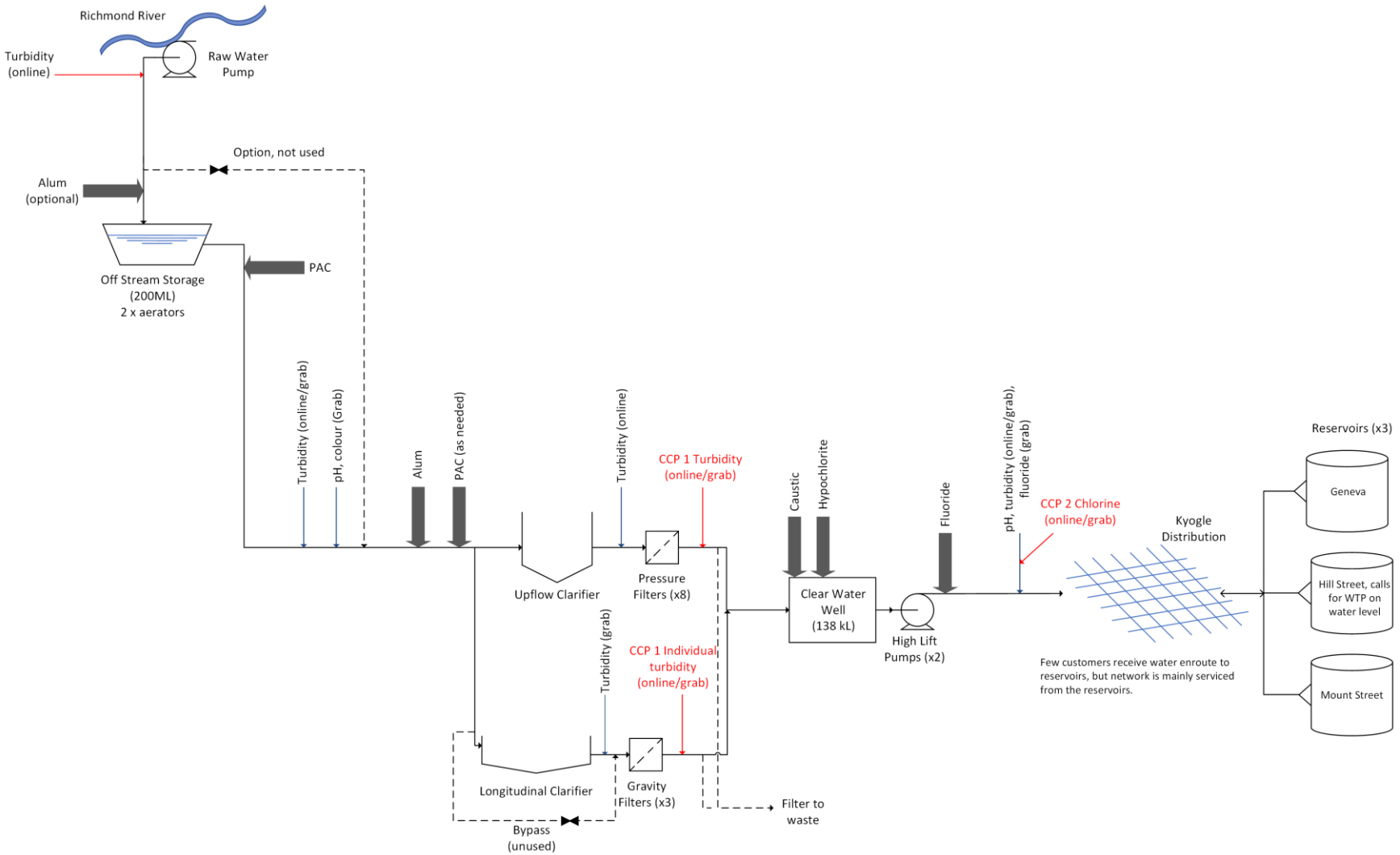


Figure 2 Kyogle Drinking Water Supply System Process Flow Diagram

2.3. Drinking Water Catchment

Kyogle is located in the Richmond River catchment, and the water supply consists of an on-stream storage and filtered supply serving approximately 3,200 persons.

The Richmond River catchment has an area of over 70,000 km^2 and a population of approximately 100,000. Kyogle lies in the upper reaches of the Richmond River, including sub-catchments of Grady's Creek, Roseberry Creek, Eden Creek, Toonumbar Area, Doubtful Creek and Fawcetts Creek. The north and west areas are flanked by steep slopes while the southern area ranges from undulating to flat.

Kyogle's geology is derived from the Tertiary Lamington Volcanics, with basaltic or sedimentary parent materials. The major soil types in the area are red brown earths, yellow red contrast soils and red clay loams, with impacts including gully erosion and soil acidification.

The primary land uses in the Kyogle Council Area is agriculture and forestry, with the major agriculture type being beef, dairy and pigs. Urban development is low density, in small towns.

2.4. Water Treatment Process

Water is pumped from the Richmond River into off-stream storage, which is then drawn from by the WTP. The off-stream storage is fenced and well protected.

The Kyogle WTP has a capacity of 3ML per day. A process flow diagram of the treatment process at the WTP is shown in Figure 2.

The treatment process at the Kyogle WTP comprises of the following process steps:

- Raw water is dosed with alum and powered activated carbon (PAC) as it drawn from the off-stream storage
- Secondary alum dosing is undertaken at the inlet of WTP. Additional PAC is also dosed if required.
- The dosed water flows into the WTP, where the process splits into two parallel treatment trains
- The first parallel treatment train comprises of clarification and pressure filtration
- The second parallel treatment train comprises of clarification and gravity filtration
- Filtered water from both treatment trains re-combine
- Filtered water then enters the clear water well, where it is dosed with caustic for pH adjustment then dosed with hypochlorite for disinfection
- The disinfected water is fluoridated
- Treated water is transferred to reticulation reservoirs via two high lift pumps

The treatment plant at Kyogle is fenced to prevent vandalism or deliberate contamination of drinking water.

2.5. Distribution

The Kyogle Water Supply System is summarised as:

- Clear water pumping station 54L/s
- Hill Street Reservoir 1.5ML
- Mount Street Reservoir 2.2ML, James Street Reservoir 1.1ML and Geneva Reservoir 1.2 ML
- 1,209 residential connections
- 275 non-residential connections
- 44km of reticulation mains
- Approximate population serviced by water supply – 3,200

- Original construction date 1933, first augmentation 1956, second augmentation 2017-18

2.6. Reservoir Integrity

Maintaining the integrity of the distribution system is an important barrier in keeping the supply safe from potential recontamination. This includes ensuring that the service reservoirs are not vulnerable to contamination, for example, by vermin, birds or rainwater runoff ingress.

Reservoirs are not classed as a CCP for Council supplies, however, a breach in integrity (e.g. evidence of vermin) will be reported to the PHU, as required by NSW Health and urgent corrective actions undertaken.

Operators use a checklist and undertake inspections every 6 months. Checklists are filled out for each inspection, and then uploaded and saved into the appropriate location.

Council undertakes reservoir cleaning in-house, and external contractors (e.g. divers) are engaged as required.

2.7. Risk Assessment

The original risk assessment was undertaken as a workshop in 2012, with updates made in 2018/19. Details are included in the Risk Register, available in Council's network drive relevant folder.

The Risk Register is comprehensively reviewed every 4 years. Operators play a crucial role in risk assessment and management and are part of the core risk assessment team.

3. Element 3 – Preventive Measures

3.1. Preventative Measures and multiple barriers

The preventative measures were identified and assessed during the risk workshop and have been documented, alongside the significant risks that they address, in the Risk Register.

The key barriers include: solids removal processes (coagulation, flocculation, filtration), disinfection, maintaining integrity of the distribution network and reservoirs and maintaining an adequate residual chlorine level in the network.

The SOPs document and explain implementation of preventive measures.

3.2. Critical Control Points

Critical Control Points (CCPs) are activities, procedures or processes where the operator can apply control, and are essential processes in reducing risk to an acceptable level.

In order to define acceptable form unacceptable performance at each point, target levels, alert levels and critical limits have been identified for Council's drinking water supply systems.

Three different limits have been set for each CCP within Council's drinking water supply systems:

- *Target Level:* representing day to day operational limits and procedures. This is what is to be achieved
- *Alert Level:* deviation to this level indicates a trend towards loss of control and corrective actions should be immediately taken to resolve the problem and restore control to the drinking water supply system
- *Critical Limit:* deviation from the critical limit indicates loss of control and the potential of unacceptable health risks. If the critical limit is exceeded, corrective actions should be immediately activated, and the PHU notified immediately.

The CCPs were reviewed in October 2018, including identification of the CCPs using the combined knowledge of the risk team.

The CCPs and CCP SOPs for the Kyogle supply are included in Appendix D of the Overall Manual.

