# 2011-12
# Annual Water Quality Monitoring Plan

**March 2011**

## Plan Details

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# 1. STRATEGIC WATER QUALITY MONITORING

Protection of public health by assuring the safety of drinking water is the primary objective of drinking water quality management and treatment.

The *2004 Australian Drinking Water Quality Guidelines* (ADWG) *Framework for the Management of Drinking Water Quality* (the Framework) integrates best practice and provides the basis for management of drinking water quality at Hunter Water Corporation (Hunter Water). The framework emphasises a preventative risk management approach for all steps in water supply from the water source to the consumer.

The Framework incorporates a strategic approach to water quality monitoring:

> *"The best assurance of drinking water safety is to develop a complete monitoring system which includes relevant monitoring aspects of research, operational performance, validation and verification…Essentially, a strategic water quality monitoring system involves an integrated program of source water, process control and event-driven monitoring when the system is being increasingly challenged, supplemented with verifying the effectiveness of distribution system prevention programs, and monitoring consumer satisfaction"*
>
> (Rizak and Hrudey 2007, p. 5.)

Hunter Water's drinking water quality monitoring plan corresponds to the following elements of the Framework.

**TABLE 1 Components of water quality monitoring and corresponding elements of the Framework**

| Monitoring Component | Framework Element | Element Description |
|---|---|---|
| Source Water Monitoring | Element 2 | Assessment of drinking water supply system |
| Operational Monitoring | Element 4 | Operational procedures and process control |
| Customer Based Monitoring | Element 4<br>Element 5 | Operational procedures and process control<br>Verification of drinking water quality |
| Verification Monitoring | Element 5 | Verification of drinking water quality |
| Monitoring in response to incidents and emergencies | Element 6 | Management of incidents and emergencies |

## 1.1 Source water monitoring

Historical water quality data can assist in understanding source water characteristics and system performance. This can aid the identification of hazards and aspects of the drinking water supply system which requires improvement.

Trend analysis and control charts to monitor source water quality are used for recognising potential problems or hazards and the accumulation of any gradual changes or cumulative effects.

Source water quality monitoring builds on current knowledge and increases Hunter Water's understanding of its supply systems.

## 1.2 Operational monitoring

Operational monitoring includes water quality monitoring to assess and confirm the performance of preventive measures. On-line operational monitoring of water quality parameters is a key component of process control and “real-time” management of drinking water quality. Data from operational monitoring is used as a trigger for corrective actions to improve drinking water quality. Examples include on-line monitoring for fluoride, chlorine residual, pH and turbidity.

## 1.3 Customer based monitoring

An effective customer complaint and response system closely linked to operations is an important component of preventive strategy for drinking water safety. Customer complaints are documented and investigated. A customer complaints system is in place to highlight and track unusual types or numbers of complaints.

## 1.4 Verification monitoring

Verification of drinking water quality provides an assessment of the overall performance of the system and the ultimate quality of drinking water being supplied to customers. The water quality verification monitoring plan includes monitoring at representative points throughout the supply system. All source waters, treatment processes, and distribution systems are routinely monitored for a range of parameters as recommended in the Australian Drinking Water Guidelines (ADWG) using a National Association of Testing Authorities (NATA) accredited laboratory testing program.

## 1.5 Monitoring in response to incidents and emergencies

Protocols for response to water quality incidents and emergencies include increased and strategic monitoring of water quality. Hunter Water has in place the capacity to sample and analyse water quality at short notice, and with minimum turnaround times.

# 2 OPERATING LICENCE REQUIREMENTS

Hunter Water delivers its services under an operating licence granted by the State Government and administered by the Independent Pricing and Regulatory Tribunal (IPART). The operating licence is the major customer protection instrument and prescribes standards of service that must be met in relation to water quality, continuity, pressure, sewer overflows and wastewater transportation.

