

Water Quality Requirements for commissioning assets in contact with Potable Water or Class A Recycled Water

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1 Purpose

The purpose of this document is to ensure newly commissioned assets that will be in contact with drinking water or Class A recycled water, conform to Barwon Water's legislative requirements to provide safe, clear water that is free from objectionable taste and odours.

The Australian Drinking Water Guidelines 2011 (ADWG 2011), Victorian Safe Drinking Water Act 2003 and Safe Drinking Water Regulations 2015 prescribe that water authorities must develop and maintain a water quality risk management plan for the entire water supply system. This document forms part of Barwon Water's water quality risk management plan. Following the requirements outlined in this document will reduce the risks associated with commissioning of assets in contact with drinking water or Class A recycled water, and ensure that all steps to reduce hazards and potential contamination have been undertaken, thereby verifying that the supplied water is safe and compliant with the relevant standards prior to being accepted into service.

This document has been written to enable a Barwon Water Responsible Officer to communicate these requirements and provide approval to connect new assets to the existing water network and bring them into service. The requirements contained in this document have been written based on the control of risks where the cleaning/disinfection process and completion of the commissioning checklists (Appendix A, B and C) is equally important as the end point verification results. Planning of the commissioning process is important to meet these requirements.

The commissioning requirements have been arranged in sections according to asset type. Refer to the relevant section of this document accordingly.

Note: All references within the document to "Barwon Water Responsible Officer" shall be taken to be the Contract Administrator.

2 Scope

This document details requirements for the commissioning of newly constructed assets in contact, or likely to be in contact, with potable water or Class A recycled water. This includes, but is not limited to water mains and water tanks. Compliance with these requirements is achieved by adhering to the standards as described in the following documents:

- Water Supply Code of Australia WSA03-2011-3.1 (Appendix I Disinfection of water mains, Water quality compliance specifications),
- MRWA Specification No. 04-02-2.1 Construction and Connection of New Drinking Water & Non Drinking Water Mains,



- American Water Works Association Standard for Disinfection of Water Storage Facilities C652-02 2011,
- Australian/New Zealand Standard (AS/NZS 4020:2005) Testing of products for use in contact with drinking water,
- Australian/New Zealand Standard (AS/NZS 3500:2003) Plumbing and Drainage,
- WSA 03-2011 Water Supply Code of Australia Version 3.1, and
- Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (2008)

3 Approved Products

All products and assets that will be, or are likely to be in contact with drinking water, must comply with the *Australian/New Zealand Standard: Testing of products for use in contact with Drinking Water* (AS/NZS 4020:2005). The standard specifies the requirements for the suitability of all items including pipes, fittings, components, and materials used in coating, protection, lining, joining, sealing and lubrication applications, in the water supply and plumbing industry. For products in contact with Class A recycled water, the *WSAA Water Supply Code of Australia, Australian Guidelines for Water Recycling* and MRWA approved products list shall be followed.

No contaminated material or any material capable of supporting growth of microorganisms shall be used within the assets. Materials or gaskets must be handled in a manner which avoids contamination. The jointing lubricant used must be an approved product and delivered to the site in closed containers which are to be kept in a clean condition at all times.

3.1 Approved Chemical Requirements

Barwon Water has adopted its own quality assurance principles for the addition of chemicals, based on risk management principles outlined in Chapter 8 of the ADWG 2011. Any residual amount of chemicals, by-products of their reactivity or minor contaminants in their formulation must not pose an unacceptable health risk through the water supply. Barwon Water has adopted these principles for the derivation of chemical specifications and specific impurity limits.

The disinfectant used needs to be an approved chemical for water treatment by the NMHRC (ADWG, 2011) and shall contain no soluble materials or organic substances in quantities capable of producing deleterious or injurious effects on the health of those consuming water that has been treated properly, and shall not cause the treated water quality to exceed ADWG 2011 water quality standards.



Contractors shall ensure that the supplier of the disinfection product provides a certificate of compliance and ensures the product adheres to the product specification. Refer to Figure 1, Barwon Water's Sodium Hypochlorite Specification, as an example below. The reference document for the full product specification for these chemicals is the Chemical Product Specification - Chemical Services Management (A11434592). This document will be provided to external parties on request to <u>waterquality@barwonwater.vic.gov.au</u>.

Description	Specification		
General	Pale, yellow-green liquid, containing no large		
	lumps, crystals or foreign matter		
Available Chlorine	>12.5% w/v		
Free Alkalinity	0.5 – 1.0% w/v		
Insoluble matter	<0.5% w/w		
Impurity	Maximum Impurity Content (mg/Kg)		
Cadmium	5		
Mercury	2.5		
Manganese	250		
Iron	750		
Nickel	50		

Figure	1:	Example	Specification	(Sodium	Hypochlorite)
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4 Laboratory Samples

Upon completion of flushing/disinfection of the new asset (procedure based on project specific requirements), water samples shall be taken and analysed by an independent National Association of Testing Authorities (NATA) registered laboratory to ensure compliance to water quality parameters. A representative sample from the feed water supplied to fill the asset is to be collected to compare water quality parameters.

