

Drinking Water Monitoring Program

December 2005
(updated October 2011)



NSW
GOVERNMENT

Health

NSW DEPARTMENT OF HEALTH

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1. Introduction

1.1 NSW Health Drinking Water Monitoring Program

Regular testing of drinking water is one of the measures available to help ensure a safe water supply. NSW Health provides drinking water testing through the Division of Analytical Laboratories (DAL) in Sydney, the Greater Murray Water Testing Laboratory in Albury and the Northern Rivers Pathology Service in Lismore. This service has been provided to water utilities for more than 100 years.

Drinking water quality monitoring samples are taken in the distribution system and are representative of the water supplied to the consumer. NSW Health has recommended **minimum** sample numbers for each water supply system to monitor drinking water quality. The tests to be performed in drinking water quality monitoring are listed in Appendix 1. It is the responsibility of the water utility to conduct appropriate operational monitoring. NSW Health laboratories provide testing free-of-charge for the recommended number of samples for indicator bacteria and health-related inorganic chemicals. The free-of-charge service does not extend to samples from private water supplies, rivers, other water bodies or recreational water, repeat samples, or samples taken for operational purposes (i.e. samples of raw water, or checks done on treatment processes and equipment). However, the NSW Health laboratories can carry out these tests on a fee-for-service basis, or as a special project.

The number of samples allocated to a water utility is calculated on the population served and the complexity of each supply system. The monitoring frequencies and sample numbers recommended by NSW Health are a pragmatic approach to implementing the *Australian Drinking Water Guidelines* 2004 (the Guidelines).

NSW Health provides water utilities with labels to identify samples collected under the NSW Health Drinking Water Monitoring Program. These labels allow the samples to be tested for free at NSW Health laboratories, and carry a barcode that allows results to be recorded in the NSW Drinking Water Database. Use of the labels is essential for all NSW Health Drinking Water Monitoring Program samples.

1.2 Australian Drinking Water Guidelines 2004

The NSW Government has approved the *Australian Drinking Water Guidelines* 2004 (Guidelines) for implementation as a model of best practice in New South Wales. The Guidelines are a joint publication of the National Health and Medical Research Council and the National Resource Management Ministerial Council. The 2004 Guidelines supersede the 1996 Guidelines.

The Guidelines define the quality of water suitable for human consumption, and provide advice on protecting water supplies. The Guidelines provide a solid foundation for assessing water quality, by specifying health-based and aesthetic criteria, as well as describing a philosophy of the multiple barrier approach from catchment to tap to ensure the safety of the water. This is embodied in the Guidelines as the Framework for Management of Drinking Water Quality (Chapters 2, 3 and 4). A major change in the 2004 Guidelines is the reliance on *Escherichia coli* (*E. coli*) as the main indicator of microbiological contamination.

All water utilities should have a copy of the Guidelines. Copies of the Guidelines may be obtained from the National Health and Medical Research Council (**Free call** 1800 020 103 ext 9520), by email request to nhmrc.publications@nhmrc.gov.au or downloaded from the internet <http://www7.health.gov.au/nhmrc/publications/synopses/eh19syn.htm>

The Guidelines are directed by seven fundamental principles *vital to ensuring safe drinking water quality* (Chapter 1):

- *The greatest risks to consumers of drinking water are pathogenic microorganisms. Protection of water sources and treatment are of paramount importance and must never be compromised.*
- *The drinking water system must have, and continuously maintain, robust multiple barriers appropriate to the level of potential contamination facing the raw water supply.*
- *Any sudden or extreme change in water quality, flow or environmental conditions (eg extreme rainfall or flooding) should arouse suspicion that drinking water might become contaminated.*
- *System operators must be able to respond quickly and effectively to adverse monitoring signals.*
- *System operators must maintain a personal sense of responsibility and dedication to providing consumers with safe water, and should never ignore a customer complaint about water quality.*
- *Ensuring drinking water safety and quality requires the application of a considered risk management approach.*

(Guidelines Page 1-1)

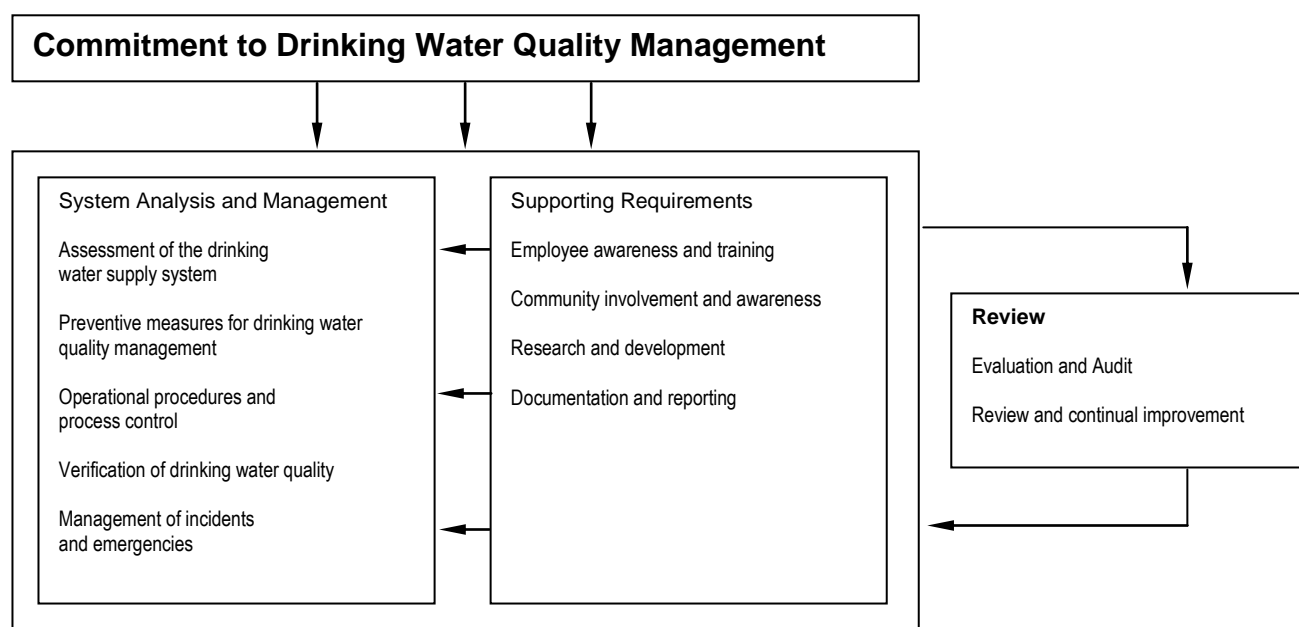
The Framework for Management of Drinking Water Quality is a preventive approach to assuring water quality. The Framework addresses four general areas describing good management of a water supply system (Chapter 2):

- **Commitment to drinking water quality management**
- **System analysis and management:** Understanding the entire water supply system, the hazards and events that can compromise drinking water quality, and the preventive measures and operational control necessary for assuring safe and reliable drinking water.

- **Supporting requirements:** Activities and attitudes that support management of the supply system such as employee training, community involvement, and validation of the effectiveness of processes.
- **Review:** The evaluation and audit of the effectiveness of the management system, and the adoption of improvements based on the evaluation.

The Guidelines (Chapters 2, 3 and 4) give greater detail on how the Framework can be incorporated into the activities of a water utility. Participation in the NSW Drinking Water Monitoring Program helps water utilities to satisfy several elements of the Framework. Figure 1 is a diagram of the Framework, showing the interactions of its different elements.

Figure 1 Framework for the management of drinking water quality



From *Australian Drinking Water Guidelines*, 2004, NHMRC.
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The Framework recommends that water utilities undertake an assessment of their supply systems. At its simplest this requires that the following questions be addressed, from the water source to the consumer:

- What are the potential hazards and their sources?
- How do we manage the risks associated with these hazards?
- How do we know the risk has been managed?

Answering these will help a water utility address the System Analysis and Management elements of the Framework.

Monitoring serves as a check that barriers to contamination are working effectively. Water utilities should exercise due diligence by using a multiple barrier approach and by implementing appropriate monitoring. Such programs should satisfy community concerns about water quality and assist in preventing outbreaks of waterborne disease. Results obtained from a comprehensive monitoring program may identify parts of the water supply system in need of maintenance or upgrade.

