Pr9032 - Procedure for Managing Water Quality During Mains Commissioning

Document Owner	Executive Manager Sustainable Infrastructure Solutions
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Document Stakeholders	Manager Capital Delivery Development Services Manager Manager Field Services and Support Manager Network Operations Scientific Services Manager
References to internal or external documents this procedure relies upon or satisfies	BP8137 - Drinking Water Quality Policy BP8124 - Water Hygiene Policy Pr9817 - OPRP Mains Commissioning Pr8207 - Drinking Water Quality Results interpretation and Corrective Action Procedure *Australian Drinking Water Guidelines (2011),* NHMRC SEQ Water Supply and Sewerage Design and Construction Code *SEQ WSA 03 Water Supply Code –* • *Part 2: Construction;* and • *Appendix I – Disinfection of Water Mains and Water Quality Compliance Specification* Water Services Association of Australia (WSAA) Guideline: Dechlorination of Drinking Water to Discharged Waterways, National Guidance for the Urban Water Industry 2019 Drinking Water Quality Management Plan (DWQMP)
References to other documents or resources that gives effect or is associated with this procedure	F10045 - Water Quality – Mains Commissioning Form Pr8996 - Manage Planned Network Intervention Procedure F9785 - Water Hygiene Field Guide (5C's) F8696 - New Main Water Quality Acceptance Testing Form

1. Purpose

The purpose of this Procedure is to define the process for commissioning potable water mains in order to manage public health risks in accordance with Unitywater's approved Drinking Water Quality Management Plan (DWQMP).

2. Scope

This Procedure applies to the 'commissioning', including connection, of water mains to Unitywater's network inclusive of:

- newly constructed mains; or
- existing mains that have been disconnected for more than 10 days.

This includes new water mains that are constructed by Unitywater or on behalf of Unitywater, donated water mains from Developers or mains commissioned by Unitywater internal staff.

This Procedure is relevant to the following functional areas within Unitywater:

- Development Services;
- Capital Delivery;
- Scientific Services;
- Water Quality;
- Construction Services;
- Network Engineering;
- Field Services.

This Procedure is also relevant to the following external groups:

- Developers;
- Contractor;
- External Certifiers.

3. Responsibilities and Authorities

The following responsibilities and authorities have been assigned in relation to this Procedure.

a. **Water Quality Manager** (or delegate) -

- Reviews this Procedure to address compliance requirements for the Unitywater DWQMP/HACCP Plan;
- Performs internal reviews (as per DWQMP requirements) which will provide information about the effectiveness of this Procedure;
- Provides technical advice on water quality matters to other sections with the purpose to prevent contamination of the drinking water supply and meet the conditions of approval for the DWQMP;
- Keeps appropriate records of any contribution to water quality matters within Unitywater's EDRMS; and
- Reviews water quality criteria periodically to ensure criteria stated in this Procedure are in line with best industry practice[1].

b. **Scientific Services Manager** (or delegate) -

- Communicates with the appropriate staff as outlined in this Procedure;
- Supports the directive that only Scientific Services staff sample live (existing) Unitywater assets;
- Can authorise Scientific Services staff to sample and analyse water obtained from new mains if requested to do so by Constructor or External Contractor; and
- Supports the verification of mains water analyses results through establishing and maintaining internal quality processes and confirming that results are representative of water quality at the time of sampling.

c. **Development Services Manager, Manager Capital Delivery** (or delegates) **-**

[1] This is necessary as in this Procedure Unitywater has made modifications to the standard SEQ WSA03 water quality acceptance criteria to allow flexibility and ease of use. If it becomes evident that the current water quality criteria are inappropriate, the criteria will need to be updated.