For a list of water quality parameters required for analysis, refer to Section 10. The contact details of the independent NATA certified laboratory used by Barwon Water have been provided below:

ALS Water 16 Crown Street South Geelong VIC 3220 <u>https://www.alsglobal.com/au</u> (03) 5246 9403

Alternative NATA approved laboratories are acceptable, however any suggested alternatives must be listed as approved drinking water analysts and laboratories by the Department of Health and Human Services (DHHS) Victoria. Refer to the following website for details: <u>http://www.health.vic.gov.au/environment/water/d-guidelines.htm</u>



Where required, sample bottles containing the correct preservatives may be obtained from the laboratory by providing a complete list of the parameters to be tested.

4.1 Mains sampling

To ensure adequate representation of the water quality in the main is tested, water samples are required at the nearest point to the midpoint and/or dead end of the new main. If the new main is greater than 500m in length, a sampling regime demonstrating adequate representation of water quality across the entire new main shall be prepared and submitted to Barwon Water Responsible Officer for approval. The plan shall consist of a network diagram that has the start/end of the main with the intended sampling points marked on it.

4.2 Tank Sampling

A representative sample of the water inside the tank is required, ensuring through procedure that adequate mixing has been achieved.

4.3 Basin Sampling

A representative sample of the water inside the basin at the inlet, outlet and midpoint inspection hatch is required.

5 Disposal of Chlorinated Water

Should disposal of chlorinated water be required, attention shall be taken to the receiving environment. Use of neutralising agents should be considered. All water released to the environment must comply with Environmental Protection Authority (EPA) guidelines and other relevant regulations. It is expected that the disposal of water during the cleaning or disinfection stages of any asset commissioning will remain the responsibility of the contractor.

The Guidelines for Environmental Management: Disinfection of Treated Wastewater (EPA 2002) states that a chlorine residual of less than 0.1 milligram per litre should be achieved in order to reduce its potential toxicity.

6 Considerations

6.1 Zero Waste

Appropriate consideration should be given to water conservation, particularly during times when water restrictions are in force. Where applicable and practicable, efforts to conserve water during the commissioning phase are advocated. This may include, but is not limited to, water capturing and reuse.



6.2 Exceptions and alternatives

In any instance where the requirements outlined in this document are not practical or feasible, alternative suggestions for commissioning assets may be considered. Acceptance of such alternative workflows will remain the discretion of the Barwon Water Responsible Officer and will be made in conjunction with the Barwon Water Drinking Water Quality team and other relevant stakeholders, and with consideration of the situation. Any suggested alternative must be consistent with the water quality risk management philosophy. Hence, it must be able to demonstrate that water supplied through the asset will be safe for consumption and meet all relevant standards and regulations.

6.3 Safety, Quality and Environment

Employees and contractors carrying out the work methods described in this document must follow Barwon Water's safety, quality and environmental procedures and policies at all time. Chlorine disinfectants and chlorine neutralising agents are harmful substances. To mitigate the associated public and workplace health risks, the manufacturer's specification and Material Safety Data Sheets must be followed when using, storing and handling.

7 Requirements for New Mains

This section outlines the processes and risk management control measures to be taken when commissioning new water mains.

7.1 Storage, Temporary Capping and Construction of mains

Preventing foreign materials and contamination from entering pipes during storage, construction and connection provides benefit to meeting water quality requirements. Reducing contamination can also save time and water consumed in swabbing/flushing processes, and the amount of disinfectant required.

Pipe delivered for construction shall be stored and handled so as to minimise entrance of foreign materials. Any delay in placement of delivered pipes invites contamination. Timing the rate of site deliveries to pipe laying effectively can reduce the likelihood of contamination. Fittings stored on site or in storage for more than 2 days should be boxed, capped or sealed with plastic wrapping.

During and after pipe laying operations, the contractor/responsible person should supply and use exclusion caps, plugs or blank flanges, or an appropriate alternative, to seal all openend pipes and fittings, where relevant. Similarly, tanks should be stored and built to minimise the entrance of foreign materials. These hygienic practices for the storage, delivery and construction of new water infrastructure provides a powerful control measure and barrier in minimising risk of contamination of the main, whilst providing the best possible starting point for the flushing, swabbing and disinfection processes. Wherever possible, these



hygienic practices shall be used and optimised to reduce time required for flushing, the volume of water required for flushing and amount of disinfectant required for successful disinfection. See Figures 2 – 5 for examples of appropriate hygienic pipe construction practices and unacceptable pipe construction practices. More information on pipe laying can be found in Section 15.1.4 of the WSAA Supply Code of Australia.