The Framework recommends that a range of barriers to contamination be applied in a water supply system. *The selection of appropriate barriers and preventive measures will be informed by hazard identification and risk assessment* (Guidelines Page 3-9). Barriers to contamination could include:

- Selection of water sources which are protected from contamination by human and animal faecal material, and chemicals, and maintenance of an active catchment protection program
- Pre-treatment, such as detention and settling in reservoirs for sufficient time for pathogen die off
- Protection of water storages
- Extraction management
- Treatment (eg coagulation, settling, filtration)
- Disinfection of the water before it enters the distribution system
- Maintenance of adequate residual concentrations where chemical disinfection is used
- Security of the distribution system against re-contamination.

Information on catchment management, planning and approvals, water supply system optimisation, and incident management is contained within the Department of Energy, Utilities and Sustainability (DEUS) publication *The management of Giardia and Cryptosporidium in town water supplies* (1999). This document is relevant to the control of a wide range of contaminants, in addition to *Giardia* and *Cryptosporidium*. Neither the Guidelines nor NSW Health recommend routine monitoring of treated water for *Giardia* and *Cryptosporidium*.

The DEUS *Best Practice Management of Water Supply and Sewerage Guidelines* (2004) require compliance with the NSW Health Drinking Water Monitoring Program, including collecting the required number of samples and investigating and appropriately responding to any non-compliance. Results from the NSW Drinking Water Database are reported in the annual *NSW Water Supply and Sewerage Performance Monitoring Report*.

2. Responsibilities

Water utilities are expected to satisfy themselves of the safety of the drinking water supply, including microbial, chemical, pesticide and radiological quality.

2.1 The *NSW Public Health Act 1991*

Under Section 10 of the *Public Health Act*, NSW Health has certain powers with respect to the provision of safe drinking water. These include powers to:

- require the issuing of advice to the public on the safety of a drinking water supply;
- require the correction of any misleading information issued to the public;
- enter and inspect premises of a supplier of drinking water;
- require testing of drinking water;
- require production of information including the results of testing; and
- order the rectification or closure of a water supply.

2.2 The *Fluoridation of Public Water Supplies Act 1957*

Water supplies to which fluoride is added must meet the requirements of the *Fluoridation of Public Water Supplies Act 1957*, the *Fluoridation of Public Water Supplies Regulation 2002* and the *Code of Practice for the Fluoridation of Public Water Supplies 2002*. This includes:

- daily and weekly tests at the treatment plant
- a monthly test submitted to the Division of Analytical Laboratories
- appropriate reporting to local Public Health Units of dosing above 1.5 mg/L and interruptions to dosing longer than 24 hours.

3. Monitoring of drinking water

The Guidelines recommend that monitoring programs include:

3.1 Drinking water quality monitoring (Compliance Monitoring): a wide-ranging assessment of the quality of water in the distribution system and as supplied to the consumer. This information can be used for assessing compliance with the guidelines or agreed levels of service and, if necessary, as a trigger for corrective action to improve water quality.

3.2 Operational Monitoring: used to check that the processes and equipment to protect and enhance water quality are working properly. The data can be used as a trigger for immediate short-term corrective action to improve water quality, but NOT for assessing compliance with guidelines or agreed levels of service.

Additional monitoring may also be required for:

- Emergency response, such as in the event of flooding, a mains break or following interruptions of supply and repair work;
- Investigation and research;
- Monitoring of consumer satisfaction; and
- Reporting and accountability.

The frequency of monitoring should be increased at times of unusual weather events and emergency operations.

Water utilities need to be satisfied about the safety of their supply. This may require the collection of extra samples, beyond the numbers recommended by the NSW Drinking Water Monitoring Program. Changes to allocations under the Program can be requested each year. Alternatively, utilities can conduct a short project to investigate a particular hazard. Project samples are analysed for free at the NSW Division of Analytical Laboratories. Your local Public Health Unit can help to organise project monitoring.

Water utilities may also need to assess risks, and if necessary, test for characteristics not regularly analysed as part of the Program. These might include pesticides, disinfection by-products, other organic compounds, cyanobacteria (blue-green algae), specific pathogens, and radioactive materials. Monitoring projects can be organised to test for many of these, but NSW Health laboratories do not test for cyanobacteria and radioactive materials. A full list of analyses available at NSW Health laboratories can be found in the *Guide for Submitting Water Samples to DAL for Analysis*, available from the Division of Analytical Laboratories, or on the NSW Health Website at http://www.health.nsw.gov.au/pubs/g/pdf/water_sampling.pdf

4. Allocation of sample numbers

The sample numbers allocated in the NSW Health Drinking Water Monitoring Program are based on the minimum sampling frequency recommended in the Guidelines, the population served, and the complexity of the system. Recommended sampling numbers for water supply systems may change over time to reflect supply system and population changes, and improved understanding of the risks to the supply. Water utilities should contact their local Public Health Unit if they consider their allocated number of samples does not adequately represent the supply system.

In most cases a water supply system has one source of raw water and one treatment plant. In some cases raw water is drawn from several sources. Water supply systems may serve a single town (defined as 'discrete') or several towns and localities (defined as 'complex').

4.1 Microbiology

The allocation of microbiological sample numbers for discrete water supply systems (supplying a single town and surrounds) is based on the total population served. For complex systems (supplying more than one town) separate microbiology sample numbers apply to each distinct zone or locality receiving water with similar characteristics, such as:

- a town or groups of towns that receive treated water from the same service reservoir;
- areas that are geographically distinct from others within the distribution system.

Table 1 shows the basis for allocating sample numbers. Allocated microbiology sample numbers generally meet or exceed the sample numbers recommended by the Guidelines based on the total population of the system (Guidelines Table 10.2). Additional sampling may be necessary to ensure appropriate representation of the system, as part of a sanitary investigation, or in response to events such as flooding, emergency operations, and following repair work or service interruptions.

In small systems where less than one sample per week is taken for indicator bacteria there is a low degree of statistical confidence that the supply is free from contamination at all times, even if all samples collected are free from contamination. Periodic sanitary surveys, and regular monitoring for chlorine, pH and turbidity should be undertaken. The results should be recorded by the water utility and be available for inspection if requested. More information regarding statistical confidence is available in the Guidelines (Information Sheet 3.3 in Part IV).

NSW Health laboratories provide free analysis for the allocated number of samples. Additional samples may be submitted on a fee-for-service basis.

Table 1 Basis for allocating microbiological sample numbers

Discrete Systems (supplying a single town and surrounds)	
Town population	Recommended minimum number of samples
<100	12 samples per year (1 per month)
<500	26 samples per year (1 per fortnight)
500 – 5000	52 samples per year (1 per week)
5000 – 100 000	52 samples per year (1 per week), plus one additional sample per month for each 5000 above 5000
>100 000	6 samples per week, plus one additional sample per month for each 10 000 above 100 000
Complex Systems (supplying more than one town and surrounds)	
<i>Note: the sample numbers apply to each town or zone within the system</i>	
<1000	12 samples per year (1 per month)
1000 – 5000	26 samples per year (1 per fortnight)
5000 – 100 000	52 samples per year (1 per week), plus one additional sample per month for each 5000 above 5000

4.2 Chemistry

For both discrete and complex supply systems, the recommended minimum sample numbers for chemical tests are based solely on the total population served. The sample numbers are derived from Section 9.6.4, page 9-9 of the Guidelines. The Division of Analytical Laboratories will provide free-of-charge analysis for the allocated number of samples. Additional samples may be submitted on a fee-for-service basis.

Table 2 Basis for allocating chemical sample numbers

Population served by water supply system	Recommended minimum number of samples
< 5000	2 per year (1 sample every 6 months)
> 5000	12 per year (1 sample per month)

4.3 Fluoride monitoring

The *Code of Practice for the Fluoridation of Public Water Supplies 2002* requires that:

- The concentration of fluoride in the water is tested every day at the treatment plant
- Two samples of water from the reticulated supply are tested each week
- All results from these tests are recorded on Form 4: *Daily Analysis of Fluoride Ion Content*
- Results are reported to NSW Health in the first week of the following month or entered directly into the NSW Drinking Water Database
- A sample is sent each month to Division of Analytical Laboratories to be tested. This sample should be collected from a representative point in the distribution system.

Testing of samples at Division of Analytical Laboratories allows validation of the calibration of the meter at the treatment plant. Samples sent to Division of Analytical Laboratories need to:

- use either a regular NSW Health chemistry or fluoride label
- be submitted to Division of Analytical Laboratories in the first week of the month
- have the water utility's fluoride result written on the label

Where only two chemistry samples are allocated each year, these should be taken at 6 monthly intervals, for example in autumn and spring.