- Must ensure that water quality is acceptable before connecting to Unitywater's network;
- Ensure that staff, contractors and developers involved in construction and commissioning of water mains are aware and comply with the requirements of this Procedure;
- Must be aware of their obligations under Unitywater's *Water Hygiene Policy*;
- Provide a copy of this Procedure and the related documentation to Unitywater Staff, Developers or Contractors involved in water mains commissioning.
- Assess water quality results and decide whether water quality in the main is acceptable, based on Table 1 - Water Quality Acceptance Criteria;
- Notify in writing, Construction Services, External Contractor or Developer whether the water quality result has 'passed' or 'failed';
- Maintain records supporting water quality acceptability including:
    - *F10045 Water Quality Mains Commissioning Form;*
    - copy of laboratory results;
    - Maintain auditable evidence for making the decision of a 'passed' or 'failed' water quality result (i.e. emails/forms saved in Unitywater's EDRMS);
- Provide written communication to Construction Services, External Contractor or Developer to initiate connection of the main to Unitywater's existing network;
- In the event of a 'failed' water quality result, investigate and identify corrective actions with Engineering Operations necessary to achieve a 'passed' result.

d. **Network Engineering Manager (Customer Delivery)** (or delegates) **–**

- Ensure that staff are aware and comply with the requirements of this Procedure;
- Makes staff aware of their obligations under Unitywater's *Water Hygiene Policy*;
- Provide advice on mains commissioning where it is believed that network flushing or in-main chlorine dosing is required to improve feeder mains water quality;
- Assess water quality results and decide whether water quality in the mains commissioned by Civil Maintenance only is acceptable, based on Table 1 - Water Quality Acceptance Criteria;
- Notify Unitywater's Water Quality Manager immediately if any sample is reported to contain *E.coli* and within 24 hours for any other non-compliant parameter result;
- In the event of a failed water quality result assist in investigation to identify cause and the development of corrective actions;
- Maintain auditable evidence for making the decision of a 'passed' or 'failed' water quality result (i.e. emails/forms saved in Unitywater's EDRMS); and
- Communicate with Manager Civil Maintenance (or delegate) to initiate reconnection of the recommissioned main.

e. **Manager Field Services and Support** (or delegate) **-**

- Ensure that staff involved in mains commissioning are aware and comply with the requirements of this procedure;

- Must ensure that water quality is acceptable before connecting to Unitywater's network;
- Must be aware of their obligations under Unitywater's *Water Hygiene Policy*;
- Provide a copy of this Procedure and the related documentation to Unitywater Staff involved in water mains;
- Provide the water quality results to Unitywater's Network Operations Manager (or delegate) who will evaluate and decide whether the water quality has 'passed' or 'failed'.
- Completion of *F10045 Water Quality Mains Commissioning Form*; and
- Maintain records supporting water quality acceptability including:
    - *F10045 Water Quality Mains Commissioning Form*;
    - copy of all laboratory results;

f. **External Contractors, Developers or Manager Private Works, Mechanical & Electrical** (or delegate)**-**

- Ensure that connections are not made to Unitywater's network until approval has been received from the Development Services Manager or Manager Capital Delivery (or delegates);
- Ensure that staff involved in commissioning are aware and comply with the requirements of this procedure;
- Follow *F9785 – Water Hygiene Field Guide (5C's)* and comply with their respective Chlorine Handling and Emergency Procedures;
- Provide the water quality results to Unitywater's Development Services or Capital Delivery Manager (or delegates) within 48 hours of results becoming available, who will evaluate and decide whether the water quality has 'passed' or 'failed';
    - Where a 'failed' result is received, await further direction from Unitywater's Development Services or Capital Delivery Manager or delegates (connection to Unitywater's network cannot be made);
    - Where a 'passed' result is received, await written approval from Unitywater's Development Services or Capital Delivery Manager (or delegates) before connecting to Unitywater's network;
- Records disinfection and neutralisation values – provide a copy of completion and submission of *F10045 Water Quality Mains Commissioning Form.*

4. Definitions

Term	Meaning
5C's	Acronym for water hygiene practices supporting the protection of drinking water quality
ADWG	Australian Drinking Water Guidelines 2011
CWDAT	Chlorinated Water Discharge Assessment Tool
DWQMP	Drinking Water Quality Management Plan