4. Element 4 – Operational Procedures and Process Control

4.1. Operational Procedures

Key SOPs (e.g. for CCPs) available for use by operators are included in Appendix D.

There are other SOPs available (refer to Section 4.1 of the DWMS Overall Manual). More SOPs are being developed by Council.

4.2. Operational Monitoring and Corrective Actions

Operational monitoring is conducted as detailed in Table 2. The results are recorded in appropriate recording sheets and transferred into excel spreadsheets. The corrective actions are also outlined in Table 2.

Table 2 Operational monitoring for the Kyogle supply

MONITORING LOCATION	PARAMETER	FREQUENCY	ACTION TRIGGER	CORRECTIVE ACTIONS
Off Stream Storage Intake	Security, signs, intake structure, water level	Daily – visual	Evidence of contamination by people and/or livestock	Remove contamination, as possible. Consider if any adjustment to treatment may be required. Jar tests as required.
	BOD	Monthly	NA	For raw water characteristics.
	pH	Monthly	NA	For raw water characteristics.
	Suspended solids	Monthly	NA	For raw water characteristics.
	Total N	Monthly	NA	For raw water characteristics.
	Total P	Monthly	NA	For raw water characteristics.
Raw Water - WTP	Colour	Daily	NA	For raw water characteristics. Perform jar testing to verify coagulation/flocculation process. Consider if any adjustment to treatment is required, including selective harvesting.
	Turbidity	Daily	NA	As above
	pH	Daily	Outside 6-9	As above
	Natural Fluoride	Daily	>0.9 mg/L	Raw water characteristic to guide adjustment to fluoride dosing, as necessary
	Pesticides (Organochlorides, Organophosphates)	As required	Relevant ADWG limits	Contact local PHU, take appropriate actions based on these discussions.

MONITORING LOCATION	PARAMETER	FREQUENCY	ACTION TRIGGER	CORRECTIVE ACTIONS
Clarification (settled water)	pH	Daily	Outside 6.5-8	Consider if any adjustment to treatment may be required.
	Turbidity	Daily	>5 NTU	Investigate cause, perform jar testing. Consider if any adjustment to treatment may be required.
	Colour	Daily	>15 HU	Investigate cause, perform jar testing. Consider if any adjustment to treatment may be required.
Individual filters and combined filtered water	Turbidity	Continuous / daily	>0.3 NTU	As per CCP 1 procedure.
Final treated water	Colour	Daily	>15 HU	Investigate cause, perform jar testing. Consider if any adjustment to treatment may be required.
	Turbidity	Daily	>1 NTU	Investigate cause, ensure CCPs are working well. Consider if any adjustment to treatment may be required.
	pH	Daily	Outside 6.5-8.5	Investigate cause, turn off caustic dosing if >8.5, ensure CCPs are working well. Consider if any adjustment to treatment may be required.
	Chlorine residual	Daily	<1.0 or > 2.5mg/L	As per CCP 2 procedure
	Fluoride	Daily	<0.9 or >1.5 mg/L	Turn off fluoride dosing if above >1.5 mg/L. Investigate cause. Follow Fluoride Overdose Plan.
Hill Street Reservoir Mount Street Reservoir James Street Reservoir	Chlorine residual	Daily	<0.5 mg/L	Investigate cause, check disinfection CCP, check chlorine in reservoirs, check system integrity. Consult with Overseer for further action. Consider if any adjustment to treatment may be required. Consider dosing chlorine in the reservoirs
	pH	Daily	Outside 6.5-8.5	Investigate cause, check disinfection CCP. Consult with Overseer for further action. Consider if any adjustment to treatment may be required.

MONITORING LOCATION	PARAMETER	FREQUENCY	ACTION TRIGGER	CORRECTIVE ACTIONS
Reticulation (various sites)	Free Chlorine residual	Weekly	Outside 0.2-4 mg/L	Investigate cause, check disinfection CCP, check chlorine in reservoirs, check system integrity. Consult with Overseer for further action. Consider if any adjustment to treatment may be required. If <0.2 mg/L consider dosing chlorine in the reservoirs, if >4 mg/L – test total chlorine, if total chlorine is >5 mg/L then consult with PHU, consider draining reservoirs/flushing.
	Total chlorine	Weekly	>5 mg/L	Investigate cause, check disinfection, check chlorine in reservoirs. Consult with Overseer for further action. Consider if any adjustment to treatment may be required. Consult with PHU, consider draining reservoirs/flushing.
	pH	Weekly	Outside 6.5-8.5	Investigate cause, check disinfection CCP, check reservoirs. Consult with Overseer for further action. Consider if any adjustment to treatment may be required.
	Turbidity	Weekly	>5 NTU	Investigate cause, check for breaks, check incoming water quality, check reservoirs. Consult with Overseer for further action. Consider if any adjustment to treatment may be required.
	Temperature	Weekly	>25^{0}C	Ensure chlorine residuals are maintained at >0.5 mg/L if the temperature is continually >25^{0}C for 3-4 months.
All reservoirs	Reservoir integrity	Every 6 months	Issues identified in Reservoir Checklist	As per the incident response protocols.

4.3. Equipment capability and maintenance

The operators and Overseer ensure that any testing equipment is calibrated when required. Council has an existing SOP on calibration.

4.4. Materials and Chemicals

Chemicals used at the Kyogle WTP are listed in Table 3. Council has preferred suppliers for the purchasing of products. Council's supplier contracts include chemical quality compliance requirements.

Council operators attend all chemical deliveries and obtain a certificate of analysis at the time of delivery for each batch of chemical supplied. SOP on chemical quality control has been developed and is available in Council's relevant shared network folder.

Table 3 Chemicals used in the Kyogle drinking water supply scheme

Chemical	Supplier	Contact
Sodium hypochlorite 13% solution Liquid Caustic 30% solution	Elite Chemicals	1873 Lytton Road Lytton QLD 4178 (07) 3893 7500
Liquid Aluminium Sulphate 47% solution	Omega Chemicals	20 Industrial Avenue Molendinar QLD 4214 (07) 5539 3499
Sodium Fluoride Powdered Activated Carbon Potassium Permanganate	Redox	2 Swettenham Road Minto NSW 2566 (02) 97333000

Material Safety Data Sheets (MSDS) and appropriate chemical signs are displayed at the WTP. Personal Protective Equipment (PPE), first aid kits, chemical spills kits, safety showers and eye wash stations are located at the Kyogle WTP and chemical storage areas in case of emergencies.

5. Element 5 – Verification of Drinking Water Quality

5.1. Drinking water quality monitoring

NSW Health Drinking Water Monitoring Program provides ongoing independent verification of the treatment process. Frequency of sampling is based on population. The Program assesses 36 routine parameters for microbial, physical and chemical properties of the water.

Microbial samples are collected weekly and chemical samples are collected 6-monthly by Richland Water Laboratories (RWL) on Council's behalf from various sites and sent to the RWL and Lismore Pathology Laboratory operated by the North Coast Area Health Service.

Verification monitoring locations within the reticulation network were identified in consultation with the PHU to ensure appropriate representation of the system. The monitoring sites for the NSW Health Drinking Water Monitoring Program are:

- James Street – KG 01 002
- Riverbend Close – KG 01 003

5.2. Consumer satisfaction

Where any water quality complaint is received directly by the operators, this should be reported so that it is logged into Council's records management system.

The Overseer ensures that the details are relayed back to the Council customer service staff.

5.3. Short term evaluation of results and corrective actions

Operators review results daily against the water quality targets as part of their operations and undertake corrective actions where required (e.g. using relevant CCP SOPs, as required).

Review of the results for the NSW Health Drinking Water Monitoring program is undertaken by the testing laboratory and any exceedance is notified by the laboratory to relevant Council staff and the local PHU.

Corrective actions for water quality incidents are discussed in Section 6.

6. Element 6 - Management of Incidents and Emergencies

Water quality incidents are managed as described in the incident response and reporting protocols, which is a separate document which forms part of the DWMS.

Relevant incidents are recorded in the Incident Action Recording Form (for water and sewerage) to capture incidents and outcomes. The form is filled out by operators and sent to the Urban Services Manager. The Fluoride Code of Practice is followed for fluoride related incidents.

The need to issue (and withdraw) a boil water alert is assessed in consultation with the local PHU (explained in the incident response protocols). Management of the significant incidents and emergencies is covered by Council's Emergency Management Plan (DISPLAN).

Operators are also encouraged to discuss water quality issues and improvements with the Overseer/Urban Services Manager as relevant.

7. Element 7 - Employee Awareness and Training

Operators are encouraged to discuss any additional or further training needs with the Overseer.

8. Element 9 – Research and Development

8.1. R&D Projects

Research is undertaken for the water scheme as identified during risk assessments to increase understanding of the system.

Operators are encouraged to take part in any research and also to discuss any relevant research idea with the Overseer/Urban Services Manager.