Interruptions to dosing (greater than 24 hours) or overdosing (concentrations greater than 1.5 mg/L) must be reported to the Water Unit NSW Health (fax 02 9816 0377, phone 02 9816 0589, email: waterqual@doh.health.nsw.gov.au). The report should be made within three working days by fax or email and include details of the incident (extent, times, water volume affected etc), and remedial and preventive action.

Full details are contained in the Fluoridation Code on the NSW Health website: www.health.nsw.gov.au/csd/lisb/regulate/FluoridationCode.pdf

For further information please contact your Public Health Unit.

5. Selection of sample sites

The aim of the NSW Health Drinking Water Monitoring Program is to help verify that consumers receive safe drinking water. For this reason the majority of allocated drinking water quality samples should be taken from sites representative of the supply to the consumer. Water utilities may need to take additional samples for operational purposes from raw water, treated water (water entering the distribution system) or from sites well into the distribution system (where off-take to consumers has occurred).

NSW Health recommends that drinking water quality monitoring rotate amongst designated sample sites throughout the distribution system. Sample sites should give good geographic representation of the water supply system and enable the comparison of water quality over time for particular sections of the system. Do not sample from the same site every time.

As far as possible, sample locations and frequencies should be selected to give the greatest confidence that all parts of the system are free from contamination. Random sites should be selected periodically to complement routine sampling locations.

Where a water supply system serves a discrete Aboriginal community, this community should be included in the sampling program.

The distribution of sample points throughout each system should reflect the number of people served by each distinct part of the system. This is particularly important for microbiological samples. The distinct parts of the system may include distribution loops, branch lines, different pressure zones where water quality may vary from other zones, or areas within the system receiving water from different sources or treatment plants.

Suggested sampling programs for discrete and complex systems are shown on the following pages. The actual sampling program implemented should reflect local knowledge and conditions. More detailed information on the design of sampling programs is contained in the Guidelines (Chapter 9).

Samples should be collected at regular intervals throughout the year. The more frequent the sample collection, the greater is the confidence that the system is free from contamination.

A description of each sample site should be recorded on the NSW Drinking Water Database, including the sample site code, the address and the location of the tap. Please contact your local Public Health Unit if you require help with creating new sample sites on the Database.

5.1 Example of a sampling program for a discrete water supply system

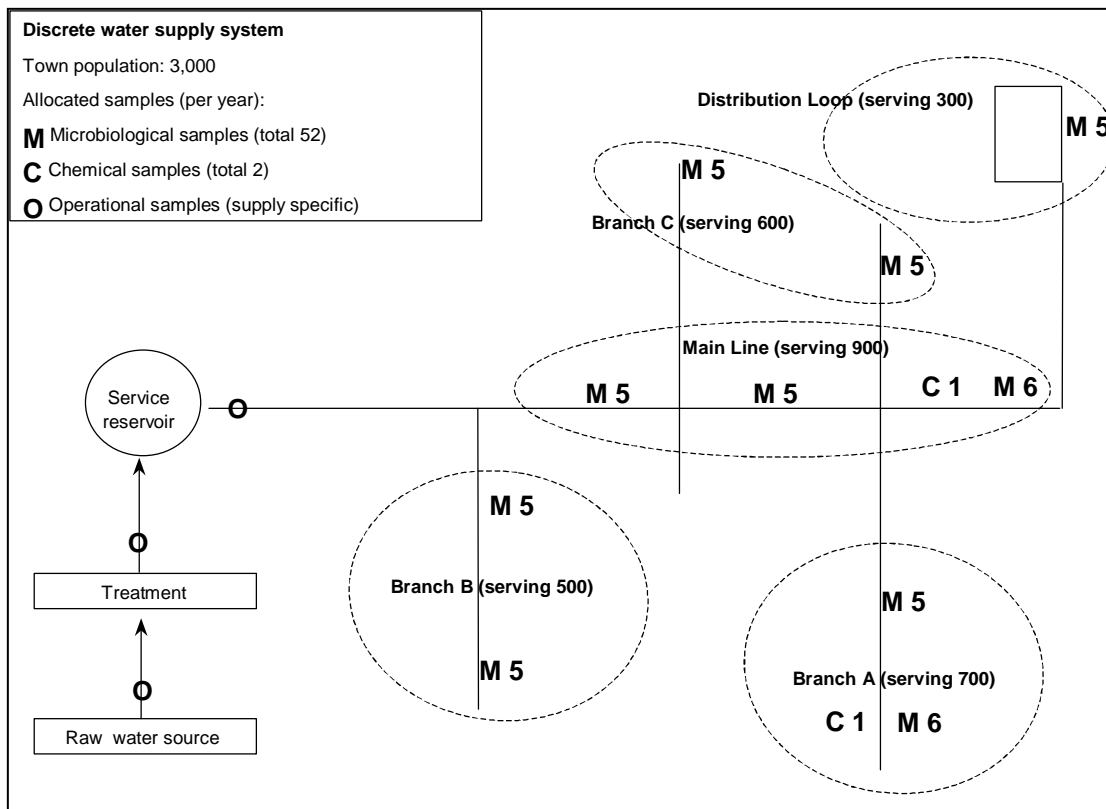
The sampling program shown below is representative of a discrete water supply system serving a single town with a population of 3,000. This supply system has been allocated a total of 52 microbiological samples and two chemical samples. Sample sites have been allocated to reflect the number of people supplied by different parts of the system. Operational requirements and local knowledge would determine the number, location and frequency of operational sampling. The routine drinking water quality sampling frequency for each of the system components is detailed below:

Table 3 Discrete water supply system – allocation of sample numbers

System component	Population (%)	Microbiological sample numbers ^a	Chemical sample numbers ^b	Operational
Branch line A	700 (23%)	11	1	<i>as required</i>
Branch line B	500 (17%)	10		
Branch line C	600 (20%)	10		
Main line	900 (30%)	16	1	
Distribution loop	300 (10%)	5		
TOTAL	3,000	52	2	

^a Within each system component, rotate samples between different sites during the year

^b Sample chemistry every six months, rotate sites from year to year



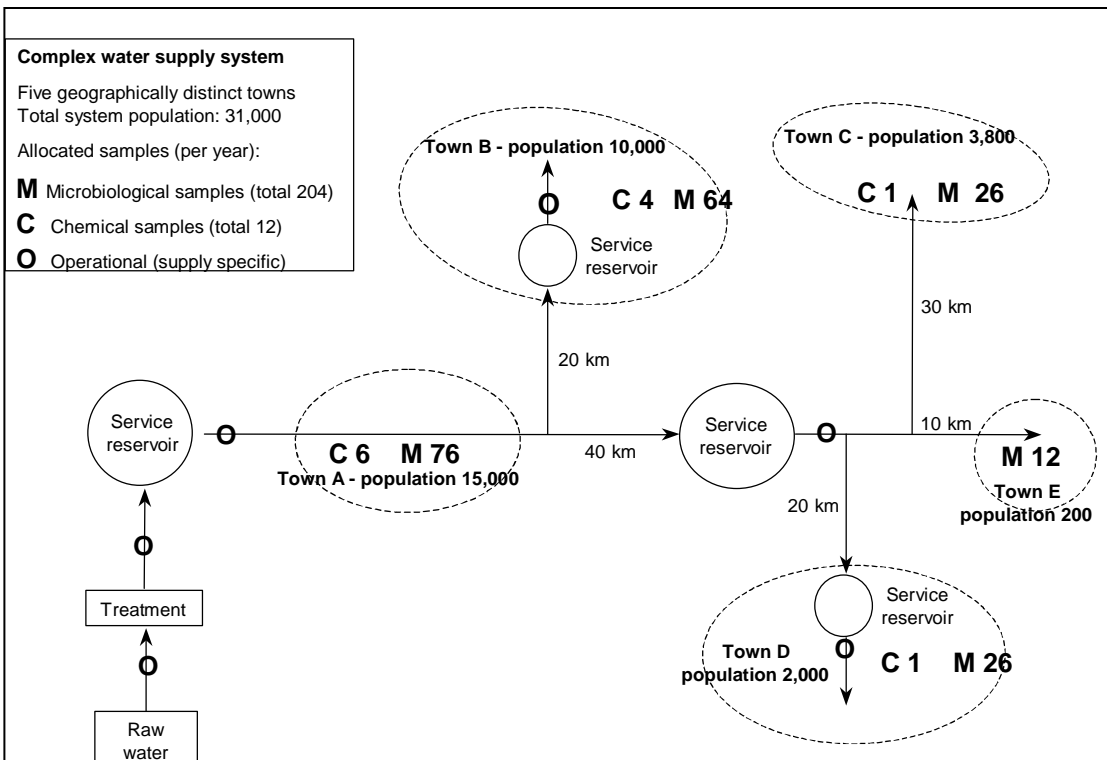
5.2 Example of a sampling program for a complex water supply system

