



Urbenville Water Supply

DWMS Subplan

March 2021



Urbenville Water Supply

DWMS Subplan

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Executive Summary

The Drinking Water Management System (DWMS) demonstrates Tenterfield Shire 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

There is an overall DWMS Manual which contains or references the overarching elements common to the management of drinking water quality for all TSC supplies.

DWMS Subplan – Urbenville Water Supply

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

Critical Control Points

Urbenville water supply critical control points (CCPs) are included in this document. The corrective actions for managing CCP breaches are included in the relevant CCP standard operating procedures (SOPs), which are also included in this document.

Drinking Water Quality Incidents

Drinking water quality incidents and emergencies are managed through the Drinking Water Quality Incident Response Plan.

Improvement Plan

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

Document Review

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

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Document History and Status

Revision	Date	Reviewed by	Initials	Details
0.1	06/11/18	Tasleem Hasan	TH	Subplan created following 2018 DWMS review workshop facilitated by Viridis.
1.0	5/12/18	Gillian Marchant Melissa Blum	GM MB	Review of the updated DWMS Subplan
1.1	29/3/21	Tasleem Hasan	TH	Section 3.2 updated - CCP procedures updated to include the revised reporting to PHU process.

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1. Introduction

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

2. Element 2 – Assessment of the Supply Scheme

2.1. Overview

Tenterfield Shire Council manages the Urbenville township drinking water supply system. The Urbenville Water Treatment Plant (WTP) is a conventional water treatment plant located next to the Tooloom Creek intake, on Tooloom Falls Road, Urbenville. The Urbenville WTP treats water from the Tooloom Creek and distributes it through a network of reticulation to consumers.

Bulk water is also supplied to both Woodenbong and Muli Muli in Kyogle Council area by pipeline under a water supply arrangement. Muli Muli and Woodenbong are approximately 9 km and 13 km north east of Urbenville respectively.

Table 1 Overview of the Urbenville Drinking Water Supply System

Category	Detail
Water Source	Tooloom Creek
Treatment Processes	Urbenville WTP (0.75 ML/day): <ul style="list-style-type: none"> • Coagulation • Flocculation • DAF Filtration • pH correction • Chlorination • Fluoridation
Reservoirs	One reservoir with 0.9 ML (less than 2 days) storage
Customers	Township of Urbenville - population of 450 (approx.) Average demand of 0.28ML/day Villages of Woodenbong and Muli Muli - population of 550 (approx.) Average demand of 0.18 ML/day

2.2. Process Flow Diagram

The process flow diagram (PFD) or schematic of the Urbenville drinking water supply scheme is shown in Figure 1.