Section 3.3 of the Hunter Water Corporation Operating Licence 2007-2012 sets out the requirements for water quality monitoring:

***3.3 Water Quality – Monitoring***

*3.3.1 Hunter Water must prepare, to the satisfaction of NSW Health, a comprehensive annual water quality monitoring plan (Annual Water Quality Monitoring Plan) for the Water Supply System by 31 March each year, for the duration of the Licence. This Annual Water Quality Monitoring Plan must:*

- *(a) include monitoring of Bulk Water and Drinking Water quality and details of laboratory testing and reporting processes to ensure quality control;*
- *(b) have regard to the concepts of good practice set out in the Australian Drinking Water Guidelines and apply those concepts as specified by NSW Health;*
- *(c) for Bulk Water, include a list of characteristics that will be monitored to identify potential hazards with the water supply, or a change in water quality;*
- *(d) include targeted, investigative and event-based monitoring; and*
- *(e) include monitoring for any other water characteristic nominated by NSW Health.*

*3.3.2 Monitoring under the Annual Water Quality Monitoring Plan must be undertaken for the period from the Commencement Date to 30 June 2008 and after that for each subsequent financial year.*

*3.3.3 The sampling frequency and the locations chosen for the Drinking Water quality monitoring should be representative of the quality of Drinking Water supplied to Consumers.*

*3.3.4 Hunter Water must provide IPART with a copy of the Annual Water Quality Monitoring Plan as soon as possible after it is agreed with NSW Health. Hunter Water must make a copy of that plan available to the public after it has been provided to IPART.*

*3.3.5 If Hunter Water and NSW Health cannot agree on the Annual Water Quality Monitoring Plan, the views of NSW Health will prevail and Hunter Water must accept the Annual Water Quality Monitoring Plan determined by NSW Health.*

# 3 SOURCE WATER

Routine as well as targeted and investigative monitoring is undertaken at source waters.

This water quality data is analysed and incorporated into the risk assessment process. Trend analysis and control charts are used for recognising potential problems or hazards and the accumulation of any gradual changes or cumulative effects.

Analysis of source waters contributes to the framework principle “know your system”, that is, the data aids in understanding Hunter Water’s sources and assessing the risks.

## 3.1 Routine monitoring

Under the operating licence, the water quality monitoring plan for bulk water must include a list of characteristics that will be monitored to identify potential hazards with the water supply, or a change in water quality.

Table 2 on the following page sets out routine drinking water quality parameters for raw (bulk) waters for Chichester, Grahamstown, Tomago, Lemon Tree Passage, and Nelson Bay/Anna Bay Sources. Table 3 on page 12 sets out routine drinking water quality parameters for raw water for Gresford.

Sampling frequencies for most parameters are at least equal to the frequency recommended in Table 10.7 of the ADWG (ADWG 2004, p.10.16). The last column of Table 2 indicates characteristics that are recommended in the ADWG for monitoring in raw waters.

Where the recommended sampling frequency is “annually if at all”, Hunter Water has adopted (as a minimum) a default frequency of once every 5 years.

**TABLE 2 Routine drinking water monitoring parameters for raw (bulk) water – Chichester, Grahamstown, Tomago, Lemon Tree Passage, and Nelson Bay/Anna Bay Sources**

| Parameter | Frequency | No. of locations | Analysis by: | ADWG Table 10.7 |
|---|---|---|---|---|
| pH | Daily | 6 | HWA Water Treatment | √ |
| Turbidity | Daily | 6 | HWA Water Treatment | √ |
| Fluoride | Daily at Grahamstown, Dungog and Tomago. Weekly at Lemon Tree Passage, Anna Bay and Nelson Bay | 6 | HWA Water Treatment | √ |
| Iron | | | | √ |
| Manganese | | | | √ |
| Aluminium | Weekly | 6 | HWA Water Treatment | |
| Cyanobacteria | Weekly, or Twice Weekly if > 2000 cells/ml of a potentially toxic species is detected | 4 at Grahamstown and 7 at Chichester | HWA | √ |
| *E. coli* | Weekly | 6 | HWA | √ |
| Total Coliforms | Weekly | 6 | HWA | √ |
| Heterotrophic Plate Count | Weekly | 2 | HWA | √ |
| Ammonia | Quarterly | 6 | HWA | |
| Nitrites | Quarterly | 6 | HWA | |
| Nitrates | Quarterly | 6 | HWA | |
| Cryptosporidium | Quarterly at Lemon Tree Passage, Nelson Bay and Anna Bay, Fortnightly Grahamstown and Chichester | 6 | HWA | |
| Giardia | Quarterly at Lemon Tree Passage, Nelson Bay and Anna Bay, Fortnightly Grahamstown and Chichester | 6 | HWA | |
| 2-Methylisoborneol (MIB) | Weekly | Grahamstown and Chichester[1] | HWA | |
| Geosmin | | Grahamstown and Chichester[1] | HWA | |
| Aldrin | Monthly | 6 | DAL | √ |
| Amitrole | Monthly | 6 | ALS | √ |
| Atrazine | Monthly | 6 | DAL | √ |
| Chlordane | Monthly | 6 | DAL | √ |
| Chlorfenvinphos | Monthly | 6 | DAL | √ |
| 2,4-D | Monthly | 6 | DAL | √ |
| DDT | Monthly | 6 | DAL | √ |
| Dieldrin | Monthly | 6 | DAL | √ |
| Diuron | Monthly | 6 | DAL | √ |
| Endosulphan | Monthly | 6 | DAL | √ |
| Fosamine | Monthly | 6 | DAL | √ |
| Heptachlor | Monthly | 6 | DAL | √ |

