QUALITY MANAGEMENT SYSTEM

Standard Operating Procedure

Disinfection and Hygiene for Water Reticulation

WSP 005

DOCUMENT CONTROL SHEET

This is a controlled document with all amendments to be processed via:
Selwyn District Council's Services Delivery Manager

Document	WSP 005: Disinfection and Hygiene for Water Reticulation	
Date	27 February 2023	
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REVISIONS

Number	Issue date	Description	Additions
Version 0.0	17 April 2013	Draft for discussion	Original draft prepared by Opus
Version 0.1	21 February 2014	Draft for discussion	Edited by Hannah Staples to incorporate changes required by SDC
Version 0.2	28 February 2014	Review	Edited by Hannah Staples to accommodate Opus feedback on changes
Version 0.3	14 April 2014	Review	Edited by Hannah Staples to address Asset Manager (Murray England) comments and finalise for approval
Version 1.0	09 June 2022	Review	Edited by MA – now covers both urban and rural supplies (WSP 005 also supersedes WSP 006)
Version 1.1	27 February 2023	Review	Edited by MA – to align with new DWQAR requirements

1.0 SOP Control Information

Heading	Detail
Status	Final
Frequency	As required
Audience	Operator
Purpose	Document disinfection and hygiene procedures applicable to water reticulation during construction and maintenance to afford a high degree of confidence that when work is carried out the water supply is not put at unnecessary risk of contamination. ***This version of WSP 005 supersedes all previous versions of WSP 005 and WSP 006.***
Responsibilities / Qualifications	Process Owner – Service Delivery Manager Adviser – Principal Water Engineer
Review / Audit Frequency	Frequency: 5 yearly Next Review: February 2028

2.0 SOP Prerequisites

Heading	Detail
Health and Safety	• Chemicals used for the disinfection are hazardous. These must be stored, handled, used and disposed of in accordance with the applicable material safety data sheets (MSDS) and any other applicable Health and Safety procedures. • Asbestos Cement (AC) pipe materials are present in the existing water network reticulation. Ensure that all appropriate health and safety precautions are complied with when handling and cutting AC pipe materials.
Materials and Equipment	• 1% chlorine solution and means of application (e.g. spray bottle) • Hydrant standpipe fitted with approved testable backflow prevention • Disinfection chemicals • De-chlorination chemicals • Containers and measuring equipment for making up chemical solutions • Chemical dosing pump • Water sample collection equipment • Water test equipment and consumables – FAC, pH
Contingency Plan	Implement appropriate follow up actions including, but not limited to, further repetition of the disinfection procedure, re-testing, and possibly the issue of a boil water notice. Advise Council Engineer or representative of any situation when contamination of the reticulation has, or is likely to have occurred, or when disinfection procedures are unsuccessful or unable to be followed.
Record Keeping	The record keeping requirements are the responsibility of the operator and must be available for inspection on demand. The checklists found at the rear of this document provide sufficient record keeping details and shall be completed by the operator.

3.0 Background

Selwyn District Council (Council) monitors the water quality throughout its 26 public water supplies on a daily basis to ensure a safe supply is maintained. Of the 26 schemes,10 are permanently chlorinated and 16 which are temporarily chlorinated until such time as an exemption from the requirement for residual disinfection is granted by Taumata Arowai.

Permanent chlorination is in place for the schemes with a surface source and/or rural-restricted schemes where water enters private tanks before being consumed. These sources have more variable quarter quality and restricted supply private tanks introduce an additional risk of contamination after the point of supply, and thus the extra level of protection is required in these cases.

Temporarily chlorination is in place for the schemes with more stable source water quality, generally from deeper ground water and with no or few restricted water connections. These sources have more stable water quality and are currently being prioritised for exemptions from the requirement for residual disinfection mandated by the new Drinking Water Quality Assurance Rules 2022 (DWQAR) published by Taumata Arowai.

The schemes where a permanent chlorine residual is maintained are as follows:

- Acheron
- Arthurs Pass
- Castle Hill
- Dalethorpe
- Hartleys
- Hororata
- Springfield
- Sheffield
- Upper Selwyn Huts
- Lake Coleridge

The schemes where a temporary chlorine residual is maintained (until such time as an exemption from the requirement for residual disinfection is granted by Taumata Arowai) are as follows:

- Claremont
- Darfield
- Dunsandel
- Jowers Road
- Kirwee
- Lincoln
- Leeston
- Greater West Melton
- Prebbleton
- Rakaia Huts
- Rolleston
- Southbridge
- Springston
- Tai Tapu
- Te Pirita
- Taumutu

If an exemption from the requirement for residual disinfection is granted by Taumata Arowai, all schemes have emergency chlorine systems available such that they can be chlorinated at short notice, in response to an event. The potential triggers for such actions are detailed in individual scheme Water Safety Plans.

In both the cases of the permanently chlorinated and temporarily chlorinated schemes, it is imperative that the quality of the water delivered from the treatment plants is not compromised as the water is

transported through the reticulation system to residents' properties. In order to achieve this, it is required that works carried out on the water supply network follow industry good practices as outlined in this Code of Practice in order to preserve water quality and safeguard the water system against contamination, both chemical and microbiological.

4.0 Objectives

Water supply authorities are required by law to ensure that the water supply system is free from conditions that may be hazardous to public health.

The Water Services Act 2021 requires drinking water suppliers to ensure they provide safe drinking water to consumers by:

- Providing a drinking water regulatory framework that is consistent with internationally accepted best practice, including a duty on drinking water suppliers to:
    - have a drinking water safety plan; and
    - comply with legislative requirements (such as drinking water standards) on a consistent basis;
- Providing a source water risk management framework that, together with the Resource Management Act 1991, regulations made under that Act, and the National Policy Statement for Freshwater Management, enables risks to source water to be properly identified, managed, and monitored; and
- Providing mechanisms that enable the regulation of drinking water to be proportionate to the scale, complexity, and risk profile of each drinking water supply.

This Act has the following additional purposes:

- To establish a framework to provide transparency about the performance of drinking water, wastewater, and stormwater networks and network operators;
- To provide mechanisms that build and maintain capability among drinking water suppliers and across the wider water services sector; and
- To establish a framework for the continuous and progressive improvement of the quality of water services in New Zealand.