Figure 2: Pipe capped overnight in trench Figure 3: Fittings capped overnight in trench



Exposed pipe end with ingress





Figure 4:





7.2 Flushing

Flushing should be carried out with reference to the feed water location.



7.3 Disinfection to achieve the required Contact Time

Disinfection of water mains is carried out by the contractor under most circumstances. Disinfection shall be carried out using chlorine as the disinfectant, in the form of sodium hypochlorite solution. Alternate forms of disinfection must be approved by the Barwon Water Responsible Officer prior to use.

In order to adequately determine the effectiveness of disinfection, the concept of contact time (Ct) is used. Ct describes the relative effectiveness of a specific disinfectant against different microorganisms under specified conditions. **Chlorine contact time is determined by multiplying the concentration of free residual disinfectant (in mg/L) by the contact time (in minutes).**

The Ct concept is expressed mathematically as: k = Ct where:

C = concentration of free chlorine residual (FCR)

t =contact time required for a fixed per cent of inactivation

k = constant for a specific microorganism exposed under set conditions

Ct values for specific organisms exposed to particular disinfectants have been calculated. Based on the body of evidence in relation to microbial inactivation research, a minimum value for k of 300 is required to satisfactorily fulfil disinfection requirements in water assets. This will ensure a 99.9% inactivation of Giardia, and complete inactivation of viruses and bacteria is achieved (US EPA 2003).

The minimum contact time is calculated on the lowest measured free chlorine residual (FCR) within the asset being disinfected throughout the duration of the disinfection process. Hence if the FCR falls from 5.0mg/L at the commencement of the disinfection process, to 3.0mg/L during the disinfection process, the minimum contact time will need to be 100 minutes (refer to Table 1).

Free Chlorine Residual (FCR) mg/L at time T	Minimum time (t) minutes to achieve Ct of 300
5.0 or greater	60
4.0	75
3.0	100
2.5	120
2.0	150
1.5	200
1.0	300

Table 1: Minimum contact time for the disinfectant is based on the lowest measured free chlorine residual. The contact time is proportionally based on a minimum Ct value of 300.



NOTE: It is suggested that a free chlorine residual less than 2 mg/L, especially when the feed water is chloraminated, is not stable and may undergo a backward reaction into combined chlorine.

The disinfectant shall be injected into the main after a suitable flow has been achieved, and at a suitable point downstream (within 3 metres) of the connection to the existing main to ensure the disinfected water travels the entire length of the main requiring disinfection.

The disinfectant shall be injected at suitable rate, determined by the flow, to achieve a minimum FCR of 5mg/L at the discharge point. When this is achieved, the disinfected new main shall be isolated from the existing supply and allowed to stand for the minimum contact period. During this period, it is recommended that FCR should be measured at 15 minute intervals for the first hour to ensure the correct minimum contact time is achieved based on the lowest FCR measured (refer to *Appendix A: Checklist for Commissioning of Mains*).

During the disinfection process, disposal of the chlorinated water shall be undertaken as per Section 5 Disposal of Chlorinated Water.

The requirements listed in Table 2 are based on best practice recommendations taken from the MRWA specification and *Practical Guide to the Operation and Optimisation of Distribution Systems* (Mosse et al., 2016). WSAA guidelines stipulate that **water mains** ≥**100mm shall be swabbed.**

Pipe diameter	Swabbing	Flushing	Disinfection to achieve a minimum Ct of 300mg.min/L (Table 1)	Water quality compliance analysis (Table 4)
< 100mm		×		×
≥ 100mm to < 225mm	×	×		×
≥ 225mm to < 750mm	×	×	×	×
≥ 750mm	×*		×	×

Table 2: Works required for commissioning and approval

* Manually cleaned in stages by swabbing or sweeping, then hosing and sealing after completion of internal works.



Table 3: Minimum flushing time (mins) for commissioning of new mains (once hydrant has been opened SLOWLY to deliver approx. 10 – 15 L/s)

		Pipe diameter		
		≤ 100mm	150mm	225mm
	≤ 100m	2	3	5
	< 200m	3	5	10
Laurath a farada	< 400m	5	10	20
Length of main	< 600m	7	15	30
	< 800m	10	20	40
	> 800m	12	25	50

If any of the above procedures cannot be completed effectively, contact is to be made with the Barwon Water Responsible Officer so that a collaborative (in consultation with the Barwon Water Drinking Water Quality team and other relevant stakeholders), risk-based approach can be taken to ensure commissioning undertaken will comply with requirements.

7.3.1 Alternative Method for Mains Cleaning

Approval from Barwon Water Responsible Officer in consultation with the Barwon Water Drinking Water Quality team is required.