[1] *Sampling for MIB and Geosmin for Chichester source is undertaken in Dungog filtered water, ie after flocculation and filtration, but before disinfection, fluoridation and pH and alkalinity correction*

| Parameter | Frequency | No. of locations | Analysis by: | ADWG Table 10.7 |
|---|---|---|---|---|
| Lindane | Monthly | 6 | DAL | √ |
| Molinate | Monthly | 6 | DAL | √ |
| Pichloram | Monthly | 6 | DAL | √ |
| Propiconazole | Monthly | 6 | DAL | √ |
| Temephos | Monthly | 6 | ALS | √ |
| Polychlorinated Biphenyl (PCB) | Quarterly | 6 | ALS | |
| Glyphosate | Quarterly | 6 | ALS | √ |
| Metsulfuron-methyl | Quarterly | 6 | ALS | √ |
| Antimony | Quarterly | 6 | HWA | |
| Arsenic | Quarterly at Grahamstown and Chichester, weekly at Tomago, Lemon Tree Passage, Anna Bay, Nelson Bay | 6 | HWA | √ |
| Barium | Quarterly | 6 | HWA | √ |
| Beryllium | Quarterly | 6 | HWA | √ |
| Boron | Quarterly | 6 | ALS | √ |
| Cadmium | Quarterly | 6 | HWA | |
| Chromium | Quarterly | 6 | HWA | |
| Copper | Quarterly | 6 | HWA | |
| Cyanide | Quarterly | 6 | ALS | |
| Iodide | Quarterly | 6 | AWQC | |
| Lead | Quarterly | 6 | HWA | |
| Mercury | Quarterly | 6 | HWA | √ |
| Nickel | Quarterly | 6 | HWA | |
| Molybdenum | Quarterly | 6 | HWA | √ |
| Selenium | Quarterly | 6 | HWA | √ |
| Sodium | Quarterly | 6 | HWA | |
| Sulphide | Quarterly | 6 | HWA | |
| Tin | Quarterly | 6 | HWA | √ |
| Zinc | Quarterly | 6 | HWA | |
| Pathogenic Thermophilic and Nuisance Mesophilic Amoeba | Annually | 6 | AWQC | |
| Beryllium | Once every five years | 6 | HWA | √ |
| Silver | Quarterly | 6 | HWA | √ |
| Benzene | Once every five years at Lemon Tree Passage, Anna Bay, Nelson Bay and Chichester / Annually at Grahamstown and Tomago | 6 | SGS | √ |
| Chlorobenzene | | 6 | SGS | √ |
| Dichlorobenzenes<br>1,2-dichlorobenzene<br>1,3-dichlorobenzene<br>1,4-dichlorobenzene | | 6 | SGS | √ |