The objectives of this Code of Practice are to:

1. Prevent contamination of the water supply system by defining the minimum requirements for the disinfection of new watermains.
2. Prevent contamination of the water supply system by defining the minimum requirements for the disinfection of existing watermains and fittings following planned or reactive maintenance.
3. Prevent contamination of the water supply system by defining required best practices for workers and materials that come in contact with water.
4. Comply with regulatory requirements under:
    a. Water Services Act 2021
    b. Health (Drinking Water) Amendment Act 2007
    c. Drinking Water Standards for New Zealand 2005 (Revised 2018)
    d. Health and Safety at Work Act 2015
    e. Resource Management Act 1991
5. Set out practices that follow good practice through the Guidelines for Drinking Water Quality Management for New Zealand 2005 (2016 edition).
6. Assist with demonstrating gaining an approved Water Safety Plan for each scheme

4.1 Areas of Application

- Installation of new mains and connections
- Reticulation repairs/maintenance

- Valve and hydrants inspections/repairs
- Flushing of reticulation systems
- Reticulation inspections involving cutting of live mains
- Service connections and meters
- Temporary supplies
- Repair work or modification work on pipeline or connected facilities
- Water pump stations
- Reservoirs
- Transmission pipeline specific requirements
- Treated Water tanks at water treatment facilities
- Wells and surface pumps

4.3 Roles and Responsibilities

Contractor Responsibility

All water supply contractors must adhere to the Disinfection Code of Practice for all work on the Council's water supply networks.

Contractors, Engineers overseeing works, and the Council Water Services Team shall audit the disinfection practises to ensure the Code is being followed. Records must be kept of audit results.

Contractors shall ensure that their water reticulation workers are medically fit for work on a daily basis. Refer to section 5.2 Water Reticulation Workers – Hygiene and Health.

Any problems or deviations from the outlined procedures, or any confirmed or suspected contamination of the water supply network, must be reported as per Section 4.2 at the earliest opportunity.

Council Water Services Team Responsibility

In response to any issues, the responsibilities of the Council's Water Services Team are to:

- Be satisfied that disinfection and safety of the system is being undertaken in compliance with written procedures;
- Identify any special conditions or restrictions applicable to the management procedure being followed; and
- Maintain a record of key steps taken in their relevant area of authorisation.

4.4 Reporting of Gastrointestinal Illness

Water supply workers shall report any gastrointestinal illness (e.g. vomiting, diarrhoea) or having had a gastric or viral illness within two weeks leading up to work on treated water facilities to their employer. The worker shall be required to not undertake any work in direct contact with the live water network for a minimum of 48 hours from the time that their last symptom of the illness is experienced.

In the event of a specific outbreak of a particular disease, they shall also follow any advice from the Ministry of Health, Taumata Arowai and the Canterbury District Health Board that may supersede the above minimum requirements.

Refer to section 5.2 Water Reticulation Workers – Hygiene and Health.

Medical clearance shall be provided upon request. In particular, this shall be required for any staff member diagnosed with a serious illness including typhoid, shigella, cholera or hepatitis A.

Any stand downs, or serious illnesses shall be reported through the following channels, depending on the nature of the works:

- New subdivisions: Reporting to the assigned Subdivisions Engineer, who shall notify Council's Water Services Team.
- Capital works: Reporting to the Engineer's Representative, who shall notify Council's Water Services Team.

- Maintenance works: Reporting to Council's Water Services Team

4.5 Notification

Any incident in which it is believed that the safety of the supply may have been compromised, or any testing indicating a non-compliance to the Council Water Services Team.

Proven non-compliance will be notified to Taumata Arowai by Council's Water Services Team. If E. coli or Total Coliform contamination is detected Council will follow internal procedures defined in the relevant Water Safety Plan and Incident Response Plan.

4.6 Assessment of Level of Risk

Disinfection is key to preventing contamination of the water supply during maintenance but isn't a substitute for incorrect procedures and poor practices. A key part of the assessment of level of risk will include whether or not the water supply is chlorinated or what the disinfection residual readings are at the time of the event/work being undertaken.

The level of risk shall be assessed for all work carried out on the water supply system and documented in the job specific Health and Safety documentation (Daily Site Management Form / JSEA / SSSP). Where this work is undertaken by the SDC Network Management Contractor, the Health and Safety documentation (including risk assessment) must be attached to the Asset Management System Task. In work on the live system, the contractor shall assess the risk of contamination on a case-by-case basis using the procedure in section 10.1 and then follow the corresponding recommended procedures.

The procedure for work and requirement for bacteriological testing depends upon the level of risk of contamination to the water supply system.

5.0 Water Reticulation Workers

5.1 Qualifications

Work on the water reticulation system shall be undertaken by a Water Supply Installer who is dedicated to the job on site overseeing the work who meets one of the requirements below:

- Is certified as a Christchurch City Council (CCC) Authorised Water Supply Installer, OR;
- Holds one of the following qualifications, as a minimum;
    - National Certificate in Water Reticulation (Planned and Reactive Maintenance Technician) (Level 3), OR;
    - New Zealand Certificate in Utilities Maintenance (Strand Water) (Level 4), OR;
    - Have committed to ongoing training towards the New Zealand Certificate in Utilities Maintenance (Strand Water) (Level 4), OR;
    - New Zealand Certificate in Infrastructure Works (Pipeline Construction and Maintenance) (Level 4) (strand Drinking-Water), OR;
    - New Zealand Certificate in Pipe Installations (Level 4) (trenched).

The qualified Water Supply Installer shall be present on site to oversee the pipe installations, connections and sterilisation process. This requirement shall apply to:

- Tendered capital works on the reticulation system;
- Subdivision works;
- Reticulation maintenance works.

For other works that are not specifically reticulation works (i.e. reservoir repairs, pump replacement or well works) where the above qualifications may not be relevant, staff do not require the above authorisation. For these works, the contractor shall submit and adhere to a site specific safety plan (SSSP) and commissioning plan detailing disinfection practices that are approved by a suitably qualified and experienced Council staff member prior to undertaking the works.