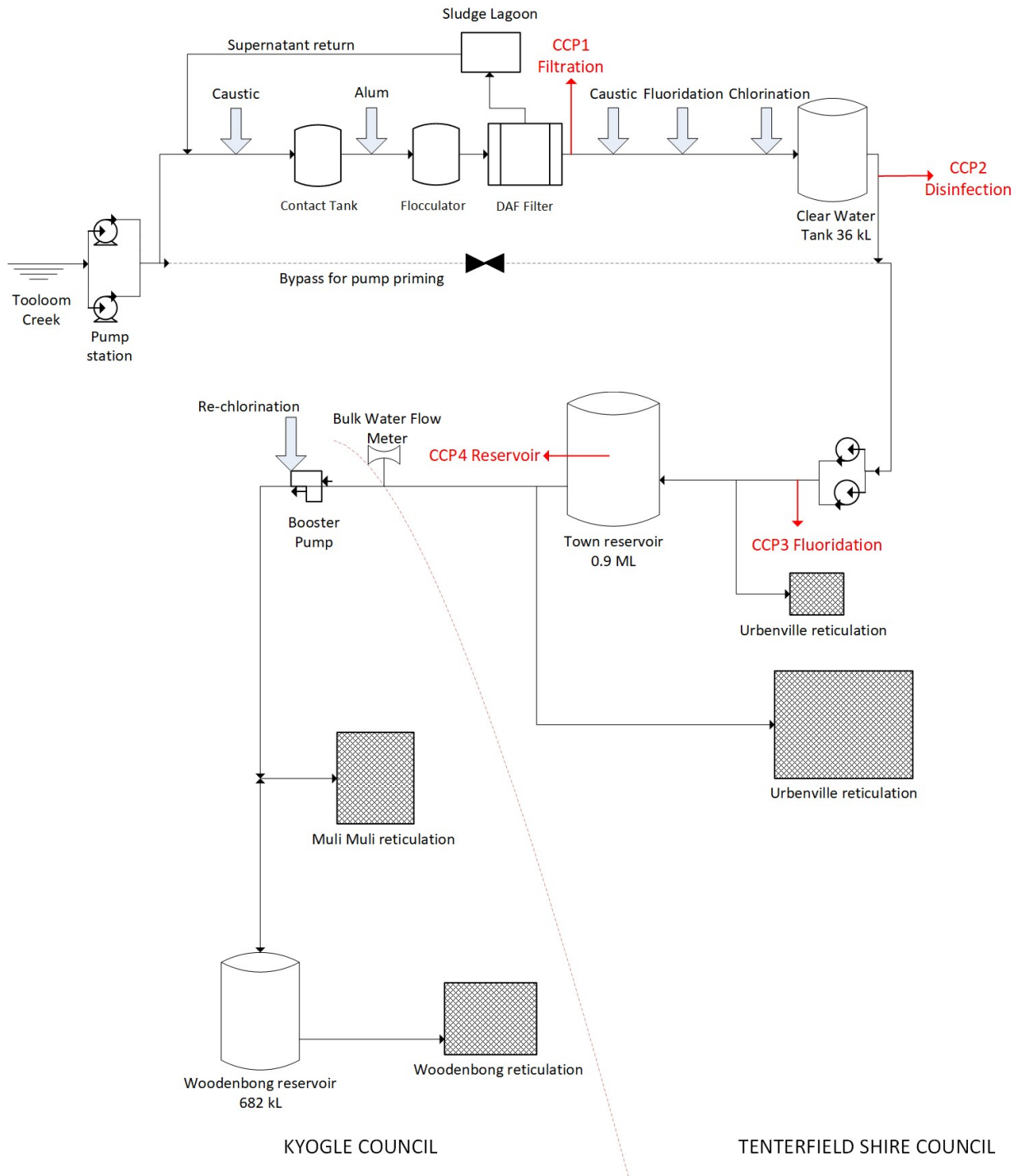


Figure 1 Urbenville DWSS process flow diagram

2.3. Drinking Water Catchment

Tooloom Creek in northeast NSW starts at an elevation of 399 m and ends at an elevation of 197 m flowing into the Clarence River. The creek drops around 202 m over its 68.2 km length.

The creek is relatively shallow and there have been algal outbreaks reported during periods of drought. The creek water quality is generally poor and turbidity can change rapidly.

The creek is affected by both drought and flood. The main land-use in the catchment is cattle grazing. Dead cattle have been reported in the creek occasionally, but these are removed by the farmers as soon as possible.

2.4. Water Treatment Process

Raw water is sourced from Tooloom Creek, at the Urbenville weir pool and treated before distribution. The intake pipe has a coarse screen and is surrounded by a protective cage. Although the pool has a natural capacity of 240 ML, the effective storage capacity of the pool is approximately 160 ML.

The Urbenville WTP was commissioned in August 2010. The WTP has a hydraulic capacity of 1.5 ML/day and has been designed to operate at a minimum and maximum flow rate of 0.3 and 0.75 ML/day respectively. The WTP is connected to a Supervisory Control and Data Acquisition (SCADA) system which allows remote access to the operation of the plant. The WTP has been designed to start and stop automatically depending on the treated water level in the clear water tank, which is 36 kL. The WTP will automatically stop in the event of a failure in the treatment or flow within the system. The water supply schematic is shown in Figure 1.