When it is not practicable to disinfect a main by the standard disinfection procedure, an alternative method may be arranged with the Water Responsible Officer in consultation with the Barwon Water Drinking Water Quality team. For example, when:

- An extension from an existing main consists of not more than 25 metres.
- Part of the connecting pipework between a new main and its connection to the feeder main cannot be isolated, as required for standard disinfection and pressure test, and/or
- The new main is connected to the main under pressure (cut-in) connection method.

Cleaning can be conducted by inspection of each pipe fitting and mechanically clean (e.g. brush to remove dirt and other contamination.) Disinfection shall follow, with rinse solution of sodium hypochlorite and water with a chlorine residual of 10mg/L immediately before installation. Disinfect the ends of the existing main in the same manner.

Water quality analysis must still be conducted as per Section 4.

7.3.2 Mains in staged development areas

Barwon Water has developed a methodology for cases where there are multiple offtake mains in a new and unsettled staged development. This approach for water quality sampling may be applied following submission of the network sampling plan for review to the Drinking Water Quality team. Following the required cleaning and disinfection, laboratory samples will be taken for all ends of mains within the stage unless the offtake end main is < 25m in length, or an exemption is sought from Barwon Water and granted based on the



application of a case-related risk based approach. Exemptions will only be considered for offtake mains. Parent mains will always require laboratory based verification of water quality as per Section 4. As part of any exemption, a representative water quality sample from a number of the offtakes is required. In the case of an exemption request, the contractor would likely be requested to utilise calibrated hand-held analysers for turbidity and chlorine on site to verify and document compliance (see Section 10) to these parameters at all offtakes.

7.4 Gaining approval to connect mains to the Barwon Water system

In order to satisfy the commissioning requirements, the *Appendix A: Checklist for Commissioning of mains* shall be completed and submitted by the contractor along with the NATA approved laboratory water quality sampling results and Construction Plan to the Barwon Water Responsible Officer via email for approval.

Lodgement of results is to be as follows:

- For Barwon Water Capital works projects: email to the Project Manager.
- For land development works ("Developer Works"): submit to the Accredited Consulting Engineer and attach to <u>Request for Water Main Shutdown or Pressure Tapping</u> form when seeking to connect new asset.

Approval of results is as follows:

For Barwon Water capital works projects, connection to the Barwon Water network will only be granted following the satisfactory review of the results AND *Appendix A: Checklist for Commissioning of mains* (including the marked-up Construction plan) by the relevant Barwon Water Responsible Officer. This documentation will be saved in the Barwon Water Enterprise Content Management system (ECM - Objective). This process will be audited externally and internally for compliance to Barwon Water's certified Drinking Water Quality Risk Management Plan.

For land development works, connection to the Barwon Water network will only be granted following the satisfactory review of the results *and* completion of relevant sections of *Appendix A: Checklist for Commissioning of mains*.

(including the marked-up Construction plan) by the Accredited Consulting Engineer. The accredited consulting engineer is bound by the conditions as declared on the <u>Request for</u> <u>Water Main Shutdown or Pressure Tapping</u> form that includes cancelling the requested shutdown should failed results be received.

Should the minimum chlorine residual results in the existing water main not meet the parameters listed in *Table 4. Water Quality Parameter Limits for commissioning potable water*



assets, the Accredited Consulting Engineer can make an application for exemption to the Drinking Water Quality Team via waterquality@barwonwater.vic.gov.au. Exemptions will only be granted following a case-related risk based assessment completed by the Drinking Water Quality Team.

When satisfactory results are received, the water quality results package is then to be forwarded to Barwon Water as part of the *Completion of Works* package where it will be saved in the Barwon Water Enterprise Content Management system (ECM - Objective). This process will be audited externally and internally for compliance to Barwon Water's certified Drinking Water Quality Risk Management Plan.

8 Tank Cleaning Requirements and Disinfection Methods

This section outlines the steps to be taken when commissioning a new tank, or recommissioning an existing tank.

8.1 Cleaning and Disinfection Works prior to and during commissioning of a Tank

All scaffolding, planks, tools, rags and other materials not part of the structural or operating facilities of the tank shall be removed. The surfaces of the walls, floor, and operating facilities of the storage facility shall then be cleaned thoroughly using a high-pressure water jet, sweeping, scrubbing or equally effective means. All water, dirt, and foreign material accumulated in this cleaning operation shall be discharged from the storage facility or otherwise removed.

Following the cleaning operation, the vent screen, overflow screen, and any other screened openings shall be checked to be in a satisfactory condition to prevent birds, insects and other possible contaminants from entering the facility. Any material required to be in the operating storage facility after the cleaning procedure has been completed shall be clean and sanitary when placed in the facility. In such instances, care shall be taken to minimize the introduction of dirt or other foreign material.