It is also noted that the above outlines generic minimum requirements. The Selwyn District Council may impose any other requirements over and above these minimum requirements for individual construction contracts or subdivision consents, if deemed necessary.

Any exceptions to the above minimum requirements are required to be approved in writing by a Council's Waters Services Team or Development Engineer.

5.2 Hygiene and Health

Water supply workers are to partake in normal good personal hygiene procedures (washing hands after going to the toilet). Water supply workers with running/septic skin infections or wounds shall not work on the water supply network unless the infection or wound is effectively dressed and in a location unlikely to be immersed.

Council may at any time require water supply workers to produce a medical clearance against being carriers of potentially waterborne diseases including Shigella, Salmonella, Campylobacter, Hepatitis A, COVID-19, Giardia and Cryptosporidium.

External contractors who have recently worked on stormwater or wastewater sites (reticulation or treatment) shall not work on any water supply works until new or disinfected PPE is provided for the worker(s), and they have adequately washed themselves.

For water supply works completed under the Council's Water Services Network Management Contract, the contractors standard operating procures shall be followed for these works.

6.0 Disinfection of tools, material and other equipment

Information provided in this section is generic minimum requirements for any contractor working on Council's water reticulation network.

6.1 Vehicles

A high standard of cleanliness shall be maintained in the interiors of all vehicles used for water reticulation works. Vehicles must be equipped with sanitary wipes or antibacterial liquid for hand sanitation when working on site.

The exterior of vehicles shall be maintained in a clean state. How this cleanliness is achieved shall be managed by individual contractors using their own processes. These processes may include separate vehicles for water and wastewater activities, separate processes for inspections versus maintenance works, and processes for cleaning vehicles, including what would trigger cleaning to be undertaken, and what the cleaning method shall be employed. Contractors shall provide this methodology to Council upon request.

6.2 Stores

A high standard of cleanliness shall be maintained in the interior of all stores.

Water supply and wastewater equipment shall be stored separately.

All materials shall be free of visible contamination and remain protected from contamination until and during installation. This will include, but not be limited to, being stored and handled to minimise contact with foreign materials. Fittings shall be boxed, capped or sealed with plastic wrapping. All pipes shall be capped.

6.3 Tools and Equipment

Separate tools and equipment must be used for water, wastewater or stormwater works. In cases where this is not possible, they are to be thoroughly cleaned and disinfected before use on water supply works and this cleaning documented within job specific Health and Safety documentation (minimum requirements to include: what cleaned, by who, date, time and method used).

All tools contacting the water supply or its parts, including but not limited to cutting surfaces, must be adequately disinfected prior to commencing work and subsequently as necessary when tools come into contact with soil, backfill materials or unsterilised surfaces.

Cleaning shall include disinfection either using a minimum 1% chlorine spray, or by submerging the tool into a 1% chlorine solution.

Disinfected tools and equipment must not be placed directly on the ground prior to use.

Larger items of plant and equipment that may have become contaminated (i.e. excavators) shall be steam cleaned or thoroughly cleaned and disinfected with evidence available before use on potable water works.

6.4 Materials

All materials used in the construction or maintenance of the main and fittings that come into contact with the drinking-water must be thoroughly disinfected prior to use. Disinfected items must be protected from potential contamination sources after sterilisation and prior to/during installation. Water mains and pipe work will still be required to be disinfected and pressure tested in accordance with Section 8.

Disinfection shall include either using a minimum 1% chlorine spray, or by submerging the tool into a 1% chlorine solution.

Disinfected materials must not be placed directly on the ground prior to use.

A bactericidal lubricant complying with AS/NZS4020 shall be used on all rings and gaskets coming into contact with the reticulated water.

6.5 Disinfection and Neutralising Chemicals

A minimum 1% solution for disinfection of tools, equipment, fittings and materials shall be used. A newly prepared solution shall be made available at least weekly and the old solution disposed of after de-chlorination.

Chemical neutralising of chlorine solution (de-chlorination) should only be carried out using the chemicals listed in Appendix B.

6.6 Use of Fire Hydrants

The DWQAR rule D3.6 identifies that ‘Access to a water network through use of a standpipe is not permitted except by Fire and Emergency New Zealand, other emergency services, the drinking water supplier, or authorised contractors to the drinking water supplier where it is reasonably necessary to access the network for the operation of the drinking water supply.’

Connecting to hydrants can present a risk of contaminating the water supply network if there is a loss of pressure causing a backflow event while they are connected.

Selwyn District Council’s Water Services Network Management Contractor Processes

As CORDE are currently the Council’s dedicated Water Services Network Management Contractor, there are requirements for them to use hydrants that are different to other contractors. CORDE may be undertaking flushing of a scheme, either in reaction to a water quality event, or as part of programmed works. In general, routine flushing does not require upstands with testable RPZ backflow preventers provided the following requirements are able to be met:

- All upstands clean, and meet requirements for other tools and equipment used on water supply (as per Section 6.3).
- No hose connected to upstand, such that water is flowing freely to open air environment (therefore no risk of backflow), or;
- If layflat hosing is used to control discharge;
    - Layflat hosing meets requirements for tools and equipment in terms of cleanliness, as per Section 6.3.
    - The layflat hose must be laid above ground, and not submerged in water at all.
    - The hydrant must be manned at all times by an experienced operator, ready to close the hydrant if there is any loss of pressure event

In any other scenario, an upstand with a testable RPZ backflow preventer shall be used.

External Contractors

Council are currently constructing dedicated bulk water extraction sites. Once constructed, these sites will require users to register and extract water from a dedicated location. The filling point will be located downstream of a point of supply flow meter and include a testable double check valve maintained by Council. Use of these filling points will require use of a standpipe, however being downstream of the point of supply it will be a controlled activity not within the reticulation network.

The form to gain approval to use a bulk water extraction location can be found here: Selwyn District Council - Bulk Water Extraction

6.7 Water Tankers for Emergency Supply of Potable Water

Any tanker used to provide an emergency water supply for Council must be a tanker water carrier that only carries potable drinking water as defined by Taumata Arowai. The source of the water must be water taken from a reticulated supply that complies with the DWSNZ and is listed in the Taumata Arowai Register of Community Drinking water Supplies and Suppliers in New Zealand.