The sampling program shown below represents a complex water supply system with a total population of 31,000. This supply system has been allocated a total of 204 microbiological samples (this is the total of individual allocations made to each town) and 12 chemical samples). Samples have been allocated throughout the entire system based on the population served by each town or zone. Designated sites are then chosen throughout each town or zone. Operational requirements and local knowledge would determine the number, location and frequency of operational sampling. The routine drinking water quality sampling frequency for each distinct area is detailed below:

Table 4 Complex water supply system – allocation of sample numbers

System component	Population	Microbiological ^a	Chemical	Operational
Town A	15,000	76	6	<i>as required</i>
Town B	10,000	64	4	
Town C	3,800	26	1	
Town D	2,000	26	1	
Town E	200	12		
TOTAL	31,000	204	12	

^a Within each system component, rotate samples between different sites during the year



6. Laboratories

6.1 NSW Health laboratories

NSW Health laboratories are accredited by the National Association of Testing Authorities (NATA) for drinking water testing. Microbiology testing is available from the Northern Rivers Pathology Service and the Greater Murray Water Testing Laboratory. The Division of Analytical Laboratories provides both microbiology and chemistry tests. Contact the laboratories for more information regarding sample submission, available tests, and costs for additional sampling. Information about the Division of Analytical Laboratories is provided in the *Guide for Submitting Water Samples to DAL for Analysis* available from the NSW Health website at http://www.health.nsw.gov.au/pubs/g/pdf/water_sampling.pdf

NSW Health laboratory contact details:

Division of Analytical Laboratories

Ph: (02) 9646 0222

Fax: (02) 9646 0333

Delivery Address:

Weeroona Rd (off Joseph St)

Lidcombe NSW 2141

Greater Murray Water Testing Laboratory

590 Smollett Street

Albury NSW 2640

Ph: (02) 6058 1650

Northern Rivers Pathology Service

76 Uralba Street

Lismore NSW 2480

Ph: (02) 6620 2900

6.2 Other Laboratories

If not using the free-of-charge service provided by NSW Health, water utilities should still use NSW Health labels for all samples and engage a laboratory that meets the following criteria:

1. The laboratory has National Association of Testing Authorities (NATA) accreditation for the necessary analyses. Categories of NATA accreditation are shown in the table below. In addition, some laboratories may hold relevant certification under AS/NZS ISO 9001.
2. The laboratory performs well in NATA inter-laboratory proficiency testing. Water utilities should request the testing results from the selected laboratory to ensure satisfactory proficiency testing performance.

3. The laboratory should carry out the required tests as specified for the water supply system. The tests to be performed are listed in Appendix 1.
4. The laboratory must immediately notify the water utility and the local Public Health Unit by phone and facsimile of any test result that exceeds a health guideline value.
5. Laboratories should enter all results into the NSW Drinking Water Database. If the laboratory does not have Internet access, then the water utility should enter the results.

Public Health Units can provide advice to water utilities regarding the choice of laboratory.

Table 5 Categories of NATA accreditation relevant to drinking water analysis

Biological testing	
8.70 Waters, including effluents	.11 Bacteriological testing of potable waters
	.16 Bacteriological testing of environmental waters
	.81 Sample collection
8.65 Aquatic biology for specified source (potable water)	.11 Identification of planktonic microalgae and cyanobacteria to specified level (specified organisms)
	.12 Enumeration of planktonic microalgae and cyanobacteria to specified level (specified organisms)
	.31 Identification of enteric protozoa to specified level (specified organisms)
	.32 Enumeration of enteric protozoa to specified level (specified organism)
Chemical testing	
7.66 Waters	.01 Waters for potable and domestic purposes
7.84 Residues in constituents of the environment	.01 Elements
	.02 Pesticides
	.03 Polyhalogenated biphenyls
	.04 Halogenated hydrocarbons
	.05 Phenols
	.11 Hydrocarbons
	.12 Petroleum hydrocarbons
	.21 Monocyclic aromatic hydrocarbons
	.22 Polycyclic aromatic hydrocarbons
	.99 Other substances

7. Monitoring and Response to Results

7.1 Sample labels

Each year NSW Health issues each water utility with sufficient sample labels for the recommended number of drinking water quality monitoring samples. These labels allow laboratories to easily identify NSW Health Drinking Water Monitoring Program samples and enter results into the NSW Drinking Water Database. The labels are printed with a two letter code to identify the water utility and a two digit code for the water supply system. The labels provided by NSW Health should always be used for Drinking Water Monitoring Program samples, regardless of the laboratory responsible for testing.

NSW Health produces labels for the following test types:

- Microbiology (indicator bacteria)
- Chemistry (inorganic chemical and physical characteristics analysis)
- Fluoride samples (smaller supply systems with only two chemistry labels)
- Repeat/additional samples (for following up exceptions, or to allow collection of extra samples)
- Special project labels

When using NSW Health labels remember to:

- Use a NSW Health label for all drinking water quality samples. Barcoded *NSW Health Drinking Water Monitoring Program* labels are NOT to be used for operational, private water supply, raw water, river or recreational water sampling.
- Check that you are using the correct label for the sample that you want to collect. NOTE: A fee will be charged for the analysis of samples with repeat and additional labels.
- Record the relevant details on all labels such as:
 - Sample site code
 - Time
 - Date
 - Field results
 - Chlorination and fluoridation information.

The image shows a sample label for the NSW Health Drinking Water Monitoring Program. The label is rectangular with a thick black border. At the top, it says "NSW HEALTH" and "Drinking water monitoring program 2005". Below this, it says "Allocated microbiological sample". The label is divided into several sections:

- Water utility code:** AB
- Supply system code:** 01
- Sample site code:** 001
- Barcode:** 105AB0187868
- Date:** 1/12/05
- Time:** 1030
- Time of day:** AM/PM (with a circle around AM)
- Chlorination:** Is the system chlorinated (Y/N)? [X]
- Comments/Field Results:** PH 7.8, TURBIDITY 2.3 NTU, FREE CHLORINE 0.41 mg/L, TOTAL CHLORINE 0.55 mg/L
- Water utility name:** Albury City Council
- Supply system name:** Albury

 Arrows point from these labels to the corresponding fields on the sample label.

7.2 The NSW Drinking Water Database

Test results for drinking water quality monitoring samples are stored in the NSW Drinking Water Database. The Database can be accessed via the Internet at www3.health.nsw.gov.au/waterqual/samples/register.cfm. The Database is password protected. Each water utility can use the Database to view the results of monitoring in its own water supply systems and to enter details of sample sites. Results can be reviewed as customised reports for any time period, characteristic and location. Water utilities should regularly review these reports. Please contact your local Public Health Unit for help if you have difficulty accessing the Database. They can assist you with the entry of sample site codes and the generation of reports from the Database.

7.3 Notification of results, and response

Results from the NSW Health Drinking Water Monitoring Program that exceed a Guideline value will be notified immediately to the water utility and entered into the Database. Results that satisfy the Guideline values will be entered into the Database without a hard copy report.

Where a risk to public health is suspected based on routine monitoring for microbiological indicators and chemical contaminants, or health surveillance in the community, it is vital that water utilities follow up with repeat sampling and investigation. Public Health Units can help provide a health response to these issues and will assist in investigating problems.

Public Health Units have protocols for responding to the detection of *E. coli* (or thermotolerant coliforms), the failure of water treatment and disinfection processes, or hazardous levels of chemicals in a supply system (Appendix 2). Water utilities should also be familiar with their Regional Algal Co-ordination Committee contingency plans, which outline response protocols for the management of blue-green algae in water bodies. Another helpful reference is the NSW Water Directorate's *Blue-Green Algae Management Protocols*.