Water storage facilities must then be cleaned and disinfected as per either method listed below, taken from *American Water Works Association Standard for Disinfection of Water Storage Facilities C652-02 2011*, in order to obtain the required contact time (Ct) for adequate disinfection. **Method 1 is the preferred option. Approval from Barwon Water shall be sought prior to following alternative methods.**



8.1.1 Tank Cleaning and Disinfection Method 1

Preferred option

Water and chlorine shall be added to the storage facility in amounts such that the solution will initially contain 50 mg/L free chlorine and will fill approximately 5 percent of the total storage volume. The actual volume of the 50 mg/L solution shall be such that, after the solution is mixed with filling water and the storage facility is held full for 24 hours, there will be a free-chlorine residual of not less than 2 mg/L.

The solution shall be held in the storage facility for a period of not less than 6 hours. The storage facility shall then be filled to the overflow level by flowing potable water into the highly chlorinated water. It shall be held full for a period of not less than 24 hours. All highly chlorinated water shall then be purged from the scour outlet. Following this procedure and subject to satisfactory bacteriological testing and acceptable aesthetic quality, the remaining water may be delivered to the distribution system.

8.1.2 Tank Cleaning and Disinfection Method 2

Approval from Barwon Water Responsible Officer in consultation with the Barwon Water Drinking Water Quality team is required.

A solution of 200 mg/L free chlorine shall be applied directly to the surfaces of all parts of the storage facility that would be in contact with water when the storage facility is full to the overflow elevation. The chlorine solution may be applied with a suitable brushes or spray equipment. The solution shall thoroughly coat all surfaces to be treated, including the inlet and outlet piping.

Following this procedure, the storage shall be filled such that it will have an available chlorine content of not less than 10mg/L and shall be held for at least 30 minutes. All highly chlorinated water shall then be purged from the scour outlet. Should highly chlorinated water be discharged to the environment it shall be neutralised using a chemical chlorine neutralising agent prior to being discharged.

The storage facility shall then be refilled by flowing potable water. Subject to satisfactory bacteriological testing and acceptable health and aesthetic quality, such water may be delivered to the distribution system.

8.1.3 Tank Cleaning and Disinfection Method 3

Approval from Barwon Water Responsible Officer in consultation with the Barwon Water Drinking Water Quality team is required

The water storage facility shall be filled to the overflow level with potable water to which enough chlorine is added to provide a free chlorine residual in the full facility of not less than 10 mg/L at the end of the retention period. Consideration should be given to products (mixers, level sensing equipment) being in contact with highly chlorinated water.



A minimum retention period of 6 hours is required where:

1. Chlorine has been added via liquid-chlorine injection or,

2. Chlorine is dosed directly into the filling water to provide a uniform chlorine concentration.

A minimum retention period of 24 hours is required where chlorine is hand poured into the facility. Mixing should be utilized to ensure a uniform concentration of chlorine is achieved throughout the tank.

For water to be supplied to customers, the use of any chemical chlorine neutralising agents should be avoided. Barwon Water Responsible Officer in consultation with the Barwon Water Drinking Water Quality team must review and approve any proposal of this nature.

8.2 Gaining approval to connect a tank to the Barwon Water system

In order to satisfy these requirements, *Appendix B: Checklist for Commissioning of Tanks* shall be completed and submitted along with the NATA approved laboratory water quality sampling results, provided via email to the Barwon Water Responsible Officer (Project Manager, Land Development personnel or Operations Coordinator) for approval.

Approval from the Barwon Water Responsible Officer will only be granted following the review of the results *AND Appendix B: Checklist for Commissioning of Tanks*. This documentation will be saved in the Barwon Water Enterprise Content Management system (ECM - Objective). This process will be audited externally and internally for compliance to Barwon Water's certified Drinking Water Quality Risk Management Plan.

9 Lined and Covered Service Basins Cleaning and Disinfection Requirements

This section outlines the processes and risk management control measures to be taken when commissioning or reinstating a basin or basin cover over water storage.

9.1 Cleaning and Disinfection Works prior to commissioning a basin or installing a basin cover

The cleaning and disinfection process is most often undertaken collaboratively by a contractor and Barwon Water Operations staff, where the contractor will install the liner and cover and Operations will manage the filling and disinfection process. The filling and disinfection aspect of the procedure shall be utilised following any construction works of a basin, for example, inlet/outlet works or works on access hatches.



It is essential that following any installation works for a basin liner or cover, a liner walkover is carried out by the installer and Barwon Water Responsible Officer to verify site joins and factory joins have been inspected and accepted. Further detail on liner installation can be found in the <u>Lined and Covered Service Basins Commissioning Procedure (ECM: A12752780)</u>. This document will be provided to external parties on request to waterquality@barwonwater.vic.gov.au.