Water tankers for emergency supply of Potable Water shall only supply potable water to the point of supply which has a chlorine residual greater than 0.3 mg/L at all times. This will require careful management of the location of extraction depending upon the status of an exemption from residual disinfection should it be approved by Taumata Arowai.

6.8 Water Tankers for Super-chlorination

Chlorination and testing of new mains shall be completed by either personnel specified on the Christchurch City Council (CCC) Approved Chlorination Contractor webpage Chlorination Contractors: Christchurch City Council (ccc.govt.nz) or Council's Water Services Network Management Contractor.

These contractors shall use a registered water carrier's tanker to carry the potable water to the site that is dedicated for the purpose of carrying potable water (i.e. it must not be a tanker that is used for any other activities such as transporting milk, wastewater or stormwater systems).

Water tankers shall only supply potable water to the point of supply/discharge to the point of use/filling location which has a chlorine residual greater than 0.3 mg/L at all times. This will require careful management of the location of extraction depending upon the status of an exemption from residual disinfection should it be approved by Taumata Arowai.

For further information on the requirements for the chlorination of new mains as part of their commissioning, refer to Section 8.2.

7.0 Work Practices

Good practices shall be applied at all times in main laying, maintenance and repair procedures.

In the event of a confirmed or suspected contamination of the water supply system the immediate area shall be isolated and escalated to Council's Water Services Team. All valves used to isolate the area must be tagged and recorded by the CORDE operator/site supervisor.

All connecting valves used to isolate the reticulation system from a main being repaired/disinfected shall be tagged and recorded by the site supervisor responsible for the disinfection and signed off at re-commissioning.

For planned works (rather than repairs), pressure testing and super chlorination must not be undertaken against live network valves, there must be an air gap between tested mains and the existing live reticulation network until a successful test result for pressure test, super chlorination and bacteria testing is achieved and supporting information passed to the Council's Engineer.

The DWQAR rule D3.6 identifies that 'Access to a water network through use of a standpipe is not permitted except by Fire and Emergency New Zealand, other emergency services, the drinking water supplier, or authorised contractors to the drinking water supplier where it is reasonably necessary to access the network for the operation of the drinking water supply.'

7.1 Backflow Prevention Devices for Temporary Connections

Temporary connections to pipework will be required in some specific circumstances. An example would be to fill a pipe from a tanker as part of super chlorination or pressure testing.

All temporary connections to reticulated water supplies shall incorporate a testable RPZ device. This includes water being used for hydrostatic pressure testing, flushing and disinfection. See Figure 7.1 below for a recommended temporary set up.

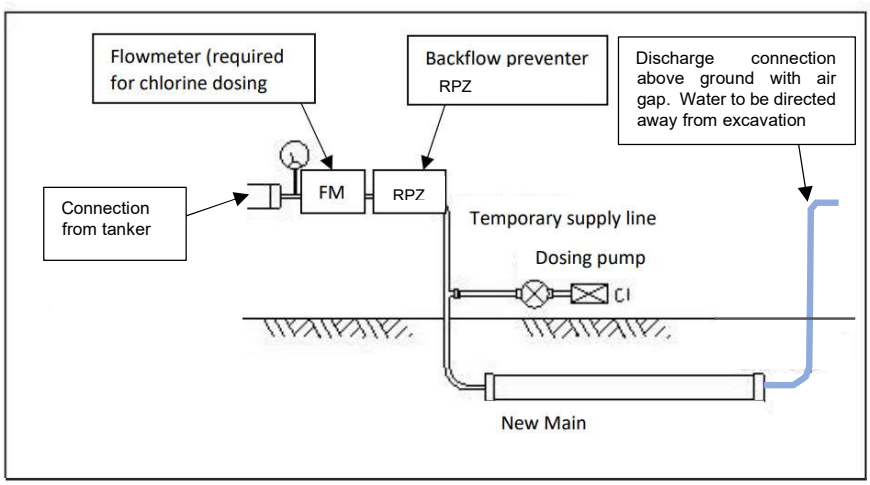

Figure 7.1: Suggested temporary dosing/discharge connection

7.2 Air Scouring

Air scouring is not routinely undertaken on Council supplies, and would only be undertaken by direct request from Council's Water Services Team.

If undertaken, a specific control plan shall be adopted. Consideration shall be given to the potential requirements below in the creation of the control plan.

During a programme of air scouring the contractor shall ensure:

a) A trial shutdown is completed and shutdown notifications distributed to ensure scouring operations do not adversely affect public health.
b) All valves to be operated must be confirmed as functioning to close fully, so that they contain scour wastes.

c) All service connections, where possible, are isolated before air scouring.
d) All fittings and equipment must be disinfected with minimum 1% chlorine solution prior to use.
e) The compressor pressure shall be set at 200KPa less than the mains pressure to eliminate any risk of backflow.
f) All mains must be purged of scour waters following the air scouring to ensure mains are returned to service in a hygienic state.
g) Scouring should be followed by checks that the normal chlorine residual has been achieved again for normally chlorinated schemes, or bacteriological testing shall be completed for non-chlorinated schemes at the nearest available sampling location.

8.0 New watermains disinfection procedure

Connecting a new network watermain to the existing reticulation is not permitted until all requirements in the following sections have been successfully completed. The following overview gives the preferred method. Approval shall be requested from the relevant Council Engineer (Engineer's Representative or Subdivisions Engineer) for the process to be used.

a) Preferred Method:
This method involves bringing in water for the pressure testing and chlorination. It is noted that with this method, the main cannot be flushed adequately until the mains are connected to generate sufficient flushing velocity. It therefore requires a Council approved commissioning plan to be in place and skilled and experienced operators to do this without risking water flowing in the wrong direction as part of the flushing exercise.

i. Construct the pipe;
ii. Chlorinate (fill pipe using water brought in by tanker);
iii. Undertake pressure test
iv. Flush out chlorinated water and dispose of (need to bring in more water to pump through to push out chlorinated water).
v. Undertake bacteria testing and obtain acceptable result.
vi. Connect to reticulated water (i.e. construct permanent connection). Refer 8.3 for connection process;
vii. Flush using mains pressure after final connection, ensuring only connected from one location, and all water is flowing away from connection point.