The treatment process at the Urbenville WTP comprises the following process steps:

- raw water is dosed with caustic then enters a contact tank, to allow for sufficient pH adjustment
- pH adjusted water is then dosed with alum, and flows to the flocculation chamber where flocculation and coagulation occurs
- the process water then enters the dissolved air flotation and filtration (DAFF dual media) unit
- caustic is dosed again after the DAFF unit for pH adjustment
- filtered water is then dosed with chlorine to for disinfection
- disinfected water is then fluoridated

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

2.5. Distribution

The Urbenville distribution network is comprised of the Tooloom Creek Pump Station, one service reservoir (0.9 ML) and 9.9 km of water mains. Bulk water is also supplied to both Woodenbong and Muli Muli by pipeline under a water supply arrangement with Kyogle Council.

There is no regular flushing program in place, and there are no reported issues with mains/pipe breaks. Backflow has not reported as an issue by Council.

2.6. Risk Assessment

The original risk assessment was undertaken as a workshop in 2013 and details included in the Risk Register (excel spreadsheet), available in Council's shared network drive relevant folder. The Risk Register is reviewed periodically.

A risk review of the unacceptable residual risks from 2013 was undertaken in August 2018 as part of the DWMS review process and the Risk Register updated accordingly. Operators play a crucial role in risk assessment and management and are part of the core ongoing risk assessment team.

3. Element 3 – Preventive Measures

3.1. Preventative Measures and multiple barriers

The preventive 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: treatment process steps, maintaining integrity of the distribution network and reservoir and maintaining an adequate residual chlorine level in the network.

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 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 August 2018, with consensus from the combined knowledge of the risk team.

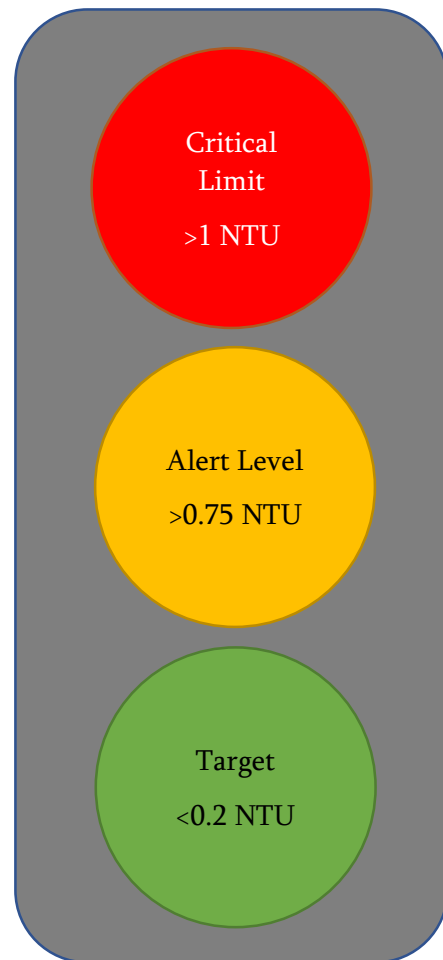
The CCP and CCP SOPs for the Urbenville supply are included below and is summarised in Table 2.

Table 2 Urbenville drinking water scheme Critical Control Points (CCPs)

CCP	Control Parameter	Location	Target	Alert Level	Critical Limit	Justification
Filtration	Turbidity	Out of filters	<0.5 NTU	>0.75 NTU	>1.0 NTU	Critical limit is set to ensure effectiveness of disinfection. Interim value, needs to be revised in future to ensure protozoa control.
Disinfection	Free chlorine	CWT outlet	2.5 mg/L	<1.8 or >3.0 mg/L	<1.0 mg/L	Critical limit ensures adequate C.t and having at least 0.2 mg/L at network extremities.
Fluoridation	Fluoride	WTP Outlet	1.0 mg/L	<0.9 or >1.1 mg/L	>1.5 mg/L	Critical limit is set to ensure compliance with ADWG health-based target for fluoride.
Reservoir	Integrity	Reservoirs	No breach	Poor reservoir condition	Evidence of vermin	NSW Health advice and guidance

3.2.1. Procedure: Urbenville Filtration CCP

What is being measured?	Post filter turbidity
Where/how is it measured?	Filtered water turbidity (combined) – continuous (online)
What is the control point?	Filtration
What are the hazards?	Pathogens, turbidity