Term	Meaning
EDRMS	Electronic Document Records Management System
Feeder Main	A water main on the Unitywater network that is used in the Flushing or Filling process
FCR	Free Chlorine Residual
PNI	Planned Network Intervention
SEQ WSA 03	South East Queensland Water Supply Design & Construction Code
High chlorine water	Water used for disinfection that contains a free chlorine residual (FCR) concentration greater than 5 mg/L
Water Mains commissioning	Water Mains that: • are newly constructed requiring connection to Unitywater's network; • have been out of service for more than 10 days that require to be brought back into service by connecting to Unitywater's Network.
Water Quality Results Assessor	Unitywater Officer responsible for assessing Water Quality results against acceptance criteria. • For Capital Works projects – Manager Capital Delivery or delegate • For Donated Assets – Manager Development Services or delegate • For Civil Maintenance – Manager Engineering Operations or delegate

5. Procedure Water Mains Commissioning

In order to prevent contamination and protect the quality of drinking water during mains commissioning, the process steps described below must be followed:

Refer to the flow charts Figure 1 and 2 for a general overview of the Procedure.

Step	Requirements	Mains ≤ 50m in Length and ≤ DN300	Mains > 50m in Length OR >DN300
All	5Cs Water Hygiene	✓	✓
1	Flushing	✓	✓
2	Disinfection	✓	✓
3	De-Chlorination	✓	✓
4	Filling	✓	✓
5	Water Quality Sampling	✗	✓
6	Water Quality Analysis	✗	✓
7	Water Quality Results Assessment	✓	✓
8	Connect to the Network (PNI approval)	✓	✓

Legend:- *Required* ✓ *Not required* ✗

KEY **POINTS:**

Mains must not be connected to Unitywater's network until:

- water quality results have been assessed and 'passed'; and
- Unitywater has approved the connection.

5C's Water Hygiene Program

Any work conducted on mains for connection into Unitywater's drinking water supply network must be done using the principles of the 5C's Water Hygiene Program and in accordance with Unitywater's *F9785 – Water Hygiene Field Guide (5C's)*

Any personnel performing work on Unitywater's drinking water network must have completed Unitywater's 5C's awareness training.

The 5C's Water Hygiene Program consists of the following requirements:

a. Clean pipes and fittings -
   i. Pipes and fittings can become a source of contamination.
   ii. During transportation from supplier to storage, it is preferable for pipes and fittings to be sealed.
   iii. During storage (off site or on site) pipes and fittings must be sealed and positioned clear of the ground.
   iv. Seals can be removed only when a pipe is being installed.

b. Clearance -
   i. Wherever possible, maintain clearance (min. 150mm) under pipes to prevent introduction of contaminants. If clearance can't be achieved, maintain positive pressure and use a pump to de-water.

c. Chlorination -
   i. Chlorine solution in a spray bottle can be used to effectively disinfect surfaces without requiring large volumes of water.
   ii. Chlorine kills bacteria – Spray a chlorine solution on internal pipes surfaces, boots, tools, fittings and anything else that may come in contact with drinking water.
   iii. The use of chlorine solution to disinfect/kill bacteria must be in accordance with the appropriate material data safety sheet (MDSD).

d. Cleanliness -
   i. Keep hands clean (practise good hygiene – hand washing).
   ii. Keep tools, equipment and worksite clean. Work in a clean manner on-site. Use a plastic or rubber mat on the ground to store tools, fittings and pipes before use.
   iii. Tools may have been used for both water and sewer jobs. These must be thoroughly disinfected with the chlorine solution prior to their use on water main jobs.

e. Clothing -
   i. Introduction of sewage into the drinking water supply represents a high risk to Public Health, no matter the quantity.
   ii. Maintain clean clothing – Before working on drinking water assets, ensure clothing is reasonably clean and free of sewage.
   iii. Staff may be required to attend to both sewer and drinking water jobs in the same day. It is of critical importance that clothing worn during drinking water repair, renewal or construction activities is not contaminated with sewage in any way.

iv. As a minimum, clean boots and protective overalls should be worn if the staff member has earlier attended a sewer job.