8.1 Flushing

A flushing plan shall be prepared as part of the commissioning plan/health and safety documentation, prior to any flushing occurring. This will include but not be limited to who will flush, how it will be done, where these activities will occur and for how long locations will be flushed and in which direction. The main shall be thoroughly flushed in sections through hydrants, producing sufficient flow velocity to remove all foreign matter. The volume of water used must be equivalent to at least three times the volume of the pipe being flushed. This initial flushing shall be undertaken with water brought in by tanker and pumped into the main. Where installed, all laterals shall be flushed before permanent connections being completed.

Council may also require that the main (≥50mm internal diameter) shall be CCTV inspected and the CCTV report verified as completely free of debris and any pipe shavings before starting chlorination.

Flushing guidelines are provided in Appendix A.

If adequate flushing velocities are not able to be achieved prior to connecting to the live reticulation, then the connection may be able to be made at the discretion of the Council, following preliminary flush. In these circumstances where the desired velocity cannot be achieved, the following steps shall be followed as a minimum:

- Potential CCTV survey, at the discretion of the Council. If undertaken, CCTV equipment used shall be dedicated for use in potable water supplies, and shall be stored / cleaned to maintain hygiene. Specific approval shall be obtained to undertake a CCTV survey prior to it commencing.
- The main shall have been chlorinated, the chlorinated water disposed of, and replaced with potable water and a successful bacterial test completed (showing no E.coli or Total Coliforms present)
- Visual inspection of water being disposed for any signs of discolouration.
- Connection done under direct supervision of Council staff with an approved commissioning plan in place to ensure that reticulation water flows in one direction into the new pipework to achieve flushing velocities in a controlled manner, without any water from the new pipework being given a pathway to flow back into the live reticulation (i.e. water flow in controlled via a single isolation valve rather than multiple valves).

8.2 Chlorination

Following pressure testing of the pipework and prior to commissioning of any works with which potable water will come in contact, the system must be chlorinated. Chlorination shall be completed by either:

- The Council's Water Services Network Management Contractor, for mains they have installed.
- A Christchurch City Council (CCC) Approved Chlorination Contractor to chlorinate the pipework. Refer to Chlorination contractors : Christchurch City Council (ccc.govt.nz)

The Chlorination Contractor will be required to arrange the provision, installation and removal of all temporary fittings necessary to allow for the introduction of the sterilising solution to, and its removal from, the system. The Chlorination Contractor is to ensure that a minimum of 24 hours' notice is given for sterilisation. The authorised installer is to flush the system to be sterilised to remove all debris and air (refer 8.1).

Note that the system must not be drained after flushing unless all high points are 'vented' to allow for complete removal of air.

The Chlorination Contractor will sterilise using a solution of water and chlorine. The system will be filled with water containing a free available chlorine (FAC) concentration of 25 $g/m^3 \pm 5$ g/m^3. It will be allowed to stand for a minimum of 24 hours for all new systems. At the end of the disinfection period, the FAC concentration must be at least 10 g/m^3. If the FAC is less than 10 g/m^3 at the completion of the period, the disinfection process must be repeated until a satisfactory result is obtained.

8.2.1 Chlorination

The sterilising solution will be injected into the system using a portable chlorinator system, or using a tanker with a pre-mixed solution as outlined below. Under no circumstances will the use of hypochlorite powder or chlorine tablets dumped into the pipe and hydrant tees be an acceptable practice. The sterilising solution should be fed by gravity or pumped into one end of a stem if possible and the 'flushing' water in the system displaced out of the other end of the system to be disinfected until tests carried out show that the water being displaced contains the full FAC concentration.

8.2.2 Sterilising Process

a) Fill the main with chlorinated water at the target concentration using one of the following two methods:
   I. If the solution is pre-mixed in a tank or tanker, the correct dose shall be achieved, and once confirmed, pumping of the water into the main shall commence. In this instance, the tanker shall have been filled with potable water from one of Council's registered water supplies; **OR**

II. If the chlorine is to be dosed into the new main, this shall be done at the appropriate rate using a proportional dose system to achieve the target rate, based on a combination of the chlorine concentration and the flow rate being injected.

b) Allow the chlorinated water to flow for at least the calculated travel time through the new mains before carrying out the initial total residual chlorination test.
c) If the initial test complies, close off the main and leave the chlorinated water for 24hrs. If it fails, it will require re-chlorination.
d) After 24hrs, carry out the free residual chlorine test. If it passes, continue. If it fails, repeat from step a).
e) Flush the main and dispose of the sterilising solution as detailed in the "Disposal of sterilising solution" clause (8.2.3 below). A flushing period exceeding the travel time by 15mins should be sufficient. Test for chlorine after disposing of the chlorinated water to ensure that the chlorine is at a level equivalent to or less than the normal level for that scheme.
f) Take a sample for bacteriological testing. This shall be obtained from a fill/flush point, or water toby box that is part of the new installation. If it fails, re-sterilise the watermain from step a).
g) Commission the reticulation on achieving a complying bacteriological test.

8.2.3 Disposal of Sterilising Solution

After the satisfactory completion of the sterilising process, flush the main well before the services are connected. Flushing shall achieve a concentration equivalent to or less than the normal level for that supply (the Council can advise what this is for each supply). Dispose of the chlorine solution by either:

a) Flushing into the sanitary sewer system (with approval from Council's Water Service Team). This would require RPZ backflow prevention to be in place to prevent backflow of wastewater into the water main.
b) Removing off-site; or
c) Discharging to ground in a manner approved by the Council. To do this, the solution must be de-chlorinated to below 1 mg/L (refer to Appendix B).

8.3 New Main Connection

The connection of a new main to the existing reticulation must be treated as a medium risk (refer to Section 10.1 for risk classification), provided construction procedures are followed ensuring no contamination of either the new or existing main by foreign material or groundwater.

If the newly chlorinated main has not been connected to the existing reticulation within 15 working days of chlorination, the main shall be retested for E. coli and Total Coliforms as per the initial testing. If any of the new samples fail the E. coli or Total Coliform test the disinfection procedure must be repeated.