- Confirm that the turbidity was >1 NTU for > 15mins. If the turbidity spike shows >1.0 NTU for >15 mins, then it is/was a CCP critical limit breach.
- Report to the PHU ASAP. See the Drinking Water Incident Response Plan for further details on the reporting process.
- Repeat corrective actions from alert level (below)
- Consider shutting down plant
- Check turbidity and chlorine residual in the reservoirs and reticulation
- Increase monitoring until system conforms
- Reporting/records: See the Drinking Water Incident Response Plan for further details on the reporting process. Fill in the Water quality incident reporting form. Call the NSW Health PHU (EHO on duty on 02 6764 8000). DPIE Water can be contacted for operational advice.

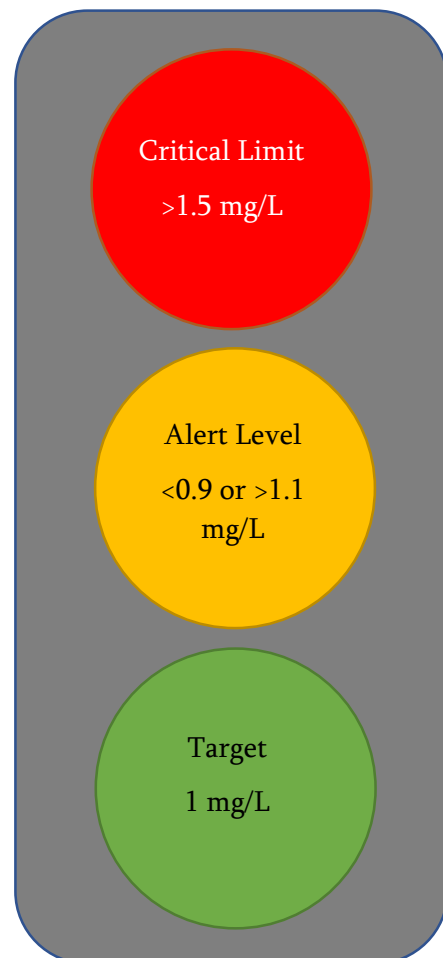
Alert Level

- Confirm result. If the turbidity spike shows >0.75 NTU for >15 mins, then it is an alert limit breach.
- Re-test immediately to verify result.
- Check calibration records and re-calibrate test equipment if required.
- Undertake an investigation to find the cause for increased turbidity.
- Check status of backwash, backwash if required
- Check status of coagulation and flocculation processes, adjust using jar testing as required
- Inform Supervisor/Manager as soon as possible
- Increase monitoring until system conforms.
- Maintain records as relevant.

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

3.2.2. Procedure: Urbenville Fluoridation CCP

What is being measured?	Fluoride (mg/L)
Where/how is it measured?	WTP outlet – continuous (online)
What is the control point?	Fluoridation
What are the hazards?	Fluoride



- Report to the PHU ASAP. See the Drinking Water Incident Response Plan for further details on the reporting process.
- Repeat corrective actions from alert level (below)
- Turn off fluoride dosing plant.
- Check fluoride in reticulation to ensure it is not > 1.5 mg/L.
- Follow Fluoride Overdose Response Plan in NSW Code of Practice for the Fluoridation of Public Water Supplies and in Councils DWQ Incident Response Plan.
- Fill out Form 5 from NSW Code of Practice for the Fluoridation of Public Water Supplies
- Reporting/records: See the Drinking Water Incident Response Plan for further details on the reporting process. Fill in the Water quality incident reporting form. Call the NSW Health PHU (EHO on duty on 02 6764 8000). DPIE Water can be contacted for operational advice.

Alert Level

- Re-test immediately to verify result.
- Check fluoride dosing unit.
- Recalibrate fluoride meter.
- Perform drop test on fluoride dosing pumps and adjust stroke as required.
- If > 1.1: Check natural fluoride levels, Decrease dose, as relevant.
- If < 0.9: Check for clumping in fluoride tank and break up clumps to ensure adequate batching concentration, Increase dose, as relevant.
- Troubleshoot system to find problem and implement corrective actions.
- Increase monitoring until system conforms.
- Maintain records as relevant.