Step 1. Flushing

Flushing (and scouring or swabbing where necessary) is to be undertaken to clean construction dirt, sediment or other material prior to disinfection.

Flushing can be performed using traditional pigging, ice pigging or water at a velocity sufficient to ensure all loose contaminants are removed from the main. Where water flushing is undertaken, velocity shall be ≥1.0m/s.

The water used for the flushing process must be disposed of in accordance with Water Services Association of Australia (WSAA) Guideline: Discharge of Chlorinated Water to Waterways, National Guidance for the Water Industry.

Details of ***Step 1 Flushing*** must be captured on *F10045 Water Quality Mains Commissioning Form.*

Step 2. Disinfection

A sodium hypochlorite solution is to be used for disinfection.

i. Preparation for disinfection is to be undertaken in the following manner:

Main Isolation: the new main must be isolated from the existing supply to prevent backflow of the disinfectant during the contract period;

Disinfectant injection point:

the disinfectant injection point is to be located within three (3) meters of the connection point to the existing main;

Flow meter: a flow meter (metered hydrant stand pipe) is to be located at the discharge end of the main and used to calculate the necessary disinfectant injection rate that achieves an initial FCR ≥ 5 mg/L at the discharge end;

Discharge point: a suitable discharge point is to be selected to ensure minimisation of environmental impact of disinfectant discharge whilst measuring the outfall rate (refer above);

ii. The actual disinfection activity must be addressed in the following manner:

Objective: disinfection has been achieved when the FCR has not dropped below three (3) mg/L at any time during the contact period;

Contact period: the disinfectant must remain in the main for a minimum of one (1) hour;

Monitoring and testing during disinfection:

the FCR within the main must be sampled, tested and recorded at 15 minute intervals during the contact period at the discharge end of the main;

Assessment of disinfection results:

if the FCR drops to less than 3 mg/L during the contact period, the disinfection process has failed and must be repeated.

Details of ***Step 2 Disinfection*** must be captured on *F10045 Water Quality Mains Commissioning Form*.

Step 3. Dechlorination

After disinfection is complete, the high chlorine water is removed by draining or displacing with fresh water.

Where the FCR is recorded following disinfection, dechlorination and disposal will be undertaken in accordance with the CWDAT in section 6 of the Water Services Association of Australia (WSAA) Guideline: Discharge of Chlorinated Water to Waterways, National Guidance for the Water Industry.

Where the FCR is > 5 mg/L or unknown following disinfection, dechlorination will be required in accordance with the CWDAT (Refer to section 6, WSAA Guideline). All super-chlorinated water (>10 mg/L FCR) should be chemically dechlorinated prior to discharge.

Details of ***Step 3 Dechlorination*** must be captured on *F10045 Water Quality Mains Commissioning Form.*

Step 4. Filling

Following disposal of high chlorine water, the main will be filled from Unitywater's network.

Testing for FCR **only** will be conducted at the outlet of the main to ensure that the FCR level is < 3 mg/L.

If the FCR is ≥ 3mg/L this indicates that disinfectant remains within the main and ***Step 3 Dechlorination*** and ***Step 4 Filling*** must be repeated until a FCR of < 3 mg/L is achieved.

Details of ***Step 4 Filling*** must be captured on *F10045 Water Quality Mains Commissioning Form.*

For mains >50m in length OR >DN300 continue to ***Step 5 (Water Quality Sampling).***

For mains ≤50m in length and ≤DN300 proceed to ***Step 7b (Water Quality Results Assessment).***

Step 5. Water Quality Sampling

Step 5 only applies to water mains > 50 m in length OR > DN300

- The main shall be sampled by Unitywater's Scientific Services or an external NATA accredited sampler;
    - Unitywater Scientific Services shall be engaged using *F8696 – New Main Water Quality Acceptance Testing Form* with a minimum of 1 week notice to request Sample Collection;
- A single sample is to be taken from a point located at the mid-point of the main (where a main has more than five (5) branches and/or dead ends, a sample must be collected midpoint of each additional branch and/or dead end);
- The sampling point must be disinfected prior to taking the sample;
- Chain of Custody sampling documentation must be provided to Unitywater
- The sampling location must be identifiable either through notations on drawings or described on the Chain of Custody documentation.