NOTE: Do not apply concentrated sodium hypochlorite directly to liner surfaces or metals.

1. Laying of Cover

The Barwon Water officer is to inspect the delivered cover material to ensure no contaminants are introduced to the basin through installation. Prior to installing the cover, the liner is to be sprayed and washed down with a solution of sodium hypochlorite and water with 5mg/L available chlorine (refer to Section 3.1). Wash down water should be prevented from entering the basin outlet pipe, and should be pumped out of the outlet pit.

A wetted surface is required between the liner and cover, when the cover is in position. Hot days should be avoided for disinfection, as wash down water may dry before the cover is laid.

Any metal fittings within the basin must be adequately protected with an appropriate protective coating, full epoxy coated or equivalent, including fasteners. Any protective coatings must comply with AS/NZS 4020:2005 as outlined in Section 3.

2. Filling

Once the cover is fully battened down and hatches and vents are installed the basin can be filled. The intention is to provide a basin filled to 80% of full supply level (FSL) over a number of days, with water that has a chlorine residual that can be provided to customers after successful water quality testing is completed. The initial chlorine concentration during filling should not exceed 5mg/L. Chlorine dosing of subsequent filling is to be planned and measured keeping the final desired residual in mind. An example has been provided for reference, see Figure 6.

Each morning and at the end of disinfecting, chlorine residual at the outlet and a mid-point vent shall be taken and recorded. Regular chlorine residual measurement (3 times/day) to observe any decrease in residual results on the final days of disinfection works are advised.



Figure 6: Basin fill plan example

Fill 100ML basin with 40ML

100ML Basin has a 5ML/day fill rate using inlet flow of 15ML/day for 8hrs.

Allow the 5ML to rest & inspect the structure each day.

After initial chlorination, the daily 5ML fill is dosed chlorine at a reduced rate.

During days 5-7 potable water is added without dosing, which dilutes the residual down to the target 1mg/L.

CHLORINE ADDITION CALCULATOR

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Volume in storage	40ML	5ML	5ML	5ML	5ML	5ML	5ML	10ML
Residual required	1mg/L (ppm)	2mg/L	2mg/L	2mg/L	2mg/L	\rightarrow	\rightarrow	1mg/L
Hypo strength	125g/L	125g/L	125g/L	125g/L	125g/L			
Hypo required	320L	80	80	80	80	0	0	0

3. Scouring the outlet pipe

It is important to flush the outlet main from within the storage to the external guard valve. Flushing is completed twice, once after day 1 of initial disinfection (as this provides a higher chlorine residual) and again prior to bringing the asset into service.

Flushing shall continue until:

- water is clear,
- chlorine residual is evident, and
- odour is acceptable.

9.2 Gaining approval to connect lined and covered basins to the Barwon Water system

In order to satisfy the commissioning requirements, *Appendix C: Checklist for Commissioning of Lined and Covered Basins shall be completed and submitted with the NATA approved laboratory water quality sampling results via email to the Barwon Water Responsible Officer for approval.*

Approval by the Barwon Water Responsible Officer is granted following the review of the results in conjunction with measurements recorded using *Appendix C: Checklist for Commissioning of Lined and Covered Basi*ns. The documentation will be saved in the Barwon Water Enterprise Content Management system (ECM - Objective). This process is audited externally and internally for compliance to Barwon Water's certified Drinking Water Quality Risk Management Plan.



10 Compliance to Water Quality Parameters and Record Keeping

Water quality analysis is to be conducted as per Section 4. Results of testing are to be provided as evidence and are to be reviewed and accepted by the Barwon Water Responsible Officer as compliant prior to the asset being connected into Barwon Water network.

The Contractor shall allow for adequate time in the program for obtaining the test results and review/acceptance by Barwon Water Responsible Officer. Generally, allow up to 2 business days for the review of results by Barwon Water Responsible Officer.

It is recommended that contractors make use of hand-held analysers for chlorine and turbidity to increase confidence that laboratory samples submitted will meet the Water Quality Parameter Limits for commissioning potable water mains.

The applicable water quality parameter limits listed in Table 4 and Table 5 must be achieved in order to place the asset into service.

Should any of the parameter limits in Table 4 and Table 5 be breached, the following rectification works are required for the new assets:

Failure modes and rectification works for new potable water and recycled water assets

- Physical parameters: Flush main and resample until acceptable results are achieved.
- Chemical parameters: Flush main and resample until acceptable results are achieved.
- E. coli: disinfect main and resample until acceptable results are achieved (Section 7.3).
- Total Coliforms: flush main and resample until acceptable results are achieved.

Note: Barwon Water will be responsible for all rectification works required for existing assets where existing assets fail to meet the requirements of Table 4 and Table 5.