- Daily delivery water fluoride monitoring
- Weekly fluoride reticulation monitoring: enter results into NSW Health database
- Daily:
 - check fluoride plant, batch fluoride day tank, fill out fluoride log, fill out forms as per NSW Code of Practice for the Fluoridation of Public Water Supplies
- Weekly:
 - calibrate fluoride meter, stocktake chemical, fluoride calculations

3.2.3. Procedure: Urbenville Chlorination CCP

What is being measured?	Chlorine residual (mg/L)
Where/how is it measured?	Chlorine: First Customer – Grab sample (daily)
What is the control point?	Disinfection
What are the hazards?	Pathogens (chlorine sensitive)

Critical Limit
Free chlorine:
<1 mg/L

- Report to the PHU ASAP. See the Drinking Water Incident Response Plan for further details on the reporting process.
- Repeat corrective actions from alert level (below)
- Consider shutting down plant.
- Check chlorine residual in the reservoirs and reticulation.
- Reporting/records: See the Drinking Water Incident Response Plan for further details on the reporting process. Fill in the Water quality incident reporting form. Call the NSW Health PHU (EHO on duty on 02 6764 8000). DPIE Water can be contacted for operational advice.

Alert Limit
Free chlorine:
<1.8 mg/L or >3 mg/L

Alert Level

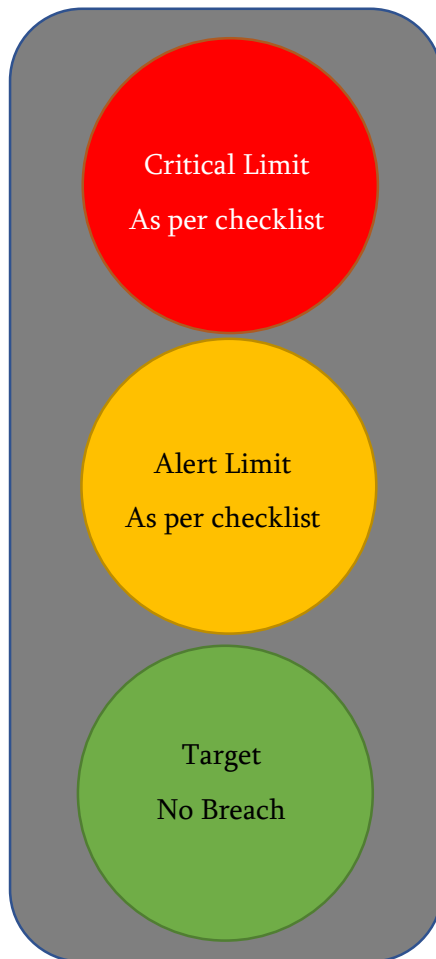
- Re-test immediately to verify result.
- Check calibration records and re-calibrate test equipment if required.
- Adjust chlorine dosing as necessary.
- Detailed inspection of the chlorine dosing system to fix any issues.
- Rectify the issue as relevant.
- Inform Supervisor as soon as possible
- Increase monitoring until system conforms.
- Maintain records as relevant.

Target
Free chlorine:
2.5 mg/L

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

3.2.4. Procedure: Urbenville Reservoir CCP

What is being measured?	Integrity of Reservoirs as per the Reservoir Inspection Checklist
Where/how is it measured?	Reservoirs - Weekly (visual), Monthly (detailed using the checklist), Event based – visual following a significant storm/high winds
What is the control point?	Reservoirs
What are the hazards?	Pathogens, contaminants.



- Report to the PHU ASAP. See the Drinking Water Incident Response Plan for further details on the reporting process.
- Isolate reservoir, if possible
- Remove source of contamination and/or repair asset.
- Repeat corrective actions from alert level (below).
- Bring storage back into service with the approval of the Manager.
- For long repair times, increase operational monitoring frequency.
- Review current security measures and procedures.
- Reporting/records: See the Drinking Water Incident Response Plan for further details on the reporting process. Fill in the Water quality incident reporting form. Call the NSW Health PHU (EHO on duty on 02 6764 8000). DPIE Water can be contacted for operational advice.