In cases where it is not practical to monitor and/or implement appropriate treatment, the water utility should consult the Public Health Unit. In these instances it may be necessary to declare the water supply as non-potable.

Regular use of the reporting functions of the NSW Drinking Water Database can help identify seasonal trends and other changes in water quality. Recognising these will allow the water utility to better manage catchments, storages and treatment. Advice on responding to long term changes in water quality can be obtained from local Public Health Units or from local officers of the Department of Energy, Utilities and Sustainability.

Appendix 1 Tests for drinking water quality monitoring

1.1 Microbiological analysis (also refer to Table 1) These are the analyses regularly reported to the NSW Drinking Water Database by NSW Health laboratories.

E. coli

total coliform bacteria

1.2 Chemical analysis (also refer to Table 2)

1.2.1 Routine chemical analysis – These are the analyses regularly reported to the NSW Drinking Water Database by Division of Analytical Laboratories.

pH*	cadmium*	mercury
turbidity*	calcium	molybdenum
total dissolved solids (TDS) or conductivity*	chloride	nickel*
true colour	chromium*	nitrate*
total Hardness as CaCO ₃ *	copper*	nitrite*
	fluoride*	selenium
aluminium	iodine	silver
antimony*	iron	sodium
arsenic*	lead*	sulfate*
barium	magnesium	zinc
boron	manganese*	

*Characteristics marked with an asterisk are mandatory tests. This is the minimum set that must be regularly tested if using a laboratory other than Division of Analytical Laboratories. NSW Health may vary the list or require additional tests where indicated by a risk assessment. Please contact your local Public Health Unit for more information if your laboratory is unable to perform the mandatory tests.

1.2.2 Optional chemical analyses – These analyses are available on request from Division of Analytical Laboratories (at no extra cost for allocated Monitoring Program samples)

specific conductance	cobalt
calcium hardness as CaCO ₃	cyanide
total organic carbon*	iodide
	phosphorus
alkalinity	potassium
ammonia	silicon as SiO ₂
bromide	vanadium

* Free of charge only for approved project samples.

1.3 Additional Monitoring

In order to satisfy the Guidelines it may be necessary to carry out more frequent monitoring for some characteristics, or to monitor for characteristics not included in the NSW Health Drinking Water Monitoring Program.

The Guidelines suggest quarterly monitoring for certain health related inorganic characteristics (Chapter 10). Each water utility should carry out a detailed assessment of their water supply system when planning a monitoring program. Public Health Units are available to assist with the design of monitoring programs. Water utilities should contact their local Public Health Unit if they consider their allocated number of free system monitoring samples to be insufficient.

Water utilities should assess the risks and, if necessary, conduct appropriate monitoring to satisfy themselves of the safety of the supply with respect to pesticides, disinfection by-products, other organic chemicals and radiological contamination.

1.3.1 Pesticides

The Division of Analytical Laboratories provides a broad range of pesticide testing. Details of the tests available can be found in the *Guide for Submitting Water Samples to DAL for Analysis*. Pesticide testing is no longer a routine part of the Drinking Water Monitoring Program, but water utilities still need to satisfy themselves that pesticide risks are adequately controlled. Pesticide testing is available free for approved projects or on a fee-for-service basis. Pesticide testing in response to suspected public health incidents will not be at the expense of the water utility. Relevant information is contained in the Guidelines (Pages 6-4, 6-5, 10-9, 10-27, 10-28, Fact Sheets for specific pesticides).

1.3.2 Disinfection by-products

The Guidelines recommend that monitoring should be carried out for trihalomethanes in systems that are chlorinated or chloraminated. If concentrations exceed the guideline value then other by-products should be analysed specifically. It is recommended that monthly samples be taken from each distribution system, with more samples taken if the chlorine disinfection dose is increased substantially, trihalomethane concentrations exceed the guideline value or the source of supply is changed. Trihalomethane testing is available free for approved projects or on a fee-for-service basis. Relevant information is contained in the Guidelines (Pages 6-3, 6-4, 10-26, Fact Sheet on Trihalomethanes).

1.3.3 Other organic compounds

The organic compounds listed in the Guidelines may contaminate drinking water as a result of pollution, industrial activity, the presence of impurities in water treatment chemicals, or by leaching from the distribution system (where PVC or bituminous linings are used). At present there is little data on the occurrence of many of these substances in Australian drinking waters. Water utilities may need to monitor where the use or presence of certain chemicals may contaminate the catchment, aquifer recharge zones or treated water. Relevant information is contained in the Guidelines (Pages 6-4, 10-22 to 26, Fact Sheets for specific organic compounds).

1.3.4 Radiological characteristics

The Guidelines recommend that radiological quality be assessed when a new supply is brought into service, and then every two years for ground water supplies, and every five years for surface water supplies. Relevant information is contained in the Guidelines (Chapter 7, pages 10-10 to 10-14, 10-29, Fact Sheets on Radionuclides, Radium, and Radon). Testing can be conducted by:

Australian Nuclear Science and Technology Organisation (ANSTO)

New Illawarra Rd
Lucas Heights NSW 2234
Ph (02) 9717 3880 or 9717 3111
Fax (02) 9543 5097
Email enquiries@ansto.gov.au
Internet www.ansto.gov.au

Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)

619 Lower Plenty Rd
Yallambie VIC 3085
Ph (03) 9433 2211
Fax (02) 9432 1835

1.3.5 Cyanobacteria (blue-green algae)

For storages with a history of algal blooms, inspect twice weekly during the danger period. Increased monitoring is recommended if the count of potentially toxic species exceeds 500 cells/mL. If the count of potentially toxic species exceeds 2,000 cells/mL consider the need for toxicity testing (see the Guidelines Table 10.1 for more information).

1.4 Project Monitoring

Projects may be designed to address issues of concern or answer broader strategic questions. Projects allow water utilities to carry out free-of-charge monitoring in addition to that allocated under the *NSW Health Drinking Water Monitoring Program*. This may involve catchment survey, risk assessment and monitoring where appropriate.

Projects have surveyed school rainwater tanks, hospitals, disinfection by-products, source water characterisation, and lake water quality.

Analyses available include routine microbiological, inorganic chemistry, disinfection by-products and pesticides. Other analyses may be arranged on request, subject to their availability through the Division of Analytical Laboratories.

All new projects will require approval, and signing of project agreements. Water utilities should approach their local Public Health Unit to arrange a project application. Advice on project design and sampling frequency is available. Special NSW Health sample labels are issued for approved projects. A key element of the agreement is the requirement to submit a final report on each project. Consolidated reports on priority issues may also be produced and published, where appropriate.

Appendix 2 NSW Health Response Protocols

NSW Health Response protocol for the management of microbiological quality of drinking water.

This protocol is derived from the *Australian Drinking Water Guidelines, 2004* (the Guidelines) to guide Public Health Units (PHU) and water utilities in their joint response following rapidly changing source water quality, treatment failure, or microbial contamination.

Under Section 10D of the *Public Health Act 1991*, the Chief Health Officer has the power to issue advice, for the benefit of the public, concerning the safety of available drinking water and any possible risks to health involved in the consumption of that water. This may include a boil water alert. These powers are delegated to Public Health Unit Directors. A supplier of drinking water must issue to the public the advice provided under the *Public Health Act*, if so directed.

A regional water utility may issue a boil water alert of its own accord. However, before issuing a boil water alert, the water utility should liaise with their local PHU to discuss the situation.

Testing drinking water for specific pathogens is impractical and can be unreliable. For this reason tests are carried out for bacteria, which are present in faeces and indicate contamination. The Guidelines recommend monitoring microbiological quality by testing for *Escherichia coli* (*E. coli*). *E. coli* is the most reliable and specific indicator of recent faecal contamination in drinking water. The presence of *E. coli* in drinking water indicates recent faecal contamination because the organism generally does not multiply in drinking water systems.

Testing for *E. coli* can help verify the adequacy of preventive measures. However, water utilities should not rely solely on end point testing. The implementation of a comprehensive risk-based drinking water management plan is the most reliable way to protect drinking water quality.

Thermotolerant (or faecal) coliform and total coliform bacteria are no longer recommended as primary indicators of faecal contamination. Although some members of these bacteria families are present in faeces, other members occur naturally in the environment in the absence of faecal contamination. Coliform bacteria other than *E. coli* can multiply in treated drinking water under the right conditions. Even *E. coli* can multiply in raw water under some conditions.