The following process shall be followed in order to connect a new main (i.e. following capital works project or new subdivision completion):

a) Complete application to connect form (Selwyn District Council - New Water Connection approval form), submit to relevant Engineer (Subdivisions Engineer for subdivision work, Engineer's representative for Council capital works), and receive approval. This process will ensure that the following has happened:
   I. Residents have been informed of the planned shutdown.
   II. The main has been adequately chlorinated and flushed.
   III. The Councils Network Management Contractor is booked in to perform the shut down and stand-over.
b) Ensure Council's Water Services Network Management Contractor are on site to perform stand-over, a minimum of 5 working days' notice is required.
c) Excavate trench and dig sump under the section of the existing pipe to be removed to allow for the connection. Ground shall be excavated to 200mm – 400mm below the bottom of the pipe, with the sump area sufficiently lower than this to allow pumping out of any water.

d) Shutdown and drain the connecting watermain in accordance with good practice. Ensure pumping is in place to pump this water from the trench while keeping the water level well below the pipe level.
e) If water is required to be added for dust suppression (i.e. AC pipe cutting where manual cutting methods are not possible), this shall chlorinated and from a potable water source.
f) Thoroughly clean and disinfect existing connecting pipework/fittings. Use 1% chlorine spray.
g) Any new fittings to be installed shall be kept clear of the surrounding trench material and when unwrapped placed on a clean surface (e.g. impervious plastic sheet) until installed.
h) Spray all surfaces of fittings and wipe the interior of open ends of the new and existing watermains with a minimum 1% chlorine solution (Refer to Section 6.5).
i) After completion of the work, the watermain must be flushed out through hydrants downstream of the new connection. The volume of water used must be equivalent to at least three pipe volumes.

9.0 Temporary watermains disinfection procedure

When a project requires the use of a temporary watermain less than 100m in length, all temporary fittings shall be disinfected as per Section 6 prior to connecting to the existing system. Otherwise the full disinfection procedure in Section 8 shall be followed.

9.1 Flushing

The temporary watermain shall be flushed with a volume of water equivalent to three pipe volumes of the temporary supply and flushed through all practical outlets to remove any foreign materials that may have entered during storage / installation. Refer to Appendix A for flushing volumes.

9.2 Chlorination

The temporary watermain and fittings shall be disinfected with a chlorine dose of 100 mg/l for a minimum period of 30 minutes. After the 30 minute contact time the water within the temporary watermain shall be re-tested and the residual FAC must not have dropped by more than 20mg/l. Field tests are acceptable as confirmation of the dosage.

The test results must be forwarded to relevant Council Engineer (Engineer's Representative or Subdivisions Engineer, whichever applicable).

Disposal of the super-chlorinated water shall be in accordance with the guidelines given under Section 8.2.3.

10.0 Disinfection Procedures for Emergency and Planned Repairs

It is noted that the Council's Water Services Network Management Contractor is responsible for the maintenance of the Council's public water supplies. For any repairs to the reticulation system, the Council's Water Services Network Management Contractor will act as the head contractor for the repair using their standard operating procedures. Generally, works will be completely solely by the Council's Water Services Network Maintenance Contractor.

10.1 Risk of Contamination

The level of controls and checks required depends on the level of risk of contamination to the network. The risk level is defined below:

Low Risk:

Scenario:

a) Supply with residual disinfection (and compliant greater than 0.2mg/L in network) where the pressure in the main is maintained at all times while carrying out the work.

The following controls shall be in place for Low Risk repairs:

- Excavate while controlling positive pressure (controlling positive pressure may include reducing the amount of water flowing out of the leak, while still maintaining some pressure).
- Reduce water level in trench to below pipe by constructing appropriate sump and pumping. Ensure pumping sufficient to keep up with water as it is drained so ponding water is always at least 200mm below the pipe invert.
- Thoroughly clean area to be worked on prior to start.
- Spray external surfaces with minimum 1% chlorine solution.
- Complete repair and return to service.

Medium Risk:

Scenarios:

b) Supply without residual disinfection (or non-compliant, less than 0.2mg/L in network) where the pressure in the main is maintained at all times while carrying out the work, or

c) Supply with residual disinfection (compliant, greater than 0.2mg/L in the network) where de-pressurising of the main has occurred in a controlled manner, with an adequate sump constructed (approximately 400mm beneath base of pipe), and controlled discharge of any water from the trench.

Under medium risk scenarios, the repair process can be completed as per the relevant standard process for the contractor completing the works. The standard process shall include the following as a minimum:

- Excavate while controlling positive pressure (controlling positive pressure may include reducing the amount of water flowing out of the leak, while still maintaining some pressure).
- Reduce water level in trench to below pipe by constructing appropriate sump and pumping. Ensure pumping sufficient to keep up with water as it is drained so ponding water is always at least 200mm below the pipe invert.
- Clean outside of pipe with minimum 1% chlorine solution.

- **For Scenario b):**
  - Complete repair and return to service
- **For Scenario c):**
  - Completely isolate the pipe and drain water to empty pipe. Ensure pumping sufficient to keep up with water as it is drained so ponding water is always at least 200mm below the pipe invert.
  - Visually inspect flushed water for contaminants and/or discolouration. If water coming out of pipe is discoloured, treat as High Risk.
  - Cut into the pipe ready to make the repair.
  - If water is required to be added for dust suppression (i.e. AC pipe cutting where manual cutting methods are not possible), this shall be from a chlorinated potable water source.
  - Thoroughly clean and disinfect interior and exterior of open ends of pipe to be connected into.
  - Complete the repair.

- After completion of works, flush in a controlled manner through the repaired section and to waste before putting back into service.

High Risk:

Scenarios:

d) Supply without residual disinfection (or non-compliant, less than 0.2mg/L in the network) where de-pressurising of the main has occurred in a controlled manner, with an adequate sump constructed (approximately 400mm beneath base of pipe), and controlled discharge of any water from the trench, or

e) If as part of an emergency repair process, it is either confirmed or suspected that contamination of the water main is considered likely to have occurred, this shall be classified as a High Risk scenario. This may be either from a third-party damage event where contaminated material is believed to have come into contact with the live network, or where depressurisation of the damaged pipe is not adequately controlled where it is suspected contaminants are likely to have entered the pipe.