POTABLE WATER										
Parameter	Unit	Limit	Mains Sampling	Tank Sampling	Lined & Covered Basin Sampling					
Physical										
рН	-	>6.5 and <9.2	\checkmark	\checkmark	\checkmark					
Apparent Colour	HU	5	✓	\checkmark	\checkmark					
Turbidity	NTU	≤1	✓	~	~					
EC	μS/cm	existing asset ± 50	\checkmark	\checkmark	\checkmark					
	1	Chemical		1	1					
Total Chlorine Residual	mg/L	0.2 - <1.5	\checkmark	\checkmark	\checkmark					
		Microbiological								
E. coli	orgs/100mL	<1	\checkmark	\checkmark	\checkmark					
Total Coliforms	orgs/100mL	<1	\checkmark	\checkmark	\checkmark					
		Disinfection by-prod	ucts							
THM	mg/L	< 0.25		\checkmark	\checkmark					
Chloroacetic acid	mg/L	< 0.15		\checkmark	\checkmark					
Monchloracetic acid	mg/L	<0.1		\checkmark	\checkmark					
Trichloroacetic acid	mg/L	<0.1		\checkmark	\checkmark					
Volatile Organic Compounds (VOCs) Not required for existing tanks that have only been drained and cleaned										
VOC suite	mg/L	< ADWG limit (Refer Appendix D: List of Volatile Organic Compounds)		\checkmark	\checkmark					

✓ Denotes requirement for laboratory sampling.



Table 5: Water Quality Parameter Limits for commissioning *Class A recycled* water assets.

RECYCLED WATER (CLASS A)								
Parameter	Unit	Limit	Mains Sampling	Tank and Basin Sampling				
		Physical						
рН	-	Between >6.5 & <9.2 AND within ± 0.5 of existing asset	\checkmark	\checkmark				
Apparent Colour	HU	≤25 AND < (existing asset ± 5)	\checkmark	\checkmark				
Turbidity	NTU	<5 AND < (existing asset ± 0.5)	\checkmark	\checkmark				
EC	μS/cm	≤1250 AND < (existing asset ± 50)	\checkmark	\checkmark				
		Chemical						
Total Chlorine Residual	mg/L	< 5.0 AND within ± 0.2 of existing asset	\checkmark	\checkmark				
	Microbiological							
E. coli	orgs/ 100mL	<10 AND \leq existing asset	\checkmark	\checkmark				
Total Coliforms	orgs/ 100mL	<10 AND < 2× existing asset	\checkmark	\checkmark				
		Disinfection by-products						
THM	mg/L	<0.25		~				
Chloroacetic acid	mg/L	<0.15		~				
Monchloracetic acid	mg/L	<0.1		~				
Trichloroacetic acid	mg/L	<0.1		\checkmark				
Volatile Organic Compounds (VOCs) Not required for existing tanks that have only been drained and cleaned								
VOC suite	mg/L	< ADWG limit (Refer Appendix D: List of Volatile Organic Compounds)		\checkmark				

✓ Denotes requirement for laboratory sampling.



11 References

American Water Works Association Standard for Disinfection of Water Storage Facilities C652-02 2011

Australian/New Zealand Standard for Plumbing and drainage (AS/NZS 3500.1:2015)

Australian/New Zealand Standard for testing of products for use in contact with drinking water (AS/NZS 4020:2005)

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Water Services Association of Australia 2011, WSAA Water Supply Code of Australia, WSA 03-2011 Third Edition, Version 3.1

<u>Water Supply Code of Australia WSA03-2011-3.1</u> Part 3- Construction, 19.5 Water Quality Testing, 20 Disinfection, Appendix I Disinfection



Appendix A: Checklist for Commissioning of Mains

NOTE: Construction plan must be attached showing new pipe sections & sample points

Organisation Name:					
Size/Diameter of main:					
Length of main:					
Volume of main:					
Cleaning/Flushing	Minutes	flushed at adequate velocity	y for:		
requirement					
(Not including swabbing)					
Volume of disinfectant					
required (N/A if main					
diameter is <225mm)	-				
Free Chlorine Residual (FCR)					
at end of pipe		Γ	T		
		Time, t (min)	FCR (mg/L)		
FCR at monitored intervals					
until minimum CT achieved	Date				
(N/A if main diameter is					
<225mm)					
		CT=Final FCR (m	ig/L) x t(min)		
Contact Time		CT =mg.min/l	-		
CT=Final FCR (mg/L) x t (min)					
		Neutralisation method used:			
	Date	Time	FCR (mg/L): Must be		
Neutralisation					
Optional space to record meas	urements	Turbidity (NTU)	FCR (mg/L)		
onsite prior to taking laborator	y sample				
to enhance confidence in comp	oliance				
		Date of Sample:			
Water Quality verification samp	ble	Sample taken by:			
Works completed declaration					
I hereby declare that the above cleaning and disinfection process has been undertaken in					
accordance with the Water Ou	ality reau	irements for commissioni	ng assets in contact		
with Potable Water or Class A Recycled Water: ECM ID: A9624292					
Print Name & Sign:		Date:			