Total coliforms. NSW Health laboratory methods routinely provide total coliform as well as *E. coli* results. The Guidelines note that total coliforms are a poor indicator because they are normal inhabitants of soil and water, and can grow in water distribution systems. Total coliforms should generally not be detected in water sampled immediately after disinfection. While total coliforms are not a reliable indicator of faecal contamination, their presence may suggest regrowth or possible ingress of foreign material. If detected, water utilities should check that disinfectant concentration is adequate, and that operation of the treatment plant

and supply system is normal. Water utilities may set system specific targets for total coliform bacteria.

Further information on the microbiological quality of drinking water is available in the Guidelines (Chapters 5 and 10).

a) Action on the detection of *E. coli* or coliform bacteria

The water utility is responsible for carrying out all necessary investigation and resampling as specified in this response protocol.

1. The water utility and the Public Health Unit (PHU) should be notified of the contamination by the testing laboratory (this must be immediate notification if *E. coli* is detected).

Water utilities must record the chlorine concentration (free and total) and, if possible, pH and turbidity on the NSW Health sample label. Take a separate sample for these tests. Do not use the microbiology sample, as it will become contaminated.

2. If total coliforms are detected (but not *E. coli*), the water utility should ensure adequate disinfectant concentration, check that the disinfection, treatment plant, source and supply system are operating normally, rectify any parameters that are not normal, and resume normal sampling. The next scheduled sample would normally be sufficient as follow-up. The water utility should consider system characteristics and analyse historical results when setting system specific targets for total coliforms.
3. If *E. coli* is detected, the water utility should immediately investigate possible sources of contamination and increase disinfection (if inadequate). Check disinfection, treatment, source and supply system are operating normally. Sources of contamination might include a treatment breakdown or malfunction (including failure to meet turbidity targets), a mains break, interruption to the supply, surges in water or power supply, or deliberate or accidental contamination of the system. The investigation may include an inspection of the system and associated service reservoirs by trained personnel. When found, the source of contamination should be rectified.

In some cases, *E. coli* may lodge in biofilm and be released at a later time. Flushing and resampling may be necessary to confirm whether contamination is persistent.

4. The water utility should immediately resample at the same site using NSW Health Repeat/Additional Labels and record chlorine (free and total) and if possible pH and turbidity information. The sample should be submitted to a NSW Health laboratory or other NATA accredited laboratory for analysis. Make sure that the laboratory knows that this is a repeat samples investigating possible contamination.

Note: If immediate resampling is not possible the water utility and Public Health Unit should assess the situation and agree on the necessary actions.

5. If disinfection, treatment, source or supply system is **not** operating normally, consult PHU regarding boil water alert and rectification. The PHU should consider the need for a boil water alert if water utility cannot provide timely confirmation of normal operation, including an adequate disinfectant concentration.
6. If *E. coli* is not detected in the repeat sample and no problem is found, resume normal sampling.

7. If *E. coli* is detected in the repeat sample and/or a problem is identified through the investigation, consult PHU regarding boil water alert and rectification. Confirm adequate disinfectant concentration, resample at same site and other sites in the distribution system, conduct full sanitary survey and assess need for boil water alert (Section d).
8. PHU Environmental Health Officers and Director should consult with the Water Unit, and provide the findings of the water utility's investigation, when determining the need for a boil water alert. The NSW Office of Water should also be advised.

b) Action in response to a failure in treatment or disinfection, or poor or rapidly changing source water quality

1. The water utility should immediately rectify the treatment or disinfection failure (i.e. failure to meet disinfectant or turbidity targets) and investigate possible cause of contamination. Additional operational or source water monitoring changes may be necessary.
2. The water utility should assess source water changes:
 - Determine if there is rapidly changing raw water turbidity that cannot be improved (eg by changing the level of off take or source).
 - Determine if there has been a recent inflow of water from a contaminated source in the catchment (even if raw water turbidity is not rapidly changing).
3. If the treatment or disinfection failure cannot be corrected in a timely manner and there is not an adequate volume of treated water in storage, the water utility should contact the local PHU and collect an additional microbiology sample of the drinking water using NSW Health Repeat/Additional Labels and record chlorine (free and total) and if possible pH and turbidity information. The sample should be submitted to a NSW Health laboratory or other NATA accredited laboratory for analysis. Make sure that the laboratory knows that this is a repeat samples investigating possible contamination.
4. If the treatment or disinfection failure has been corrected and no *E. coli* is detected, resume normal sampling.
5. If the treatment or disinfection failure cannot be corrected and/or *E. coli* is detected in the repeat sample, consult the local PHU regarding boil water alert and rectification. Confirm adequate disinfectant concentration, resample at same site and other sites in the distribution system, conduct full sanitary survey, and assess need for boil water alert (Section d).
6. PHU Environmental Health Officers and Director should consult with the Water Unit and consider investigation/risk assessment outcomes in determining need for a boil water alert. The NSW Office of Water should also be advised.

c) Corrective actions following the detection of contamination or treatment/disinfection failure:

Corrective action may include one, or more, of the following:

- Increase disinfection at the treatment plant

- Correct treatment failure if possible
- Optimise treatment processes at the treatment plant
- Increase/add chlorine at points in the distribution system
- Clean, flush, and disinfect mains

d) Contamination investigation and sanitary survey - assessing the need for a boil water alert.

The contamination investigation should aim to:

- Determine the origin of the contamination (e.g. is contamination present in water leaving the treatment plant or localised to one section of the distribution system?; is there evidence of pre- or post-treatment contamination?)
- Time and scale of contamination (i.e. the extent and likely recency of contamination)

The sanitary survey should consider whether barriers to contamination are adequate and whether treatment processes, including disinfection, are effective.

Barriers to the transmission of pathogenic microorganisms should include most, if not all, of the following:

- Selection of water sources which are protected from contamination by human and animal faecal material, and chemicals, and maintenance of an active catchment protection program
- Pre-treatment, such as detention and settling in reservoirs for sufficient time for pathogen die off
- Protection of water storages
- Extraction management
- Treatment (e.g. coagulation, settling, filtration)
- Disinfection of the water before it enters the distribution system
- Maintenance of adequate residual concentrations where chemical disinfection is used
- Security of the distribution system against re-contamination

Ensure the effectiveness of disinfectant concentration through particular attention to the following:

- Frequent (daily or continuous) monitoring of operational factors (e.g. pH, disinfectant residual, turbidity)
- No directly visible plant or animal material
- Minimum total chlorine residual of 0.5 mg/L after 30 min (if chlorination is used)
- Low turbidity, preferably <1 NTU
- pH optimised to suit the disinfectant used (subject to the need to minimise corrosion)
- Adequate maintenance of the reticulation system

- Frequent monitoring of disinfectant residual in the distribution system.
- If water temperature >30°C, monitor for amoebae