Details of ***Step 5 Water Quality Sampling*** must be captured on *F10045 Water Quality Mains Commissioning Form*.

Step 6. Water Quality Analysis

Step 6 only applies to water mains > 50 m in length OR > DN300:

- Water Quality samples shall be analysed by Unitywater's Scientific Services or an external NATA accredited laboratory;
    - Unitywater Scientific Services shall be engaged using *F8696 – New Main Water Quality Acceptance Testing Form* with a minimum of 1 week notice to request sample Water Quality Analysis;
- Samples obtained from mains are to be analysed for the physical, chemical and microbiological parameters outlined in Table 1 - Water Quality Acceptance Criteria;
- Water quality results from NATA Accredited laboratories will be submitted to Unitywater for assessment.

Step 7. Water Quality Results Assessment

a. For Water mains > 50m in length OR >DN300

Unitywater's Water Quality Results Assessor will evaluate the water quality results from the laboratory against Table 1 Water Quality Acceptance Criteria.

Unitywater's Water Quality Results Assessor will confirm in writing whether the water quality result has 'passed' or 'failed'.

Passed Result

If the water quality results are assessed and meet all the acceptance criteria in Table 1 Water Quality Acceptance Criteria, for all samples taken, the water quality is considered a 'passed' result and enables connection to the network (Step 8).

A 'passed' result is only valid for 10 calendar days from date of sampling

Failed Result

If the water quality results are assessed and any of the samples results **do not** meet all the acceptance criteria in Table 1- Water Quality Acceptance Criteria then this is considered a 'failed' result and the mains **cannot** be connected to the network.

A 'failed' result will trigger an investigation to identify the cause and identify the process steps that need to be repeated prior to obtaining further Water Quality samples.

Where the investigation may require sampling and analysis of the feeder main then:

i. Sampling of the existing 'feeder' main can only be undertaken by Unitywater's Scientific Services;

ii. The sample must be taken from a point located within 500 m of the connection point to the new main;

iii. The sampling point must be disinfected prior to taking the sample;

iv. The sampling location must be identifiable either through notations on drawings or described on the Chain of Custody documentation.

Table 1 - Water Quality Acceptance Criteria

Parameter	Units	Water Mains - Quality Limits
pH		>6.5 and <9.2
Apparent Colour	PCU	< 15
Turbidity	NTU	< 5
EC	(µS/cm)	< 1250
Free chlorine residual	mg/L	< 3mg/L
Total chlorine residual	mg/L	< 3mg/L
E.*coli*	(MPN/100mL or cfu/100ml)	< 1
Total Coliforms	(MPN/100mL or cfu/100ml)	<1 OR **<10**[1]
Heterotrophic Plate Count	(cfu/mL)	<100

*Sources: Whilst the quoted water quality criteria are compliant with SEQ WSA03 Water Supply Code of Australia and guidance provided in the Australian Drinking Water Guidelines 2011 (ADWG), some minor modifications have been included to simplify this table for easier use as well as accommodate Unitywater specific requirements

Note1: **<10 MPN/100mL or cfu/100ml** Total Coliforms will be accepted where total chlorine is greater than 0.5mg/L.

b. Water mains ≤50m length and ≤DN300

FCR results must be submitted to Unitywater in writing for review and assessment.

Passed Result

Unitywater's Water Quality Results Assessor will confirm in writing whether the water quality result has 'passed" or 'failed' based on the FCR <3mg/L.

Failed Result

If the water quality results has 'failed', the dechlorination process must be repeated until a FCR result of <3mg/L is achieved and the result resubmitted to Unitywater for review and assessment

Step 8. Connecting to the Network

Mains will be only be connected to Unitywater's network when:

- Unitywater has received the completed *F10045 Water Quality Mains Commissioning Form;*
- Approved permit to work as per *Pr8996 Manage Planned Network Intervention Procedure;*
- Written communication has been received from the Unitywater 'Water Quality Results Assessor' advising the water quality result as having 'passed'.