8.2. Primary Disinfection Contact Time

C.*t*. is a measure of free chlorine residual concentration (C) and contact time (t). A primary disinfection contact time greater than 15 min.mg/L is required to ensure effective primary kill.

Analysis of the C.*t* showed that the clear water tank onsite is sufficient for achieving C.*t* of 15 min.mg/L.

The parameters used for the analysis are included in Table 4.

Table 4 Parameters for contact time analysis for the Kyogle scheme

Parameter	Unit	Value
Minimum Concentration Used for Calculation	mg/L	0.5
Detention Volume (Clear Water Tank)	m^3	138
Maximum System Flow	L/s	15
Baffling Factor	-	0.5 (CWT)

If the minimum free chlorine concentration for the scheme (lower critical limit) is 0.5 mg/L, then a C.*t* of 15.33 min.mg/L is achieved, which is adequate. The target value for disinfection (refer to CCP procedure) at >1 mg/L ensures that sufficient C.*t* is achieved for managing any potential risk from *Naegleria fowleri.* At 1.0 mg/L, the C.*t* achieved is 30.67 min.mg/L, which is sufficient for *Naegleria* risk control.

9. Element 10 - Documentation and Record Keeping

This DWMS Subplan documents information pertinent to drinking water quality management for the Kyogle water supply.

Operators are aware of these documents and implement them.

10. Element 12 - Continual Improvement

Operators are encouraged to discuss and notify upwards to the Overseer/Urban Services Manager on the need for any improvement to drinking water quality management practices.

Appendix B – Bonalbo Supply System Subplan

Bonalbo Water Supply

DWMS Subplan

May 2019

Executive Summary

The Drinking Water Management System (DWMS) demonstrates Kyogle Council's compliance with the *NSW Public Health Act 2010* requirement to develop a Quality Assurance Plan in accordance with the Framework for Management of Drinking Water Quality in the *Australian Drinking Water Guidelines 2011* (ADWG).

DWMS Overall Manual

The Overall DWMS Manual contains or references the overarching elements common to the management of drinking water quality for all Kyogle Council supplies.

DWMS Subplan - Bonalbo Supply Scheme

This document is the Bonalbo Supply DWMS Subplan. It contains system specific information to manage the risks to the Bonalbo water supply.

Critical Control Points

Bonalbo water supply CCPs and CCP procedures are included in Appendix D of the Overall DWMS Manual, including corrective actions for managing CCP breaches.

Incidents and Emergencies

Drinking water quality incidents and emergencies are managed through Council's Incident Response and Reporting Protocols, which is a separate complementary document.

Improvement Plan

An improvement plan forms part of the DWMS and is available as a separate excel spreadsheet.

Document Review

This document is reviewed internally at least on an annual basis when the DWMS Annual Report is prepared, or earlier upon significant system change.

Contents

Figures

Tables

1. Introduction

This DWMS Subplan applies to the management and operation of the Bonalbo drinking water supply scheme and forms part of Kyogle Council's DWMS.

The Element of the Australian Drinking Water Guidelines (ADWG) Framework which the section relates to is identified in the headings. Not all Elements are relevant for this Subplan.

2. Element 2 - Assessment of the Supply Scheme

2.1. Overview

Kyogle Council manages the Bonalbo village drinking water supply system. The Bonalbo Water Treatment Plant (WTP) consists of a flocculation, Dissolved Air Flotation (DAF), gravity sand filter, fluoridation and chlorination. The Bonalbo WTP treats water from the Peacock Creek, a groundwater bore and the off-stream storage catchment and distributes it through a reservoir and reticulation to approximately 400 customers. Figure 1 shows the overall Bonalbo water supply scheme layout.

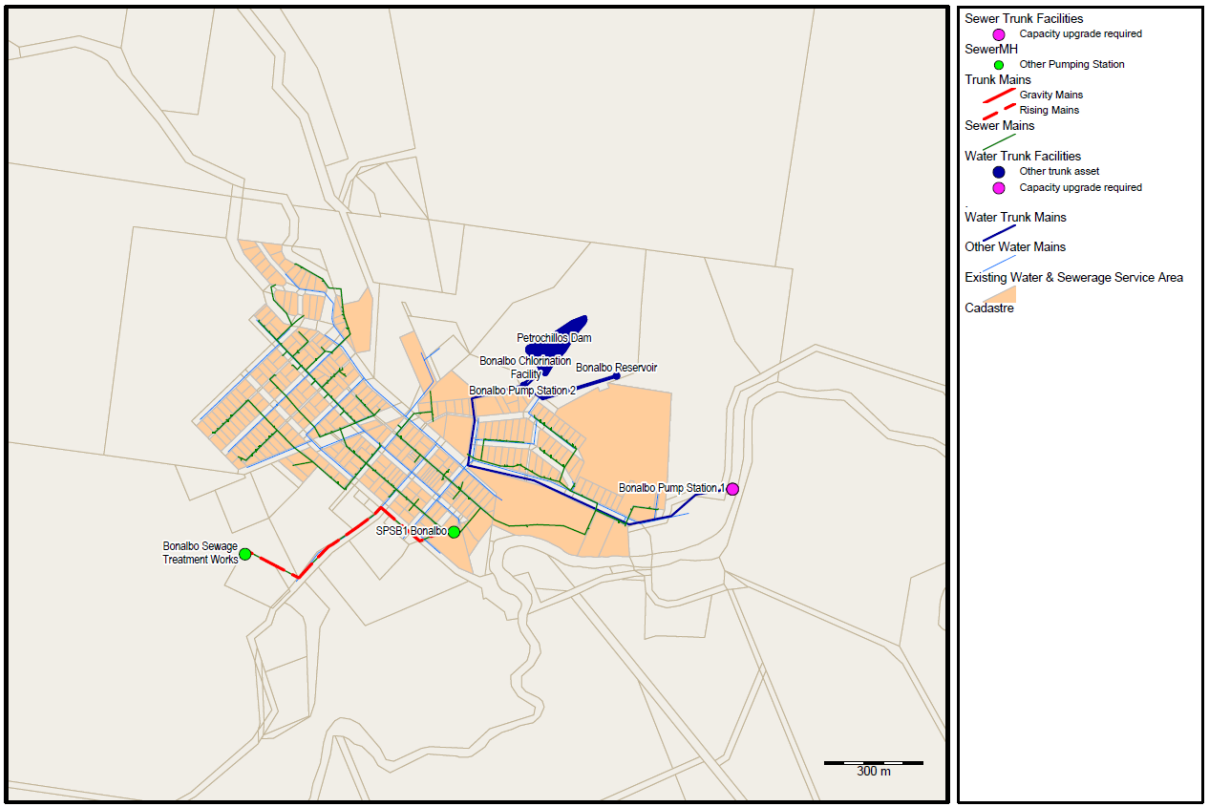


Figure 1 Bonalbo Drinking Water Supply Layout

Table 1 Overview of the Bonalbo Drinking Water Supply System

Category	Detail
Water Source	Peacock Creek, groundwater bore and off-stream storages
Treatment Processes	Kyogle WTP (0.3 ML/day): • Flocculation • DAF Filtration • Gravity sand Filtration • Fluoridation • Chlorination
Reservoirs	Reservoir 0.9 ML
Customers	Village of Bonalbo Population of 400 (approx.)

2.2. Process Flow Diagram

The process flow diagram (PFD) or schematic of the Bonalbo drinking water supply scheme is shown in Figure 2.

The schematic is reviewed annually when the DWMS Annual Report is compiled and updated if required.