| Parameter | Frequency | No. of locations | Analysis by: | ADWG Table 10.7 |
|---|---|---|---|---|
| Dichloroethanes<br>1,1-dichloroethanes<br>1,2-dichloroethanes | Once every five years at Lemon Tree Passage, Anna Bay, Nelson Bay and Chichester / Annually at Grahamstown and Tomago | 6 | SGS | √ |
| Dichloroethenes<br>1,1-dichloroethenes<br>1,2-dichloroethenes | | 6 | SGS | √ |
| Dichloromethane (methylene chloride) | | 6 | SGS | √ |
| Ethylbenzene | | 6 | SGS | √ |
| Ethylenediamine tetraacetic acid (EDTA) | | 6 | SGS | √ |
| Hexachlorobutadiene | | 6 | SGS | √ |
| Nitrilotriacetic acid | | 6 | SGS | √ |
| Organotins<br>Dibutyltin<br>Tributyltin | | 6 | Leeder Consulting | √ |
| Styrene | | 6 | SGS | √ |
| Tetrachloroethene | | 6 | SGS | √ |
| Toluene | | 6 | SGS | √ |
| Trichlorobenzenes (total) | | 6 | SGS | √ |
| 1,1,1-Trichloroethane | | 6 | SGS | √ |
| Trichloroethylene (TCE) | | 6 | SGS | √ |
| Vinyl Chloride | | 6 | SGS | √ |
| Radiological - Gross alpha & beta activity | Once every two years for groundwater (Anna Bay, Nelson Bay Lemon Tree Passage and Tomago), once every five years for surface water (Grahamstown and Dungog) | 6 | ANSTO | √ |

ALS = Australian Laboratory Services (Sydney)
ANSTO = Australian Nuclear Science and Technology Organisation (Lucas Heights)
DAL = Department of Analytical Laboratories (Lidcombe)
AWQC = Australian Water Quality Centre (SA)
SGS = SGS Laboratories  Melbourne
HWA = Hunter Water Australia Laboratories
HWA Water Treatment =  Hunter Water Australia Process and Operations
i.e. analysis is carried out at Water Treatment Plants
*(Hunter Water Australia is a fully owned subsidiary of Hunter Water Corporation)*

## Notes on raw (bulk) water testing

The six raw water sources referred to previously in Table 2 are:

- Chichester Dam;
- Grahamstown Dam;
- Tomago bores;
- Lemon Tree Passage bores;
- Anna Bay bores; and
- Nelson Bay bores.

The six locations nominated represent each of the raw water sources excluding the Gresford water supply system.

For Cyanobacteria, samples are only taken from the surface water supplies. The samples are collected from Chichester Dam (at 6 depths and at off take), Williams River at Boags Hill (off take for pumping to Grahamstown) and at three locations within Grahamstown Dam and Grahamstown Dam raw.

Particle counting is undertaken at Dungog and Grahamstown Water Treatment Plants.

Weekly monitoring for the taste and odour compounds 2-Methylisoborneol (MIB) and Geosmin is undertaken at Grahamstown raw and Dungog filtered (i.e. after coagulation and filtration, and before fluoridation, disinfection, pH and alkalinity correction). During taste and odour events, the frequency of analysis may be increased.

Monitoring for Cryptosporidium and Giardia is undertaken fortnightly for Dungog and Grahamstown raw waters, and quarterly for Tomago, Lemon Tree Passage, Anna Bay and Nelson Bay raw waters. The corresponding treated water is analysed if Cryptosporidium or Giardia are detected at any level in the raw water. Note that treated surface waters from Chichester and Grahamstown are also analysed for Cryptosporidium and Giardia quarterly (even if not detected in the raw water).

For “organics other than disinfection by-products” the ADWG recommend sampling “*monthly if persistent, otherwise event-related*”. None of Hunter Water’s sources are subject to persistent organic contamination. However, as the Grahamstown and Tomago water sources are potentially more susceptible to organic contamination due to land use within the catchments, sampling is undertaken for these sources on an annual basis. For the remaining four sources, as the risk of organic contamination is lower, sampling is undertaken once every five years.

Routine source water quality monitoring for the Gresford water supply is shown in Table 3.