6. Record Keeping

Records relating to the Water Quality must be provided including:

- Signed and completed *F10045 Water Quality Mains Commissioning Form;*
- Chain of Custody documents for water quality sampling;
- Copies of Water Quality results from a NATA Accredited laboratory;
- Written evidence demonstrating assessment of the water quality results.

These records must be stored in Unitywater Records Management System.

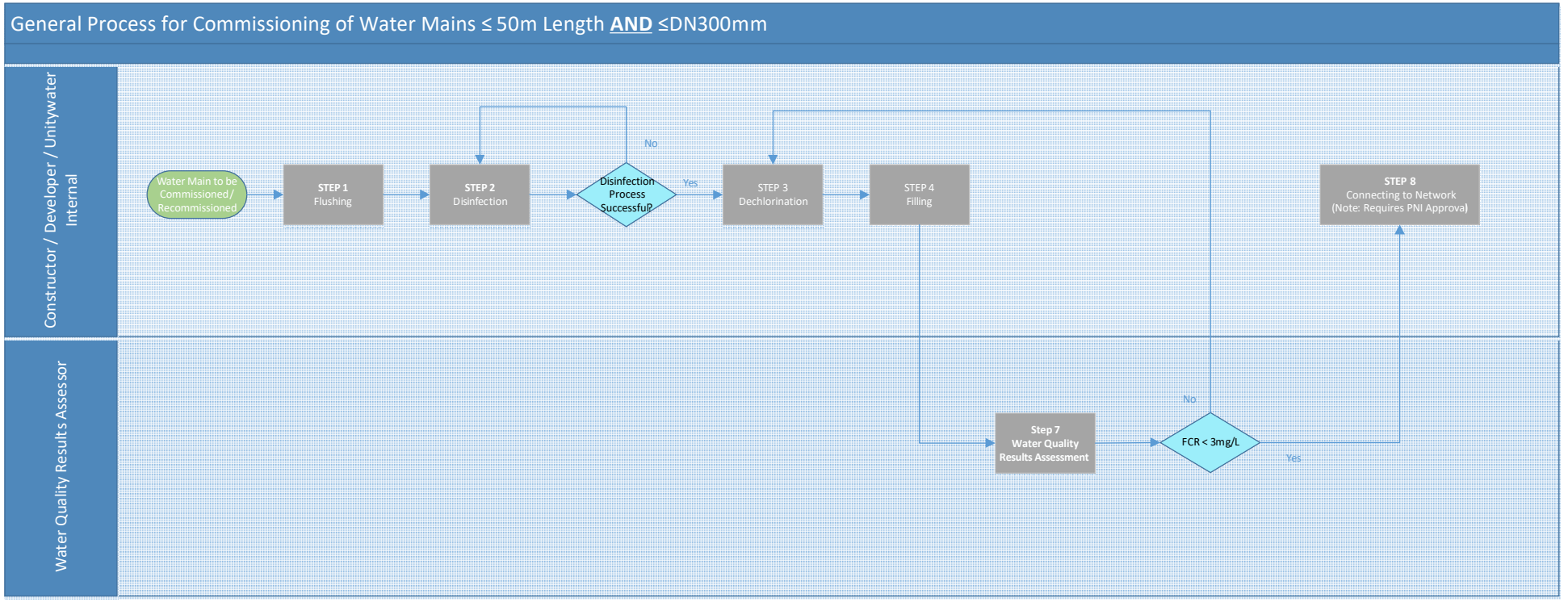
7. Procedure Flowchart

Refer to figures on following pages:

- **Figure 1** – General Process for Commissioning of Water Mains ≤50m in Length and ≤DN300;
- **Figure 2** – General Process for Commissioning of Water Mains >50m in Length OR >DN300.

Pr9032 - Procedure for Managing Water Quality During Mains Commissioning

Figure 1



Pr9032 - Procedure for Managing Water Quality During Mains Commissioning

Figure 2