Appendix B: Checklist for Commissioning of Tanks

Organisation Name:					
Size/Diameter of Tank:					
Height of tank:					
Volume of tank:					
Cleaning and Disinfection method used	1. 2. 🗖	3. 🗖			
Volume of disinfectant required	Minimum retention period (hrs)				
Free Chlorine Residual (FCR) at end of retention period					
	Date	Time	FCR (mg	FCR (mg/L)	
FCR at monitored intervals to					
observe reduction in chlorine					
residual					
	Neutralisation method used:				
Neutralisation prior to discharge. (not to be supplied to customers)	Date	ate Time		FCR (mg/L): Must be <0.1 for discharge	
Optional space to record	Turbidity (NTU)		FCR (mg	n/l)	
measurements onsite prior to		/		y/ =/	
taking laboratory sample to					
enhance confidence in compliance					
Water Quality verification	Date of Sample	. .			
sample	Sample taken by:				
Works completed declaration					
I hereby declare that the above cleaning and disinfection process has been undertaken in					
accordance with the Water Qu	ality requireme	nts for comm	issioning assets	in contact	
Print Name & Sian:	a Recyclea Wate	er (ECMIDAS	Date:		



Appendix C: Checklist for Commissioning of Lined

& Covered Basins

Organisation Name:						
Capacity of Basin:		ML		80% Capacity	/ ML	
Lay Clean and Disinfection Procedure from this document followed?	Yes 🗖	No 🗖		If No, a detai and disinfect provided and Barwon Wate Officer	led cleaning, filling ion plan must be d approved by er Responsible	
Volume of disinfectant required						
Free Chlorine Residual (FCR) at end of retention period	Inlet =m	ng/L	Mid	=mg/L	Outlet =mg/L	
	Date	Time		Inflow (ML/d)	FCR (mg/L)	
Flow and FCR at monitored intervals to observe reduction in chlorine residual (At Outlet)						
Water Quality verification sample	Date of Sample:					
Works completed declaration						
I hereby declare that the above cleaning and disinfection process has been undertaken in accordance with the <i>Water Quality requirements for commissioning assets in contact with Potable Water or Class A Recycled Water (ECM ID A9624292)</i> Print Name & Sign: Date:						



Appendix D: List of Volatile Organic Compounds

VOC - 1,1-Dichloroethene	VOC - Carbon Tetrachloride	VOC - Dibromochloromethane
VOC - Methylene Chloride	VOC - Benzene	VOC - Tetrachloroethene
VOC - trans-1,2-Dichloroethene	VOC - Trichloroethene	VOC - 1,2-Dibromoethane
VOC - 1,1-Dichloroethane	VOC - 1,2-Dichloropropane	VOC - Chlorobenzene
VOC - 2,2-Dichloropropane	VOC - Dibromomethane	VOC - 1,1,1,2-Tetrachloroethane
VOC - cis-1,2-Dichloroethene	VOC - Bromodichloromethane	VOC - Ethylbenzene
VOC - Chloroform	VOC - cis-1,3-Dichloropropene	VOC - m- & p-Xylene
VOC - Bromochloromethane	VOC - Toluene	VOC - Styrene
VOC - 1,1,1-Trichloroethane	VOC - trans-1,3-Dichloropropene	VOC - o-Xylene
VOC - 1,1-Dichloropropene	VOC - 1,1,2-Trichloroethane	VOC - Bromoform
VOC - 1,2-Dichloroethane	VOC - 1,3-Dichloropropane	VOC - Iso-Propylbenzene
VOC - 1,2,3-Trichloropropane	VOC - tert-Butylbenzene	VOC - p-iso-Propyltoluene VOC - 1,2-Dibromo-3-
VOC - Bromobenzene	VOC - 1,2,4-Trimethylbenzene	chloropropane
VOC - n-Propylbenzene	VOC - sec-Butylbenzene	VOC - 1,2,4-Trichlorobenzene
VOC - 2-Chlorotoluene	VOC - 1,3-Dichlorobenzene	VOC - Naphthalene
VOC - 4-Chlorotoluene	VOC - 1,4-Dichlorobenzene	VOC - Hexachloro-1,3-butadiene
VOC - 1,3,5-Trimethylbenzene	VOC - 1,2-Dichlorobenzene	VOC - 1,2,3-Trichlorobenzene
VOC - 1,1,2,2-Tetrachloroethane	VOC - n-Butylbenzene	VOC - Carbon Disulphide