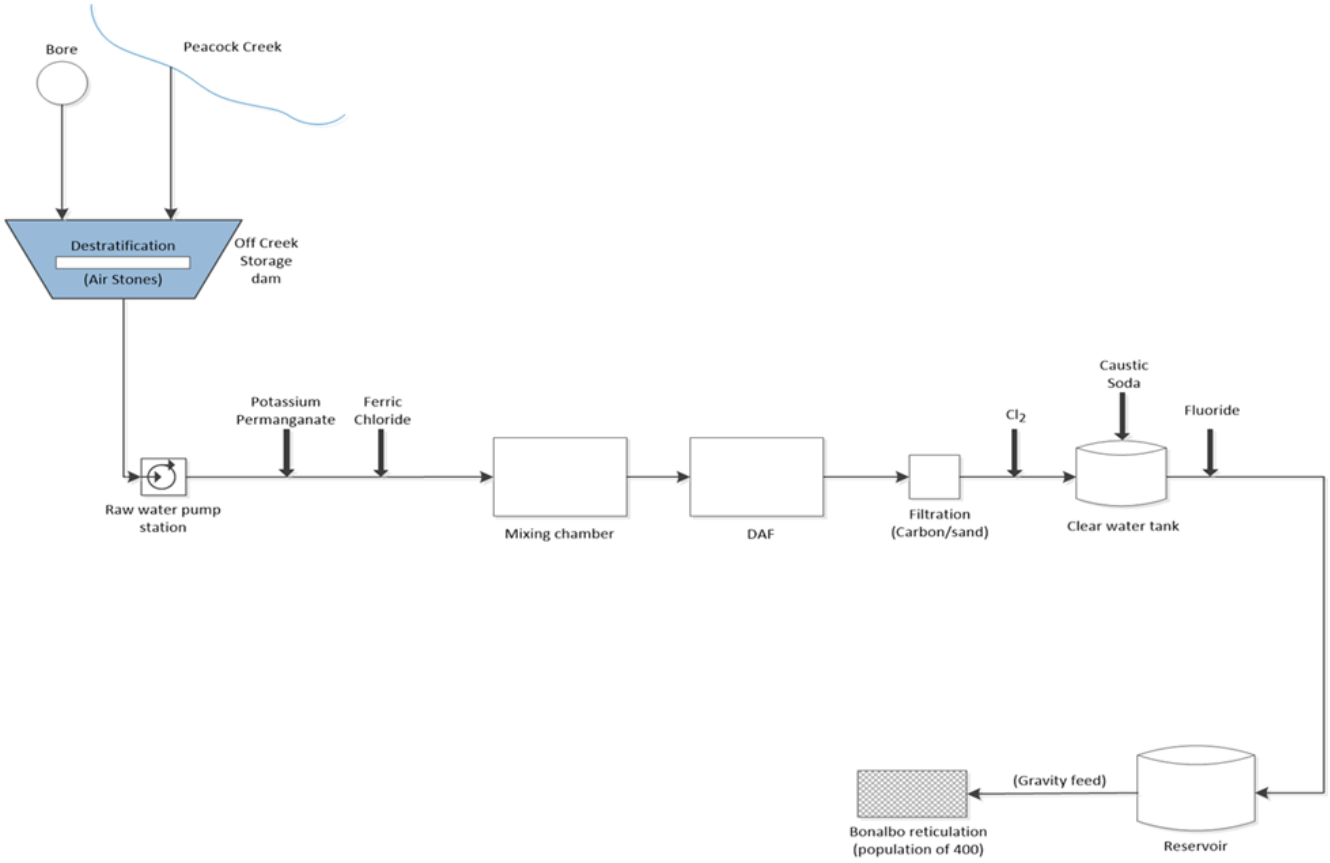


Figure 2 Bonalbo Drinking Water Supply System Process Flow Diagram

2.3. Drinking Water Catchment

Bonalbo is located in the Clarence Catchment, and the water supply consists of an upgraded (2010) WTP fed from an off-stream storage with water sourced from Peacock Creek, a groundwater bore, and the off-stream storage catchment, serving approximately 400 persons.

The village of Bonalbo is within the Peacock Creek catchment, which is part of the greater Clarence River catchment area. The Peacock Creek catchment covers an area of 170km^2 (120km^2 upstream of Bonalbo) with the Bonalbo urban footprint covering less than 1km of the catchment area.

The catchment area upstream of the Bonalbo Peacock Creek extraction point has a mixture of rural developments and farming, with a large proportion of native trees and in the upper parts of the catchment, the Toonumbar National Park. The geology of the Clarence catchment is derived from Main Range, Focal Peak and Tweed Volcanics.

The primary land uses in the catchment area include national parks, agriculture and forestry, with the major agriculture type being beef, dairy and pigs.

2.4. Water Treatment Process

Water is sourced from the Peakcock Creek, and a groundwater bore, which is stored in the off-stream storage. The WTP draws from the off-stream storage

The Bonalbo WTP has a capacity of 0.9 ML per day. A process flow diagram of the treatment process at the WTP is shown in Figure 2.

The treatment process at the Bonalbo WTP comprises of the following process steps:

- Raw water is drawn via the raw water pump station to the head of the WTP
- Raw water is dosed with potassium permanganate to oxidise dissolved iron and manganese
- Ferric chloride is then dosed for coagulation and process water enters the mixing chamber
- After the mixing chamber, the process water enters the DAF and the gravity sand filters
- Filtered water is then dosed with chlorine gas for disinfection
- Caustic soda is dosed in the clear water tank to adjust pH
- Fluoride is dosed at the outlet of the clear water tank
- Water is then pumped to the reticulation reservoir, from which it is gravity fed to customers

The treatment plant at Bonalbo is fenced to prevent vandalism or deliberate contamination of drinking water.

2.5. Distribution

The Kyogle Water Supply System is summarised as:

- Clear water pumping station 4.7L/s
- Bonalbo Reservoir 0.9ML
- 165 residential connections
- 37 non-residential connections
- 7km of reticulation mains
- 2km trunk mains
- Approximate population serviced by water supply – 350
- Original construction 1966, Water Treatment Plant Constructed 2010

2.6. Reservoir Integrity

Maintaining the integrity of the distribution system is an important barrier in keeping the supply safe from potential recontamination. This includes ensuring that the service reservoirs are not vulnerable to contamination, for example, by vermin, birds or rainwater runoff ingress.

Reservoirs are not classed as a CCP for Council supplies, however, a breach in integrity (e.g. evidence of vermin) will be reported to the PHU, as required by NSW Health and urgent corrective actions undertaken.

Operators use a checklist and undertake inspections every 6 months. Checklists are filled out for each inspection, and then uploaded and saved into the appropriate location.

Council undertakes reservoir cleaning in-house, and external contractors (e.g. divers) are engaged as required.

2.7. Risk Assessment

The original risk assessment was undertaken as a workshop in 2012, with updates made in 2018. Details are included in the Risk Register, available in Council's network drive relevant folder.

The Risk Register is comprehensively reviewed every 4 years. Operators play a crucial role in risk assessment and management and are part of the core risk assessment team.

3. Element 3 – Preventive Measures

3.1. Preventative Measures and multiple barriers

The preventative measures were identified and assessed during the risk workshop and have been documented, alongside the significant risks that they address, in the Risk Register.

The key barriers include: solids removal processes (coagulation, flocculation, filtration), disinfection, maintaining integrity of the distribution network and reservoirs and maintaining an adequate residual chlorine level in the network.

The SOPs document and explain implementation of preventive measures.

3.2. Critical Control Points

Critical Control Points (CCPs) are activities, procedures or processes where the operator can apply control, and are essential processes in reducing risk to an acceptable level.

In order to define acceptable form unacceptable performance at each point, target levels, alert levels and critical limits have been identified for Council's drinking water supply systems.

Three different limits have been set for each CCP within Council's drinking water supply systems:

- *Target Level:* representing day to day operational limits and procedures. This is what is to be achieved
- *Alert Level:* deviation to this level indicates a trend towards loss of control and corrective actions should be immediately taken to resolve the problem and restore control to the drinking water supply system
- *Critical Limit:* deviation from the critical limit indicates loss of control and the potential of unacceptable health risks. If the critical limit is exceeded, corrective actions should be immediately activated, and the PHU notified immediately.

The CCPs were reviewed in October 2018, including identification of the CCPs using the combined knowledge of the risk team.

The CCPs and CCP SOPs for the Bonalbo supply are included in Appendix D of the Overall Manual.

4. Element 4 – Operational Procedures and Process Control

4.1. Operational Procedures

Key SOPs (e.g. for CCPs) available for use by operators are included in Appendix D.

There are other SOPs available (refer to Section 4.1 of the DWMS Overall Manual). More SOPs are being developed by Council.

4.2. Operational Monitoring and Corrective Actions

Operational monitoring is conducted as detailed in Table 2. The results are recorded in appropriate recording sheets and transferred into excel spreadsheets. The corrective actions are also outlined in Table 2.

Table 2 Operational monitoring for the Bonalbo supply

MONITORING LOCATION	PARAMETER	FREQUENCY	ACTION TRIGGER	CORRECTIVE ACTIONS
Raw Water – Petrochilos Dam	Security, signs, intake structure, water level	Daily – visual	Evidence of contamination by people and/or livestock	Consider if any adjustment to treatment may be required. Jar tests as required.
	Algal cells	Monthly	>500 cells	As per the Algae Flow Chart
	Iron (total)	Every 6 months	NA	For raw water characteristics
	Manganese (total)	Every 6 months	NA	For raw water characteristics
	Turbidity	Every 6 months	NA	For raw water characteristics
	pH	Every 6 months	NA	For raw water characteristics
Raw Water Inlet	Colour	Daily	NA	For raw water characteristics. Perform jar testing to verify coagulation/flocculation process, if required. Consider if any adjustment to treatment is required, including selective harvesting.
	Turbidity	Daily	NA	Same as above.
	pH	Daily	Outside 6-8	Same as above.
	Natural Fluoride	Daily	>0.9 mg/L	Raw water characteristic to guide adjustment to fluoride dosing, as necessary.