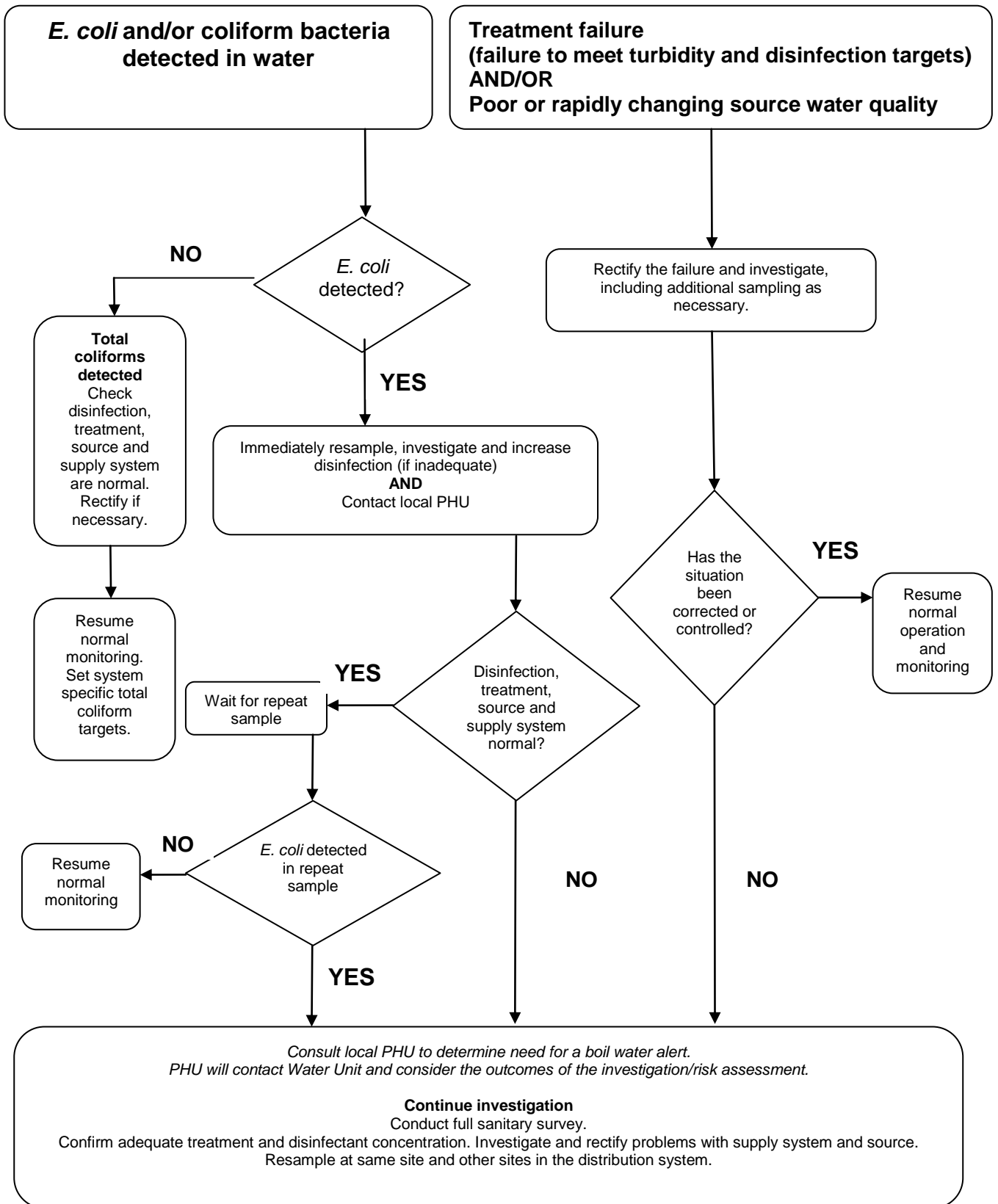
Factors to consider before issuing a boil water alert:

The water utility, PHU, Water Unit and/or Chief Health Officer will consider the following when determining the need for a boil water alert or an alternative supply:

- Are people exposed to an ongoing risk that could be prevented with a boil water alert?
- The findings of the contamination investigation and sanitary survey
- The effectiveness of current disinfection
- Likelihood of identification and correction of the problem
- Evidence of increased illness in present or previous events. The PHU should consider the need for enhanced surveillance.
- Exposure
 - Estimate daily water consumption levels.
 - Determine if the samples are representative of water that is actually consumed
- Exposure duration and scale (how long and how many people been consuming the water?)
- Have there been any complaints about water quality or health?
- Are any vulnerable populations receiving the water? (e.g. dialysis patients, immunocompromised, etc.)
- Will rectification measures affect any vulnerable populations? (e.g. disinfection changes and dialysis patients)
- Whether proper sample collection and analysis techniques were used
- Whether a NATA accredited laboratory analysed the samples
- Availability of an alternative supply
- Notification of consumers that may receive carted water from the affected system
- The need to communicate accurate and appropriate information to the public in a timely manner
- The best means to communicate the information
- The community impact of any public health action

e) Lifting a boil water alert

The PHU, Water Unit and/or Chief Health Officer will consider the factors listed in Section d as well as reviewing available test results. Where a water utility has issued a boil water alert it should consult the Public Health Unit about lifting the alert. The NSW Office of Water should also be advised.



NSW Health Response protocol for the management of physical and chemical quality of drinking water

This protocol is derived from the *Australian Drinking Water Guidelines, 2004* (the Guidelines) to be used by Public Health Units (PHU) and water utilities to guide their joint response following the detection of physical and chemical water characteristics that exceed the Guidelines.

Under Section 10D of the *Public Health Act 1991*, the Chief Health Officer has the power to issue advice, for the benefit of the public, concerning the safety of available drinking water and any possible risks to health involved in the consumption of that water. This may include a recommendation for the provision of an alternative supply of water or a “do not drink” advice. These powers are delegated to Public Health Unit Directors. A supplier of drinking water must issue to the public the advice provided under the *Public Health Act*, if so directed.

The *Australian Drinking Water Guidelines, 2004* have set aesthetic and health related guideline values for physical and chemical characteristics. Aesthetic guideline values are set at the concentration that ensures water is aesthetically pleasing in terms of taste and odour, and can be used without causing corrosion of plumbing or staining. Health-related guideline values are set at the concentration that, based on current knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption. Further information on the physical and chemical quality of drinking water is available in the Guidelines (Chapters 6 and 10).

Where both aesthetic and health-related guideline values are exceeded, consider health-related characteristics first and then aesthetic characteristics.

a) Action on the exceedance of guideline values

The water utility is responsible for carrying out all necessary investigation and resampling as specified in this response protocol.

1. The water utility and the Public Health Unit (PHU) should be notified of the contamination by the testing laboratory.
2. The water utility and the PHU should determine if a potential acute health risk exists. Consider the type of guideline value (health-related or aesthetic) exceeded, the concentration, and potential causes such as a major contamination event or treatment failure. Further information is available in the fact sheets for physical and chemical water quality in the Guidelines.
3. If a potential acute health risk exists, the water utility should consult with the PHU and the Department of Energy Utilities and Sustainability (DEUS) regional inspector regarding immediate action such as rectification, alternative supply, public warnings, and investigation and sampling. The PHU should contact the Water Unit.

4. If no acute health risk is present the water utility should conduct an investigation, in consultation with the local PHU and the DEUS regional inspector, to determine the possible sources of contamination. These might include a treatment breakdown or malfunction (eg. chemical overdose), a mains break, corrosion, interruption to the supply, surges in supply, or deliberate or accidental contamination of the system. The investigation may include a visual inspection of the system and associated service reservoirs by trained personnel. When found, the source of contamination should be rectified.
5. The water utility should resample at the same site upon advice from the PHU using NSW Health Repeat/Additional Labels, unless specific project labels are issued. The sample should be submitted to a NSW Health Laboratory or a NATA accredited laboratory for analysis. Make sure that the laboratory knows that this is a repeat samples investigating possible contamination.
6. If the repeat sample meets the guideline value resume normal sampling.
7. If the repeat sample exceeds the guideline value use available data to assess risk (section b).
8. If the risk assessment does not indicate an ongoing risk, resume normal sampling.
9. If the risk assessment indicates an ongoing risk, the water utility should consult with the PHU and the DEUS regional inspector regarding rectification (eg. flushing, system maintenance, etc.), alternative supply, public warnings, and investigation and sampling. PHU Environmental Health Officers and Director should contact the Water Unit.

b) Risk assessment and considerations for public notification:

Risk assessment

The Water Utility, PHU, and DEUS regional inspector should consider the following when conducting the risk assessment:

- Routine sampling frequency. Water utilities that collect two routine chemistry samples per year for the affected supply system should discuss, with the PHU, the need for a sampling investigation either through a project or change in the routine sampling frequency.
- Statistical analysis of available data or sampling investigation results.
 - For health-related guideline exceedances, calculate the 95th percentile of results over (at least) the last twelve months.
 - For aesthetic guideline exceedances, calculate the mean of results over (at least) the last twelve months.
- Exposure
 - Estimate daily water consumption levels.
 - Determine if the samples are representative of water that is actually consumed?
 - Exposure duration (how long have people been consuming the water?)