Alert Level

- Repair asset
- If possible, take immediate action to rectify breach
- If unable to immediately repair, report breach to supervisor/manager
- Undertake testing of chlorine residual and consider micro test
- Manually dose reservoir or increase dosing at the plant and retest chlorine residual
- Review current security measures and procedures
- Maintain records as relevant

- Undertake regular reservoir inspections
- Ensure integrity is not compromised

3.2.5. Reservoir Inspection Checklist

Frequency: Weekly – visual, Monthly – using this checklist

If any question (Q) is marked “No” it means follow up action needs to be undertaken, the Supervisor/Manager should be contacted as soon as possible. Notify PHU ASAP for ‘No’ to Q1.

TARGET	ALERT	CRITICAL
No Breach	Site or reservoir condition poor. “No” for Q2 – Q6.	Evidence of vermin. “No” for Q1.

Drinking water supply: _____ Inspection date: _____

Reservoir name: _____ Inspected by: _____

Question	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Comments
1. The reservoir (inside) is free from evidence of vermin e.g. birds, possums or other animals)? (no feathers, no start of a nest etc.).			
2. The reservoir and its roof are secure from entry by vermin? (i.e. no open holes/gaps or damaged screens)			
3. The reservoir is secure from entry of rainwater from roof runoff? (i.e. no leaks or holes in the roof, inspection hatch has a raised lip).			
4. Reservoir wall generally in good condition? (i.e. no leaks, major cracks, vegetation growth)			
5. Security measures, as relevant, are intact? (i.e. fence and gate closed, access ladder locked).			
6. Roof platforms, walkways, handrails, as relevant, in good condition?			

Additional notes (if any):

Follow up required by Supervisor:

☐ Yes

☐ No

Notify PHU for Critical breach

Follow up action/s:

Signature (date/time): _____

4. Element 4 – Operational Procedures and Process Control

4.1. Operational Procedures

Key SOPs available currently for use by operator are for all CCPs and reservoir inspection (refer to Section 3.2)

Other SOPs available are identified in the overall DWMS.

4.2. Operational Monitoring and Corrective Actions

Operational monitoring is conducted by Council for the Urbenville scheme in accordance with the Urbenville Water Treatment Plant Log Sheet. This sheet includes the targets (or action triggers) for general key operational monitoring parameters. Corrective actions are then undertaken by the operators such as jar tests, process checks, dosing adjustments, investigations upstream of process, consultation with the supervisor (DPIE Water inspector, if needed).

Corrective of for CCPs are included in the CCP procedures as outlined in Section 3.2.

4.3. Inspection, Calibration and Maintenance

Inspections are undertaken by operators to check the functioning of the equipment and assets. Table 3 summarises the general schedule of the inspections for the Urbenville supply scheme.

Table 3 Inspection Schedule

Activity	Frequency
Check all equipment at the WTP	Daily
Check raw water pumps	Monthly
Checks at reservoirs	Weekly (visual), monthly using the reservoir checklist
Leak detection	As required

Calibrations are undertaken periodically in house for benchtop monitoring equipment. Inline testing equipment is calibrated annually by external contractors. The operators and supervisor ensure that any testing equipment is calibrated when required. Checklists and recordings of calibrations results, including frequency of calibration are used.

4.4. Materials and Chemicals

At the Urbenville WTP, there are labels on filling points and storage areas to ensure correct delivery. Visual inspections are conducted on all chemicals when received. TSC receives a certificate of analysis from chemical suppliers. The SOP for chemical procurement is under development.

Table 4 Chemicals used in the Urbenville drinking water supply scheme

Chemical	Purpose	Procurement*
Alum	Coagulation	Omega
Chlorine	Primary Disinfectant	Omega
Sodium Fluoride	Fluoridation for dental health	Redox
Caustic	pH adjustment	Omega
*Supplier subject to change		

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 monthly and chemical samples are collected twice a year in Urbenville by Council's Water Operator from various sites and sent to the Richmond Water Laboratories for testing. In addition, Urbenville is tested weekly by Kyogle Council. Urbenville results are uploaded under Kyogle Council in the NSW Health database, however the laboratory sends results to TSC also, and TSC maintains an in-house spreadsheet.