MONITORING LOCATION	PARAMETER	FREQUENCY	ACTION TRIGGER	CORRECTIVE ACTIONS
DAF Water	pH	Daily	Outside 6-7	Consider if any adjustment to treatment may be required.
	Turbidity	Daily	>5 NTU	Investigate cause, perform jar testing. Consider if any adjustment to treatment may be required.
Filtered water (filter outlet)	Turbidity	Continuous / daily	>0.3 NTU	As per CCP 1 procedure.
Clear Water	Colour	Daily	>15 HU	Investigate cause, perform jar testing. Consider if any adjustment to treatment may be required.
	Turbidity	Daily	>0.5 NTU	Investigate cause, ensure CCPs are working well. Consider if any adjustment to treatment may be required.
	pH	Daily	Outside 6.5-8.5	Investigate cause, turn off caustic dosing if >8.5, ensure CCPs are working well. Consider if any adjustment to treatment may be required.
	Chlorine residual	Daily	<1.0 mg/L	Investigate cause, ensure CCPs are working well. Consider if any adjustment to treatment may be required.
	Total Chlorine	Daily	>5 mg/L	Turn off chlorine dosing. Investigate and rectify cause.
	Iron (Total)	Weekly	>0.3 mg/L	Investigate cause, perform jar testing. Consider if any adjustment to treatment may be required.
	Manganese (Total)	Weekly	>0.1 mg/L	Investigate cause, perform jar testing. Consider if any adjustment to treatment may be required.
Mains Water (from Bonalbo Reservoir)	Chlorine residual	Daily	<0.3 mg/L	As per CCP 2 procedure.
	pH	Daily	Outside 6.5-8.5	Investigate cause, check disinfection CCP. Consult with Overseer for further action. Consider if any adjustment to treatment may be required.
	Fluoride	Daily	<0.9 or >1.5 mg/L	Turn off fluoride dosing if above >1.5 mg/L. Investigate cause. Follow Fluoride Overdose Plan.

MONITORING LOCATION	PARAMETER	FREQUENCY	ACTION TRIGGER	CORRECTIVE ACTIONS
Reticulation (various sites)	Free Chlorine residual	Weekly	Outside 0.2-4 mg/L	Investigate cause, check disinfection CCP, check chlorine in reservoirs, check system integrity. Consult with Overseer for further action. Consider if any adjustment to treatment may be required. If <0.2 mg/L consider dosing chlorine in the reservoirs, if >4 mg/L – test total chlorine, if total chlorine is >5 mg/L then consult with PHU, consider draining reservoirs/flushing.
	Total chlorine	Weekly	>5 mg/L	Investigate cause, check disinfection, check chlorine in reservoirs. Consult with Overseer for further action. Consider if any adjustment to treatment may be required. Consult with PHU, consider draining reservoirs/flushing.
	pH	Weekly	Outside 6.5-8.5	Investigate cause, check disinfection CCP, check reservoirs. Consult with Overseer for further action. Consider if any adjustment to treatment may be required.
	Turbidity	Weekly	>5 NTU	Investigate cause, check for breaks, check incoming water quality, check reservoirs. Consult with Overseer for further action. Consider if any adjustment to treatment may be required.
	Temperature	Weekly	>25^{0}C	Ensure chlorine residuals are maintained at >0.5 mg/L if the temperature is continually >25^{0}C for 3-4 months.
All reservoirs	Reservoir integrity	Every 6 months	Issues identified in Reservoir Checklist	As per the incident response protocols.

4.3. Equipment capability and maintenance

The operators and Overseer ensure that any testing equipment is calibrated when required. Council has an existing SOP on calibration.

4.4. Materials and Chemicals

Chemicals used at the Bonalbo WTP are listed in Table 3. Council has preferred suppliers for the purchasing of products. Council's supplier contracts include chemical quality compliance requirements. Council operators attend all chemical deliveries and obtain a certificate of analysis at the time of delivery for each batch of chemical supplied. SOP on chemical quality control has been developed and is available in Council's relevant shared network folder.

Table 3 Chemicals used in the Bonalbo drinking water supply scheme

Chemical	Supplier	Contact
Sodium hypochlorite 13% solution Liquid Caustic 30% solution	Elite Chemicals	1873 Lytton Road Lytton QLD 4178 (07) 3893 7500
Ferric Chlorine 40% solution	Omega Chemicals	20 Industrial Avenue Molendinar QLD 4214 (07) 5539 3499
Sodium Fluoride Potassium Permanganate	Redox	2 Swettenham Road Minto NSW 2566 (02) 97333000

Material Safety Data Sheets (MSDS) and appropriate chemical signs are displayed at the WTP. Personal Protective Equipment (PPE), first aid kits, chemical spills kits, safety showers and eye wash stations are located at the Bonalbo WTP and chemical storage areas in case of emergencies.

5. Element 5 – Verification of Drinking Water Quality

5.1. Drinking water quality monitoring

NSW Health Drinking Water Monitoring Program provides ongoing independent verification of the treatment process. Frequency of sampling is based on population. The Program assesses 36 routine parameters for microbial, physical and chemical properties of the water.

Microbial samples are collected weekly and chemical samples are collected 6-monthly by Richland Water Laboratories (RWL) on Council's behalf from various sites and sent to the RWL and Lismore Pathology Laboratory operated by the North Coast Area Health Service.

Verification monitoring locations within the reticulation network were identified in consultation with the PHU to ensure appropriate representation of the system. The monitoring site for the NSW Health Drinking Water Monitoring Program is:

- Bonalbo Amenities (KG 02 001)

5.2. Consumer satisfaction

Where any water quality complaint is received directly by the operators, this should be reported so that it is logged into Council's records management system.

The Overseer ensures that the details are relayed back to the Council customer service staff.

5.3. Short term evaluation of results and corrective actions

Operators review results daily against the water quality targets as part of their operations and undertake corrective actions where required (e.g. using relevant CCP SOPs, as required).

Review of the results for the NSW Health Drinking Water Monitoring program is undertaken by the testing laboratory and any exceedance is notified by the laboratory to relevant Council staff and the local PHU.

Corrective actions for water quality incidents are discussed in Section 6.

6. Element 6 - Management of Incidents and Emergencies

Water quality incidents are managed as described in the incident response and reporting protocols, which is a separate document which forms part of the DWMS.

Relevant incidents are recorded in the Incident Action Recording Form (for water and sewerage) to capture incidents and outcomes. The form is filled out by operators and sent to the Urban Services Manager. The Fluoride Code of Practice is followed for fluoride related incidents.

The need to issue (and withdraw) a boil water alert is assessed in consultation with the local PHU (explained in the incident response protocols). Management of the significant incidents and emergencies is covered by Council's Emergency Management Plan (DISPLAN).

Operators are also encouraged to discuss water quality issues and improvements with the Overseer/Urban Services Manager as relevant.

7. Element 7 - Employee Awareness and Training

Operators are encouraged to discuss any additional or further training needs with the Overseer.

8. Element 9 – Research and Development

8.1. R&D Projects

Research is undertaken for the water scheme as identified during risk assessments to increase understanding of the system.

Operators are encouraged to take part in any research and also to discuss any relevant research idea with the Overseer/Urban Services Manager.

8.2. Primary Disinfection Contact Time

C.*t*. is a measure of free chlorine residual concentration (C) and contact time (t). A primary disinfection contact time greater than 15 min.mg/L is required to ensure effective primary kill.

The parameters used for the analysis are included in Table 4.

Table 4 Parameters for contact time analysis for the Bonalbo scheme

Parameter	Unit	Value
Minimum Concentration Used for Calculation	mg/L	0.2
Detention Volume (Clear Water Tank)	m³	20
Detention Volume (Reservoir)	m³	1000
Maximum System Flow	L/s	15
Baffling Factor	-	0.1 (Detention Vessels)

If the minimum free chlorine concentration for the scheme (lower critical limit) is 0.2 mg/L in the mains water (from reservoir), then a C.*t* of 144 min.mg/L is achieved, which is adequate. The C.*t* is also sufficient for managing any potential risk from *Naegleria fowleri.*

Note, C.*t* is not achieved if only the clear water tank is considered (CWT C.*t* is 0.67 min.mg/L).

9. Element 10 - Documentation and Record Keeping

This DWMS Subplan documents information pertinent to drinking water quality management for the Bonalbo water supply.

Operators are aware of these documents and implement them.

10. Element 12 - Continual Improvement

Operators are encouraged to discuss and notify upwards to the Overseer/Urban Services Manager on the need for any improvement to drinking water quality management practices.

Appendix C – Woodenbong Muli Muli Supply System Subplan

Woodenbong / Muli Muli Water Supply

DWMS Subplan

May 2019

Executive Summary

The Drinking Water Management System (DWMS) demonstrates Kyogle Council's compliance with the *NSW Public Health Act 2010* requirement to develop a Quality Assurance Plan in accordance with the Framework for Management of Drinking Water Quality in the *Australian Drinking Water Guidelines 2011* (ADWG).