Under high risk scenarios, the repair process can be completed as per the relevant standard process for the contractor completing the works. The standard process shall include the following as a minimum:

- Initial components of response likely completed concurrently:
  - The Contractor undertaking the repair shall take all steps to reduce the spread of the suspected contamination.
  - Contact the Council's Water Services Team to advise of the event. A specific plan will be developed as to the steps to be taken prior to returning the pipe to service. Council's Water Services Team will to refer to the relevant Water Safety Plan and Incident Response Plan for guidance. However the response will include but not be limited to the following:
    - Public notification
    - For Scenario d, this response will include immediately turning on chlorination, accompanied by network flushing as identified in the network flushing plan.
    - For Scenario e, this response will include immediately increasing dose by 0.2 mg/L (provided this does not exceed the Chlorine dose action limit within the scheme specific UPCP), accompanied by network flushing as identified in the network flushing plan.
- Following components in sequence:
  - Isolate the water main being worked on.
  - Reduce water level in trench to below pipe by constructing appropriate sump and pumping. Ensure pumping sufficient to keep up with water as it is drained so ponding water is always at least 200mm below the pipe invert.
  - Clean outside of pipe with minimum 1% chlorine solution.
  - Cut into the pipe ready to make the repair.
  - If water is required to be added for dust suppression (i.e. AC pipe cutting where manual cutting methods are not possible), this shall be from a chlorinated potable water source.
  - Visually inspect flushed water for signs of contaminants and/or discolouration.
  - Thoroughly clean and disinfect interior and exterior of open ends of pipe to be connected into.
  - Complete repair.
  - Plan re-commissioning process, with guidance from Council's Water Services Team Representative.
  - Bacteriological testing using an IANZ approved process will be required to be undertaken from the most appropriate sampling location as part of the repair and recommissioning process. The specific location will be determined on a case-by-case basis, depending on the repair location relative to existing sample points. A

portable sampling point may be required (i.e. flammable sample tap that can be fitted to either a tapping saddle, fire hydrant, or screwed onto a water toby box).

- The steps taken by the maintenance contractor shall be recorded, and a review by the Water Services Network Management Contractor and Council completed following the repair process.

10.2 Bacteriological Sampling

Where samples are required, the results shall be within the limits outlined in Section 13.

E. coli and Total Coliforms analysis must be completed by an IANZ registered laboratory. It is noted that the Food and Health Standards (2006) Ltd is responsible for E. coli sampling on the Council's public water supplies.

11.0 Well and Surface Pump Maintenance

Any contractor who will be carrying out work on either bores, wells, well pumps, or surface pumps, shall submit a methodology to the SDC Water Services Team and Water Services Network Management Contractor engaging them to complete the works to demonstrate how they will manage the hygiene of the work.

11.1 Bore and Surface Pump Replacement

Below are the minimum requirements for work on well pumps, which involves removing the well pump from the casing and either carrying out maintenance or replacement.

- Ensure staff working on site who will come into contact with the equipment manage their own personal hygiene as per Section 5.2
- Have 1% chlorine solution available on site, stored securely.
- Thoroughly clean and disinfect interior and exterior of open ends of pipework and fittings.
- Ensure all riser pipe removed is stored securely, with ends of pipework and fittings protected from both organic matter and potential for vermin to enter.
- Ensure all cables are stored securely, coiled up, and protected from any organic matter, potential contamination sources and damage.
- All riser pipe, cables, pumps and any other equipment to be reinstalled into the well shall be treated with chlorine solution.
- Bore flushed to waste and E. coli sample taken, and result confirmed as absent of E. coli and Total Coliforms prior to recommissioning. This criteria of waiting for the E. coli result before re-commissioning can only be waived with the approval of a designated member of the Council's Water Services Team (refer Appendix C). Events that might allow this exception would be where the source that has been out of service is critical to maintaining supply, and the continued use of the backup supply (or the absence of any backup supply) in the interim is considered to present a higher level of risk than using the newly commissioned source pump without waiting for the E. coli result.
- There may be times when source water quality is such that Total Coliforms are present in similar numbers to the results of testing. However this should be discussed with the designated member of the Council's Water Services Team (refer Appendix C) before returning the source to service.

11.2 Well (Surface Source) Pump Replacement

Below are the minimum requirements for work on surface pumps, where parts of the pump are to be removed or in contact with the environment that will also be in contact with the drinking-water.

- Ensure staff working on site who will come into contact with the equipment manage their own personal hygiene as per Section 5.2
- Have 1% chlorine solution available on site, stored securely.
- Thoroughly clean and disinfect interior and exterior of open ends of pipework and fittings.
- Ensure all pipe / manifold removed is stored securely on site, with ends of pipework, fittings and pump protected from any foreign material entering the pipe.
- All pipework / manifolds / gaskets, pumps and any other equipment to be reinstalled are treated thoroughly with chlorine solution.

12.0 Reservoir Disinfection Procedure

Reservoir disinfection is typically carried out by the Council's Water Services Network Management Contractor in accordance with their standard operating procedure. Care shall be taken to ensure that appropriate concentrations of disinfectant and associated contact time are used such that the reservoir materials are not adversely affected/compromised by the disinfection procedure.

Additional guidance for reservoir disinfection is provided in AWWA Standard ANSI/AWWA C652-02 for "Disinfection of Water-storage Facilities".

Care should be taken when disinfecting the glass fused steel reservoirs within the district due to the limits of the sealant to withstand elevated chlorine concentrations for extended periods. The disinfection contact time and residual requirements should be modified to accommodate an initial dose concentration not exceeding 5mg/L at these sites.

13.0 Laboratory Test Results

E. coli and Total Coliforms analysis must be completed by an IANZ registered laboratory.

It is noted that the Food and Health Standards (2006) Ltd are responsible for E. coli sampling on the Council's public water supplies.

The sample results shall be in accordance with Table 13.1 before the reservoir or pipeline will be considered satisfactory to put into service.