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 at the Doctors surgery.

5.2. Consumer satisfaction

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

The Supervisor should ensure that the details are relayed back to the Council customer service staff.

5.3. Short-term evaluation of results and corrective actions

Water operators undertake short term review of water quality results/data against the targets/limits and enter operational data into log sheets, corrective actions are undertaken 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.

Water quality incidents are managed as explained in Section 6. The communication and reporting lines are described in the relevant SOPs.

6. Element 6 - Management of Incidents and Emergencies

Water quality incidents are managed according to the *Drinking Water Quality Incident Response Plan* (separate document). The protocols are based on the NSW Health Response Protocols.

Relevant incidents are recorded in the water quality incident reporting form, included in the Plan.

Water staff use this form to record incidents, as relevant.

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

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

7. Element 7 - Employee awareness and training

Operators are encouraged to discuss any additional or further training needs with their supervisor.

8. Element 9 – Research and Development

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 Supervisor/Manager.

8.1. Effectiveness of Disinfection

The effectiveness of disinfection depends on several factors. The concentration of the disinfectant, contact time, turbidity, temperature and pH can provide useful indication of microbial quality control. For effective chlorination, the turbidity should be <1 NTU and pH <8.

The *C.t* concept describes the relative effectiveness of a specific disinfectant against different microorganisms under specified conditions. It is determined by multiplying the concentration of residual disinfectant (in mg/L) by the contact time (in minutes). *C.t* values for inactivation of bacteria and viruses are highly dependent on the temperature and pH of the water. *C.t* values for specific organisms exposed to particular disinfectants have been established through laboratory experiments.

In order to calculate the *C.t* for a drinking water scheme, a few elements of the system are needed, including volume of storage at lowest normal operating water level, peak flow rate, baffling factor, target free chlorine residual at first customer point or tee on system with distribution mains.

Caution should be used in applying *C.t* values to disinfection practice in the field due to several reasons, for e.g. laboratory data obtained under ideal conditions do not always relate to field conditions (ADWG 2011).

Generally in clean water, a residual chlorine level of 0.5 mg/L after a contact time of 30 minutes should be sufficient to ensure microbial control, given a clean distribution system and no significant recontamination (ADWG 2011).

This suggests that a minimum *C.t* of 15 mg.min/L is required.

8.2. C.t calculation

A simple C.t calculation has been done for the Urbenville scheme using the following information:

- the clear water tank is 36 kL, and the lowest operating level is 65% of geometric volume
- the minimum residual used is 1 mg/L
- peak water demand is 460 kL/day (based on Town consumption data from June 2013 to March 2018)
- a baffling factor of 0.3 (poor, separate inlet/outlet, no baffles) is used. Treated water also sits in the clear water tank until called for by the town water reservoir.

$C.t = [\text{chlorine residual mg/L}] \times \text{contact time mins}$

Contact time = $V / \text{peak flow} \times \text{BF}$ where V is the volume of pipe

Based on the above information, the contact time is 21.9 mins.

$C.t = 1.0 \times 21.9$

$C.t = 21.9 \text{ mg.min/L}$, which is adequate.

Increasing detention time within the clear water tank via the installation of baffles can be investigated as an additional measure (part of the Improvement Plan).

9. Element 10 - Documentation and Record Keeping

This DWMS Subplan, including the CCPs and SOPs documents information pertinent to drinking water quality management for the Urbenville water supply.

Operators are aware of these documents and implement them.

10. Element 12 - Continual Improvement

Operators are encouraged to discuss and notify upwards (e.g. Supervisor or Manager) on the need for any improvement to drinking water quality management practices.

The key major improvement for the Urbenville supply (which is part of the Improvement Plan) is to:

investigate solutions/options for the filter breakthrough issue at the Urbenville plant and rectify it. DoI Water is providing some advice with this. The Safe and Secure funding will be investigated also.



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A decorative graphic at the bottom of the page consisting of a solid dark blue wave-like shape with thin white curved lines above it.