DWMS Overall Manual

The Overall DWMS Manual contains or references the overarching elements common to the management of drinking water quality for all Kyogle Council supplies.

DWMS Subplan – Woodenbong / Muli Muli Supply Scheme

This document is the Woodenbong / Muli Muli DWMS Subplan. It contains system specific information to manage the risks to the Woodenbong / Muli Muli water supply.

Critical Control Points

There are no CCPs assigned for the Woodenbong / Muli Muli scheme, as it is only distribution of bulk treated water received from Tenterfield Shire Council. However, the integrity of reservoirs is included as a very important operational check with reporting requirements to the PHU for breach (evidence of vermin).

Incidents and Emergencies

Drinking water quality incidents and emergencies are managed through Council's Incident Response and Reporting Protocols, which is a separate complementary document.

Improvement Plan

An improvement plan forms part of the DWMS and is available as a separate excel spreadsheet.

Document Review

This document is reviewed internally at least on an annual basis when the DWMS Annual Report is prepared, or earlier upon significant system change.

Contents

Figures

Tables

1. Introduction

This DWMS Subplan applies to the management and operation of the Woodenbong / Muli Muli drinking water supply scheme and forms part of the Kyogle Council's DWMS.

The Element of the Australian Drinking Water Guidelines (ADWG) Framework which the section relates to is identified in the headings. Not all Elements are relevant for this Subplan.

2. Element 2 - Assessment of the Supply Scheme

2.1. Overview

The Woodenbong / Muli Muli supply scheme is serviced by a joint water supply agreement with Tenterfield Shire Council (TSC), consisting of the Urbenville WTP (constructed in 2010), serving approximately 600 persons (Kyogle LGA) and 400 persons (Urbenville township, Tenterfield LGA). Hand over occurs post treatment, therefore Kyogle Council only manages the risk for the reticulation for this scheme. Figure 1 shows the layout of the supply scheme.

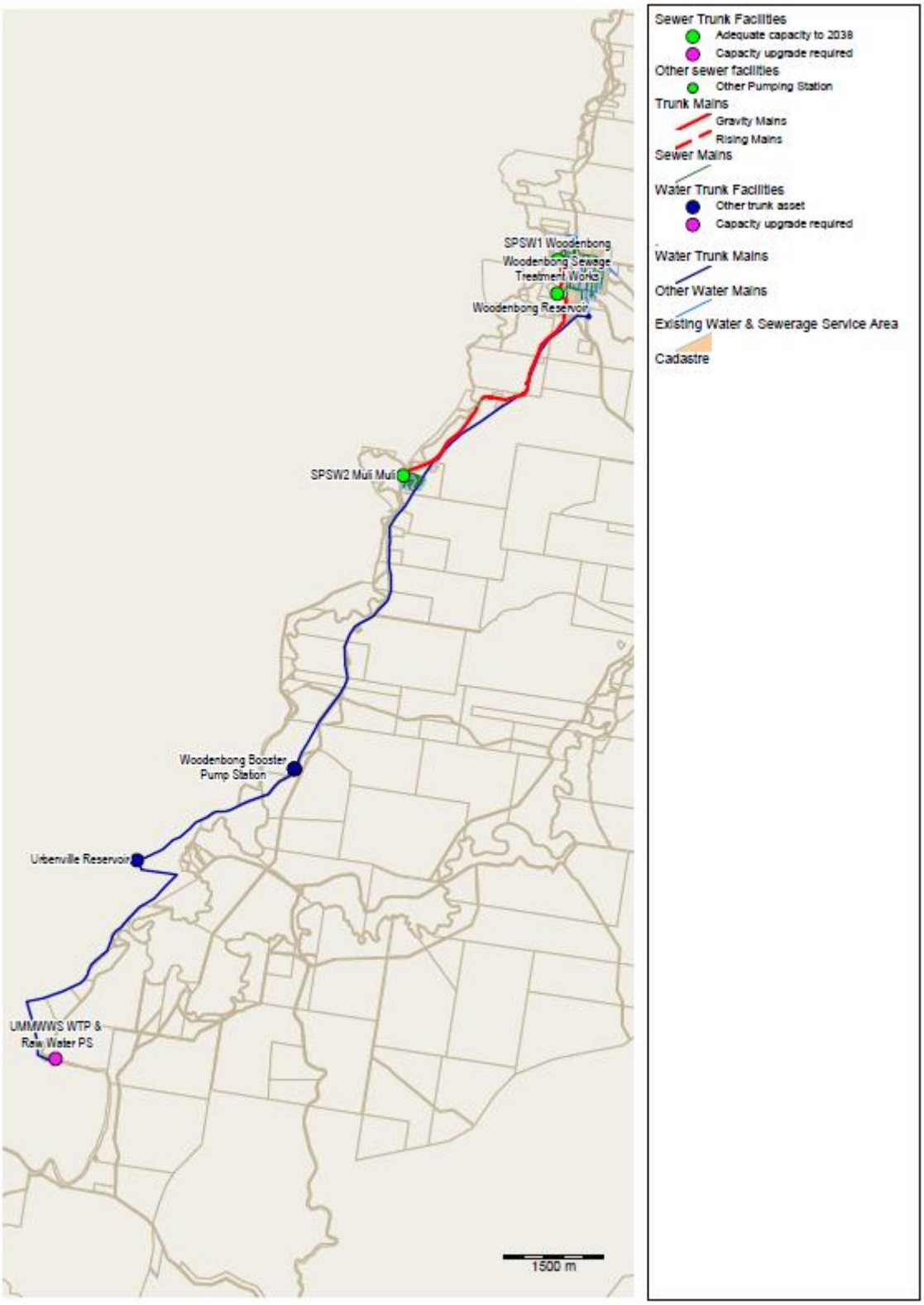


Figure 1 Woodenbong / Muli Muli Drinking Water Supply System Layout

Table 1 Overview of the Woodenbong / Muli Muli Drinking Water Supply System

Category	Detail
Water Source	Bulk treated water from the Urbenville WTP
Treatment Processes	Urbenville WTP (0.7 ML/day) – managed by TSC
Re-chlorination	Re-chlorination at the booster pump – managed by KC
Reservoirs	Woodenbong Reservoir 682 kL
Customers	KC Woodenbong - population of 400 (approx.) Muli Muli - population of 220 (approx.) TSC Urbenville - population of 280 (approx.)

2.2. Process Flow Diagram

The process flow diagram (PFD) or schematic of the Woodenbong / Muli Muli drinking water supply scheme is shown in Figure 2.

The schematic is reviewed annually when the DWMS Annual Report is compiled and updated if required.