Parameter	**Acceptable Value**
Residual Chlorine (FAC)	Within 20% of the normal value for scheme (Council can advise for each scheme)
Turbidity (NTU)	Less than 0.5 NTU (unless otherwise agreed by Council)
pH	Within 0.2 of normal value for scheme (Council can advise for each scheme)
E.coli	<1 per 100 ml sample
Total Coliforms	<1 per 100 ml sample
Odour	No adverse odour

Table 13.1: Acceptable laboratory test results

Appendix A - Flushing Guidelines

Flushing time guidelines in minutes for new works prior to disinfection

Pipe Diameter (Nominal)	Number of Hydrants to achieve flushing velocity*	Length of pipe			
(mm)	-	50m	100m	200m	500m
50	-	5 minutes	5 minutes	5 minutes	5 minutes
75	-	5 minutes	5 minutes	5 minutes	8 minutes
100	1	5 minutes	5 minutes	5 minutes	15 minutes
150	3	5 minutes	6 minutes	5 minutes	11 minutes
200	4	5 minutes	5 minutes	6 minutes	15 minutes
300	9	5 minutes	5 minutes	6 minutes	15 minutes
600	35	5 minutes	5 minutes	7 minutes	15 minutes
Pipe>600	Scour valve – per design	-	-	-	-

*assumes flow rate through 75mm hydrant of 20 L/s

Table 1: Time in minutes to flush at 20 l/s per hydrant

Note: flushing rates of 5 L/s and 10 L/s can be used effectively on 50 and 75mm lines respectively.

Appendix B – Chemical Neutralising

At the end of the contact time, the chlorine in the water in the new main must be neutralised before the water is discharged to the receiving environment. There are several options that can be used to de-chlorinate the water:

a) Chemical Neutralisation dosing;
b) Chemical Neutralisation with de-chlorination mats (where dosing at a discharge chamber is not feasible); or
c) Chlorine Dissipation.

a) Chemical Neutralisation

Chemical Neutralisation as a method to de-chlorinate water involves dosing to the water as it is being discharged from the main. The most effective and most commonly used chemical to achieve dechlorination is Sodium Thiosulphate though there are other alternatives:

Name	Chemical Formula	Solubility
Sodium thiosulphate pentahydrate	$Na_2S_2O_3.5H_20$	200g/l
Anhydrous Sodium sulphite	Na_2SO_3	26.9g in 100g of water at 20°C
Sodium Sulphite heptahydrate	$Na_2SO_3.7H_2O$	30g/100ml

Table 2: Chlorine Neutralisation Chemicals

Chemical SDS sheets must be available at all times.

Procedure:

1. To prepare 15% w/v solution of any of the above three chemicals, the following steps should be taken:
    - Step 1. Fill the solution tank approximately 2/3 full with water
    - Step 2. Add the required amount of the neutralising chemical into the tank as specified in Table 3.
    - Step 3. Mix the solution until the added chemical has dissolved
    - Step 4. Add the remainder of water and mix
    - Step 5. Stir periodically to avoid the solution stratifying

Solution Volume	Sodium Thiosulphate	Anhydrous Sodium Sulphite	Sodium Sulphite Heptahydrate
(L)	(kg)	(kg)	(kg)
100	15.2	15	30
200	30.3	30	60
300	45.5	45	90
400	61.0	60	120
500	76.0	75	150
600	91.3	90	180
700	106.2	105	210
800	121.2	120	240

Solution Volume	Sodium Thiosulphate	Anhydrous Sodium Sulphite	Sodium Sulphite Heptahydrate
900	136.0	135	270
1000	151.5	150	300

Table 3: Amounts of Chemicals Required for Chlorine Neutralisation

2. To add the neutralisation chemical to the super-chlorinated water, the following steps should be taken:

- Step 1. Calculate the flow rate required to add the neutralising chemical (refer below formula).
- Step 2. Use a calibrated dosing pump to achieve the calculated required flow rate by adjusting the speed or stroke setting of a calibration chart.
- Step 3. Verify successful neutralisation by testing for FAC (Free available chlorine). Note that the FAC of the discharged water to the environment must be <0.02mg/L.

To Calculate Flow Rate:

The following formula shows the rate at which the prepared neutralising chemical needs to be added to the water as it is being discharged from the main:

Flow (L/hr) = FAC (g/m^3) x 3 x draining flow rate of chlorinated water (L/min) x 60min/hr

% Strength of the neutralising solution x 10,000

Example: The FAC of the super-chlorinated water to be neutralised is 20mg/l (i.e. $20g/m^3$). The super-chlorinated water is being discharged from the main at a flow rate of 100 L/min. The required flow rate of the 15% neutralising chemical solution is:

Flow = 20 g/m^3 x 3 x 100 L/min x 60 min/hr

15% x 10,000 = 2.4 L/hr

b) CHLORINE NEUTRALISATION WITH DECHLOROMATS

Dechloromats must be placed such that the channelled water does not flow outside the span of the mat, but still cover the full width. The channelled flow must be long enough to ensure proper mixing with the Sodium Sulphide. Typical channelled flow height should not be more than 50mm. Sampling must be taken 10m downstream of the mat. When tablets reach half their original size it must be replaced or new tablets added.

c) CHLORINE DISSIPATION

This is an alternative method in dealing with the hyper chlorinated water which allows the chlorine to dissipate.

Capture the disinfected water on site prior to the discharge of the chlorinated water (e.g. in a tanker). It is suggested that the water is kept contained on site for a minimum of 2 days until the FAC is reduced to the acceptable level of the ultimate receiving environment.

Appendix C – Designated Selwyn District Council Water Service Team Representative

Where Water Services Team members are required for escalation or decision making, as set out in this document, one of the follow staff members can be contacted, in order of escalation (depending on who is available at the time):

Staff Member Position	Name	Contact Details
Water Services Team	-	Water.services@Selwyn.govt.nz
Principal Water Engineer	Mark Andrews	Mark.andrews@selwyn.govt.nz 03 347 1843
Water Services Delivery Manager	Elaine McLaren	Elaine.McLaren@selwyn.govt.nz 03 347 1895
Service Delivery Manager	Gareth Morgan	Gareth.morgan@selwyn.govt.nz