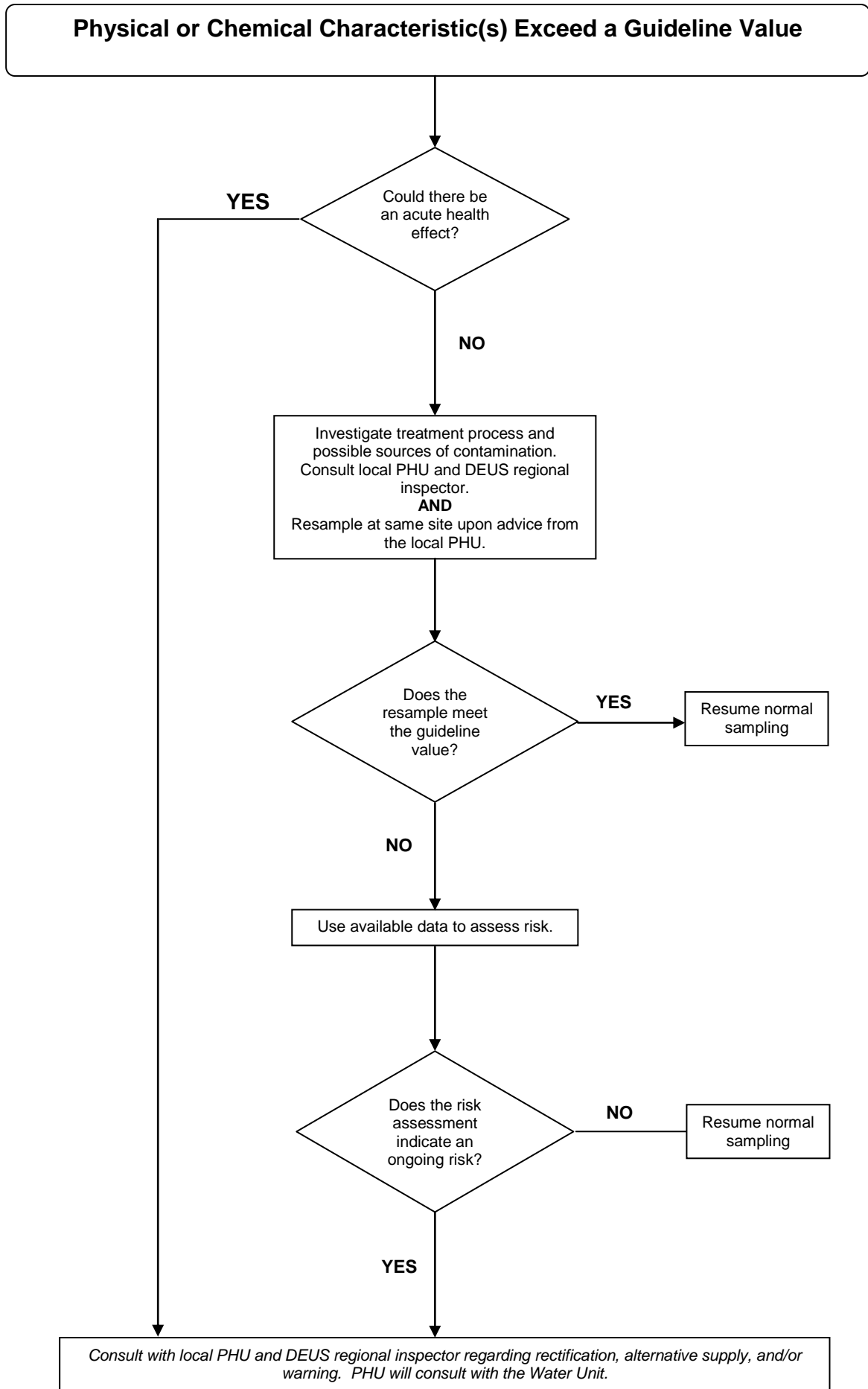
- Have there been any complaints about water quality or health?
- Are flow-on effects possible? Such as low pH causing lead and copper contamination through corrosion of plumbing.
- Are any vulnerable populations receiving the water? (i.e. dialysis patients, immunocompromised, infants, etc.)

Further information on conducting health risk assessments is available in Section 3.2.3 (page 3-6) of the Guidelines and Appendix 4 of the enHealth *Guidelines for assessing human health risks from environmental hazards*.

Public notification considerations

The PHU, Water Unit and/or Chief Health Officer will consider the following when determining the need for public notification, a do not drink advice, or an alternative supply:

- The outcomes of the risk assessment.
- Whether proper sample collection and analysis techniques were used
- Whether a NATA accredited laboratory analysed the samples
- Availability of an alternative supply
- Notification of consumers that may receive carted water from the affected system.



Appendix 3 Public Health Unit contact list

Murrumbidgee and Southern Local Health District

Albury Office

Suite 1B, 620 Macauley St, ALBURY NSW 2640
PO Box 3095 ALBURY NSW 2640
Phone: (02) 6080 8900 Fax: (02) 6080 8999

Wagga Wagga Office

2nd Floor, 63-65 Johnston St, WAGGA WAGGA
NSW 2650
PO Box 201 WAGGA WAGGA NSW 2650
Phone: (02) 6933 9100 Fax: (02) 6933 9129

Goulburn Office

Mandala House, Bourke St Health Service
234 Bourke St GOULBURN NSW 2580
Locked Bag 11 GOULBURN NSW 2580
Phone: (02) 4824 1842 Fax: (02) 4824 1831

Bermagui Office

Bermagui Community Centre
Bunga St BERMAGUI NSW 2546
Mob: 0427 004 992

Far West and Western Local Health District Broken Hill Office

Kincumber House, Morgan St, BROKEN HILL
NSW 2880
PO Box 457 BROKEN HILL NSW 2880
Phone: (08) 8080 1499 Fax: (08) 8080 1683

Macquarie Office

Dubbo Base Hospital, Myall St, DUBBO NSW 2830
PO Box 739 DUBBO NSW 2830
Phone: (02) 6841 5569 Fax: (02) 6841 5570

Bathurst Office

1st Floor, Post Office Building, 230 Howick St
BATHURST NSW 2795
PO Box 143 BATHURST NSW 2795
Phone: (02) 6339 5601 Fax: (02) 6339 5189

Hunter New England Local Health District Newcastle Office

Ground Floor, Booth Bldg, Wallsend Campus
Longworth Ave WALLSEND NSW 2287
Locked Mail Bag 10 WALLSEND NSW 2287
Phone: (02) 4924 6477 Fax: (02) 4924 6490

Tamworth Office

2nd Floor, 470 Peel St TAMWORTH NSW 2340
Locked Mail Bag 9783 New England Mail Sorting
Centre NSW 2348
Phone: (02) 6764 8000 Fax: (02) 6766 3003

Taree Office

57-61 Albert St, TAREE NSW 2430
PO Box 966 TAREE NSW 2430
Phone: (02) 6515 1854 Fax: (02) 6515 1804

Mid North Coast and Northern Local Health District

Port Macquarie Office

McLaren Building, Morton St PORT MACQUARIE
NSW 2444
PO Box 126 PORT MACQUARIE NSW 2444
Phone: (02) 6588 2750 Fax: (02) 6588 2837

Lismore Office

31 Uralba St, LISMORE NSW 2480
PO Box 498, LISMORE NSW 2480
Phone: (02) 6620 7585 Fax: (02) 6622 2151

Northern Sydney and Central Coast Local Health District

Central Coast Office

Newcastle University, Ourimbah Campus
Brush Road OURIMBAH NSW 2258
PO Box 361 GOSFORD NSW 2250
Phone: (02) 4349 4845 Fax: (02) 4349 4850

Northern Sydney Office

Main Building No.1, Hornsby Ku-ring-gai Hospital,
36-76 Palmerston Road, HORNSBY NSW 2077
Phone: (02) 9477 9400 Fax: (02) 9482 1650

Illawarra and Shoalhaven Local Health District

Wollongong Office

Building 39B, University of Wollongong, Northfield
Ave, GWYNEVILLE NSW 2500
Locked Mail Bag 9 WOLLONGONG NSW 2526
Phone: (02) 4221 6700 Fax: (02) 4221 6759

South Eastern Sydney Local Health District Randwick Office

Hut U Easy Street, off Barker Street, Randwick
Hospital Campus, RANDWICK NSW 2031
Locked Mail Bag 88 RANDWICK NSW 2031
Phone: (02) 9382 8333 Fax: (02) 9382 8334

South Western Sydney and Sydney Local Health District

Camperdown Office

Level 9 North, King George V, Royal Prince Alfred
Hospital, 83 Missenden Road, CAMPERDOWN
NSW 2050
PO Box 374 CAMPERDOWN NSW 2050
Phone: (02) 9515 9420 Fax: (02) 9515 9440

Western Sydney and Nepean Blue Mountains Local Health District

Parramatta Office

Gungarra Bldg (B68), Cumberland Hospital
5 Fleet Street, NORTH PARRAMATTA NSW 2151
Locked Mail Bag 7118 PARRAMATTA BC NSW
2150
Phone: (02) 9840 3603 Fax: (02) 9840 3608