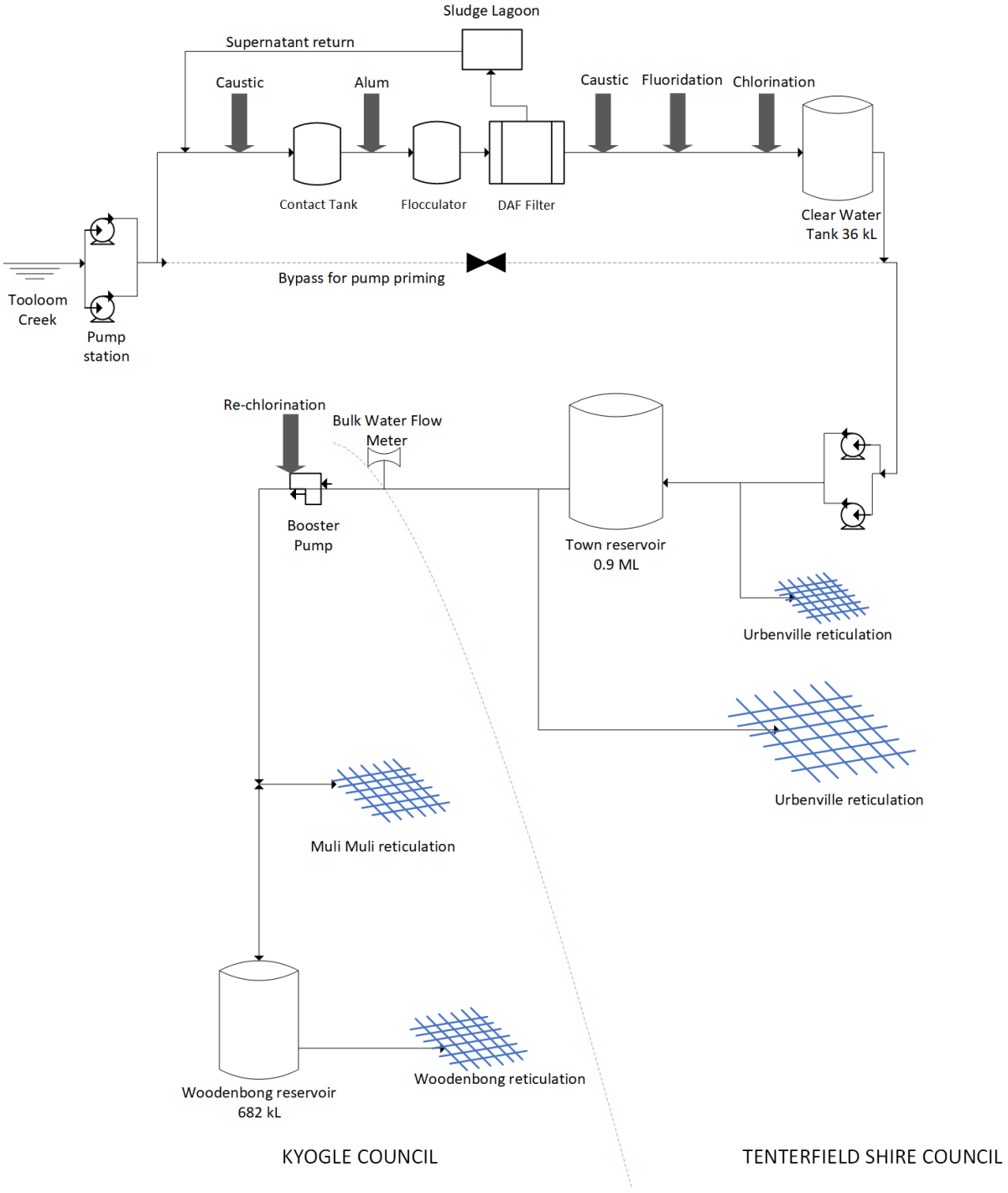


Figure 2 Woodenbong / Muli Muli Drinking Water Supply System Process Flow Diagram

2.3. Drinking Water Catchment

Water is sourced from Tooloom Creek. The catchment is not under the jurisdiction of Kyogle Council.

The land uses in the catchment include forestry, dairy and cattle grazing and other agricultural uses.

2.4. Water Treatment Process

The Urbenville WTP is managed by Tenterfield Shire Council, although under the supply agreement, some operational matters can be shared between KC and TSC (e.g. operators, if needed). The operators follow the Urbenville DWMS Subplan.

2.5. Rechlorination and Distribution

The Woodenbong / Muli Muli Water Supply System is summarised as:

- Hand-over point – bulk flow meter
- Booster Pump Station 12L/s
- Re-chlorination – managed by KC operators
- Woodenbong Reservoir 0.7ML
- 179 residential connections (Kyogle LGA)
- 68 non-residential mains (Kyogle LGA)
- 6km of reticulation mains (Kyogle LGA)
- 9.5km trunk mains (Kyogle LGA)
- Original construction 1965, WTP constructed 2010

2.6. Reservoir Integrity

Maintaining the integrity of the distribution system is an important barrier in keeping the supply safe from potential recontamination. This includes ensuring that the service reservoirs are not vulnerable to contamination, for example, by vermin, birds or rainwater runoff ingress.

Reservoirs are not classed as a CCP for Council supplies, however, a breach in integrity (e.g. evidence of vermin) will be reported to the PHU, as required by NSW Health and urgent corrective actions undertaken.

Operators use a checklist and undertake inspections every 6 months. Checklists are filled out for each inspection, and then uploaded and saved into the appropriate location.

Council undertakes reservoir cleaning in-house, and external contractors (e.g. divers) are engaged as required.

2.7. Risk Assessment

The original risk assessment was undertaken as a workshop in 2012, with updates made in 2018. Details are included in the Risk Register, available in Council's network drive relevant folder.

The Risk Register is comprehensively reviewed every 4 years. Operators play a crucial role in risk assessment and management and are part of the core risk assessment team.

3. Element 3 – Preventive Measures

3.1. Preventative Measures and multiple barriers

The preventative measures were identified and assessed during the risk workshop and have been documented, alongside the significant risks that they address, in the Risk Register.

The key barriers include: supply agreement and communication with TSC, re-chlorination, maintaining integrity of the distribution network and reservoirs and maintaining an adequate residual chlorine level in the network.

The SOPs document and explain implementation of preventive measures.

3.2. Critical Control Points

The CCPs were reviewed in October 2018, including identification of the CCPs using the combined knowledge of the risk team.

There are no CCPs assigned for the Woodenbong / Muli Muli scheme, as it is only distribution of bulk treated water received from Tenterfield Shire Council. However, the integrity of reservoirs is included as a very important operational check with reporting requirements to the PHU for breach (evidence of vermin).

4. Element 4 – Operational Procedures and Process Control

4.1. Operational Procedures

There are some SOPs available (refer to Section 4.1 of the DWMS Overall Manual). More SOPs are being developed by Council.

4.2. Operational Monitoring and Corrective Actions

Operational monitoring is conducted as detailed in Table 2. The results are recorded in appropriate recording sheets and transferred into excel spreadsheets. The corrective actions are also outlined in Table 2. This monitoring is conducted at the same time as when the microbiological samples are collected for verification monitoring (Section 5).

Table 2 Operational monitoring for the Woodenbong / Muli Muli supply

MONITORING LOCATION	PARAMETER	FREQUENCY	ACTION TRIGGER	CORRECTIVE ACTIONS
Reticulation (various sites)	Free Chlorine residual	Weekly	Outside 0.2-4 mg/L	Investigate cause, check disinfection CCP, check chlorine in reservoirs, check system integrity. Consult with Overseer for further action. Consider if any adjustment to treatment may be required. If <0.2 mg/L consider dosing chlorine in the reservoirs, if >4 mg/L – test total chlorine, if total chlorine is >5 mg/L then consult with PHU, consider draining reservoirs/flushing.
	Total chlorine	Weekly	>5 mg/L	Investigate cause, check disinfection, check chlorine in reservoirs. Consult with Overseer for further action. Consider if any adjustment to treatment may be required. Consult with PHU, consider draining reservoirs/flushing.
	pH	Weekly	Outside 6.5-8.5	Investigate cause, check disinfection CCP, check reservoirs. Consult with Overseer for further action. Consider if any adjustment to treatment may be required.
	Turbidity	Weekly	>5 NTU	Investigate cause, check for breaks, check incoming water quality, check reservoirs. Consult with Overseer for further action. Consider if any adjustment to treatment may be required.
	Temperature	Weekly	>25^{0}C	Ensure chlorine residuals are maintained at >0.5 mg/L if the temperature is continually >25^{0}C for 3-4 months.

MONITORING LOCATION	PARAMETER	FREQUENCY	ACTION TRIGGER	CORRECTIVE ACTIONS
All reservoirs	Reservoir integrity	Every 6 months	Issues identified in Reservoir Checklist	As per the incident response protocols.

4.3. Equipment capability and maintenance

The operators and Overseer ensure that any testing equipment is calibrated when required. Council has an existing SOP on calibration.

4.4. Materials and Chemicals

Chemicals used in the Woodenbong/Muli Muli scheme are listed in Table 3. Council has preferred suppliers for the purchasing of products. Council's supplier contracts include chemical quality compliance requirements. Council operators attend all chemical deliveries and obtain a certificate of analysis at the time of delivery for each batch of chemical supplied. SOP on chemical quality control has been developed and is available in Council's relevant shared network folder.

Table 3 Chemicals used in the Woodenbong/Muli Muli drinking water supply scheme

Chemical	Supplier	Contact
Sodium hypochlorite 13% solution	Elite Chemicals	1873 Lytton Road Lytton QLD 4178 (07) 3893 7500

5. Element 5 – Verification of Drinking Water Quality

5.1. Drinking water quality monitoring

NSW Health Drinking Water Monitoring Program provides ongoing independent verification of the treatment process. Frequency of sampling is based on population. The Program assesses 36 routine parameters for microbial, physical and chemical properties of the water.

Microbial samples are collected weekly and chemical samples are collected 6-monthly by Richland Water Laboratories (RWL) on Council's behalf from various sites and sent to the RWL and Lismore Pathology Laboratory operated by the North Coast Area Health Service.

Verification monitoring locations within the reticulation network were identified in consultation with the PHU to ensure appropriate representation of the system. The monitoring sites for the NSW Health Drinking Water Monitoring Program are:

- Beaury St (KG 03 001)
- Muli Muli (KG 03 002)
- Woodenbong Police Station (KG 03 003)

5.2. Consumer satisfaction

Where any water quality complaint is received directly by the operators, this should be reported so that it is logged into Council's records management system.

The Overseer ensures that the details are relayed back to the Council customer service staff.

5.3. Short term evaluation of results and corrective actions

Review of the results for the NSW Health Drinking Water Monitoring program is undertaken by the testing laboratory and any exceedance is notified by the laboratory to relevant Council staff and the local PHU.

Corrective actions for water quality incidents are discussed in Section 6.

6. Element 6 - Management of Incidents and Emergencies

Water quality incidents are managed as described in the incident response and reporting protocols, which is a separate document which forms part of the DWMS. This includes communication with TSC, where required.

Relevant incidents are recorded in the Incident Action Recording Form (for water and sewerage) to capture incidents and outcomes. The form is filled out by operators and sent to the Urban Services Manager. The Fluoride Code of Practice is followed for fluoride related incidents.

The need to issue (and withdraw) a boil water alert is assessed in consultation with the local PHU (explained in the incident response protocols). Management of the significant incidents and emergencies is covered by Council's Emergency Management Plan (DISPLAN).

Operators are also encouraged to discuss water quality issues and improvements with the Overseer/Urban Services Manager as relevant.

7. Element 7 - Employee Awareness and Training

Operators are encouraged to discuss any additional or further training needs with the Overseer.

8. Element 9 – Research and Development

8.1. R&D Projects

Research is undertaken for the water scheme as identified during risk assessments to increase understanding of the system.

Operators are encouraged to take part in any research and also to discuss any relevant research idea with the Overseer/Urban Services Manager.

8.2. Primary Disinfection Contact Time

This is managed by Tenterfield Shire Council at the Urbenville WTP.

9. Element 10 - Documentation and Record Keeping

This DWMS Subplan documents information pertinent to drinking water quality management for the Woodenbong / Muli Muli water supply.

Operators are aware of these documents and implement them.

10. Element 12 - Continual Improvement

Operators are encouraged to discuss and notify upwards to the Overseer/Urban Services Manager on the need for any improvement to drinking water quality management practices.

Appendix D – Critical Control Points

Critical Control Points (CCPs) are activities, procedures or processes where the operator can apply control, and are essential processes in reducing risks to an acceptable level.

In order to define acceptable from unacceptable performance at each point, target levels, alert levels and critical limits have been identified for Council's drinking water supply systems.

Three different limits have been set for each CCP within Council's drinking water supply systems:

- *Target Level:* representing day to day operational limits and procedures. This is what is to be achieved
- *Alert Level:* deviation to this level indicates a trend towards loss of control and corrective actions should be immediately taken to resolve the problem and restore control to the drinking water supply system
- *Critical Limit:* deviation from the critical limit indicates loss of control and the potential of unacceptable health risks. If the critical limit is exceeded, corrective actions should be immediately activated, and the PHU notified immediately.

The CCPs were reviewed in 2018/19, including identification of the CCPs using the combined knowledge of the risk team.

The summary of the CCPs is shown in Table 1.

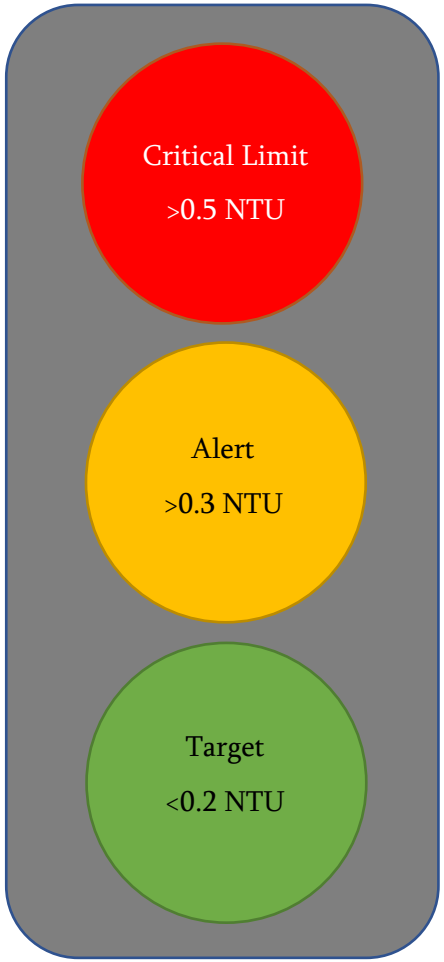
Table 1 CCPs for the KC drinking water supply schemes

Parameter	Location	Frequency	Target	Alert Level	Critical Limit	Justification
CCP Filtration (Kyogle, Bonalbo)						
Turbidity	Filter outlet	Daily / continuous	<0.2 NTU	>0.3 NTU	>0.5 NTU	Critical limit is set to ensure protozoa control and effectiveness of disinfection.
CCP Disinfection (Kyogle)						
Chlorine residual (free)	Final water - WTP outlet	Daily / continuous	1.85 mg/L	<1.0 or > 2.5mg/L	<0.5 or > *4 mg/L	Critical limit ensures adequate C.*t.* Target value ensures around 0.2 mg/L at network extremities. *If free chlorine is 4 mg/L then total chlorine should be tested and if total chlorine is >5 mg/L, the PHU must be notified. Upper chlorine limit is for precautionary purposes only to avoid overdosing.
CCP Disinfection (Bonalbo)						
Chlorine residual (free)	Mains Water (from reservoir)	Daily / continuous	0.5 – 1.0 mg/L	<0.3 mg/L	<0.2 or > *2 mg/L	Critical limit ensures adequate C.*t.* Target enables at least 0.2 mg/L at network extremities. Target may need to be run at a higher value at times (e.g. summer) to ensure chlorine residual is maintained in the network. Upper chlorine limit is for precautionary purposes only to avoid overdosing.

The CCPs procedures are shown below.

CCP1 – Filtration (Kyogle, Bonalbo)

What is being measured?	Post filter turbidity
Where/how is it measured?	Filtered water turbidity, Continuous / Grab Sample (Daily)
What is the control point?	Filtration
What are the hazards?	Pathogens (protozoa), turbidity



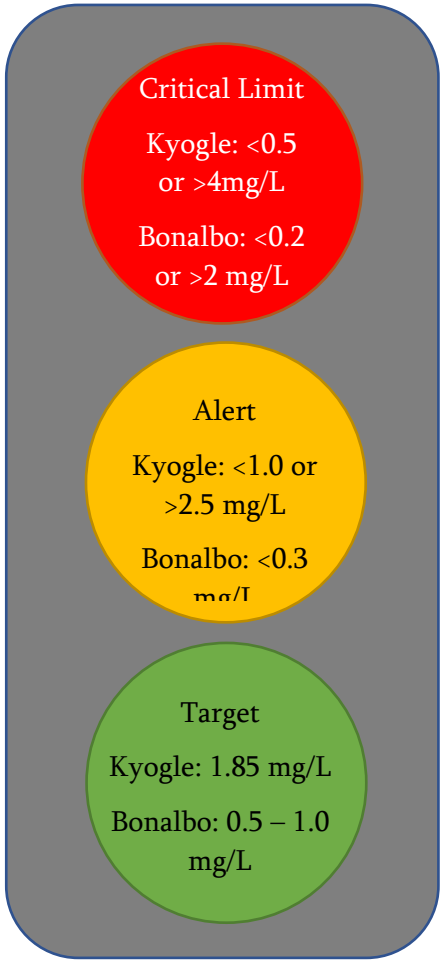
- Inform Overseer / Manager as soon as possible
- Repeat corrective actions from alert level
- Consider shutting down plant
- Check turbidity and chlorine residual in the reservoirs and reticulation
- Increase monitoring until system conforms
- Fill in the Incident Action Record Form (for water and sewerage) and provide to the Manager as soon as possible.
- The Manager must inform and consult with NSW Health PHU and DOIW
- Consider need to issue a boil water alert in consultation with the PHU.

- Re-test to verify result
- Check status of backwash, backwash if required
- Check status of coagulation and flocculation processes, adjust using jar testing as required
- Inform Overseer/Manager as required
- Increase monitoring until system conforms
- Maintain records as relevant.

- Daily plant checks and duties
- Daily process and treated water monitoring

CCP2 – Disinfection (Kyogle, Bonalbo)

What is being measured?	Chlorine residual (mg/L)
Where/how is it measured?	Kyogle: finished water leaving WTP; Bonalbo: mains water from reservoir
What is the control point?	Disinfection
What are the hazards?	Pathogens (chlorine sensitive)



- Inform Overseer / Manager as soon as possible
- Repeat corrective actions from alert level
- Consider shutting down plant
- Check chlorine residual in the reservoirs and reticulation
- Increase monitoring until system conforms
- Fill in the Incident Action Record Form (for water and sewerage) and provide to the Manager as soon as possible.
- The Manager must inform and consult with NSW Health PHU and DOIW
- Consider need to issue a boil water alert in consultation with the PHU.

- Re-test to verify result
- Thoroughly inspect system to ensure no issues (injection pipe break, dosing meter fault, dosing meter or line clog, sufficient chemical available, check raw water turbidity etc).
- Rectify the issue as relevant.
- Adjust the chlorine dose
- Inform Overseer as required
- Increase monitoring until system conforms
- Maintain records as relevant.

- Daily plant checks and duties
- Daily process and treated water monitoring

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