## TABLE 3 Routine drinking water monitoring parameters for Gresford raw water

| Parameter | Frequency | No. of locations | Analysis by: |
|---|---|---|---|
| *E.coli* | Weekly | 1 | HWA |
| Total Coliforms | Weekly | 1 | HWA |
| Temperature | Weekly | 1 | HWA |
| pH | Weekly | 1 | HWA |
| Turbidity | Weekly | 1 | HWA |
| Calcium | Fortnightly | 1 | HWA |
| Blue-Green Algal Analysis | Weekly (from Dec to Feb inclusive) | 2 (Allyn and Paterson) | HWA |
| Cryptosporidium & Giardia | Six-Monthly | 2 (Allyn and Paterson) | HWA |
| Total organic carbon | Fortnightly | 2 (Allyn and Paterson) | HWA |
| Dissolved organic carbon | Fortnightly | 2 (Allyn and Paterson) | HWA |
| Alkalinity | 3 times a week | 1 (RWT) | HWA Water Treatment |
| Colour True and Apparent | 3 times a week | 1 (RWT) | HWA Water Treatment |
| Conductivity | 3 times a week | 1 (RWT) | HWA Water Treatment |
| Iron (total and soluble) | Weekly | 1 (RWT) | HWA Water Treatment |
| Manganese (total and soluble) | Weekly | 1 (RWT) | HWA Water Treatment |
| Aluminium | 3 times a week | 1 (RWT) | HWA Water Treatment |

HWA = Hunter Water Australia Laboratories
HWA Water Treatment = Hunter Water Australia Process and Operations
i.e. analysis is carried out at Water Treatment Plants
*(Hunter Water Australia is a fully owned subsidiary of Hunter Water Corporation)*

## 3.2 Targeted, investigative and risk-based monitoring

Hunter Water's risk assessment processes use an approach which identifies and rectifies sources of risk rather than simply measuring and reporting water quality. This approach in collecting data increases understanding of the system and is considered industry best practice.

Routine monitoring, as set out the ADWG, incorporates a "generic" risk-based component. For example, the risk from pathogens feature as high on most risk assessments for drinking water quality systems and as a result, the frequency of testing for the indicator bacteria *E coli* is also high in the routine monitoring program.

"Event-based" monitoring during rainfall events has been undertaken at Campvale Canal as the canal drains water from a semi-urban catchment to Grahamstown Dam. This part of the catchment was identified during risk assessment as a potential risk of increased pathogens and pesticides particularly during rainfall events.

This monitoring plan has been established to increase Hunter Water's understanding of the supply system and supports the collection of water quality data that adds value to the existing body of knowledge from catchment to tap. These monitoring programs aim to fill in knowledge gaps identified through the Framework's hazard identification and risk assessment process.

Risks have been characterised in detail under the Framework, however, the broad categories of risk for Hunter Water's water supplies include:

- Pathogens;
- Blue-green algae (for surface storages);
- High Turbidity; and
- Chemicals (from natural geology, land use within catchment, pesticides, spills and water treatment chemicals).

Examples of risks identified and corresponding targeted monitoring are outlined in Table 4.

**TABLE 4 Risks to drinking water quality and corresponding targeted water quality monitoring**

| Risk to Drinking Water Quality | Targeted Water Quality Monitoring |
|---|---|
| Pathogens, including bacteria, viruses, protozoa | *E.coli*, Cryptosporidium, Giardia and Amoaeba (summer) |
| Blue-Green algal risks | Increased sampling frequency, speciation, and toxicity / Taste and Odour analysis as concentrations of BGA increase in line with BGA contingency plan |
| Arsenic, Manganese, Iron in Tomago source | Weekly analysis of Fe, Mn and As at individual Tomago stations while operating |
| Potential impact of Salt Ash Air Weapons Range | Quarterly Analysis for heavy metals at bore stations downstream of this site |
| Campvale Canal wet weather inflows to Grahamstown Dam | Event-based monitoring for nutrients, *E. coli*, cryptosporidium and giardia |

# 4 PROCESS CONTROL AND OPERATIONAL MONITORING

Hunter Water uses monitoring protocols for the operational performance of its water supply system including the selection of operational parameters and criteria and the routine analysis of results. These include the monitoring of key parameters such as turbidity, pH, colour, iron, manganese, aluminium, copper, lead, zinc, fluoride, chlorine and trihalomethanes (THMs).

A critical control point is an activity, procedure or process at which control can be applied and which is essential to prevent a hazard or reduce it to an acceptable level. Critical control points are monitored throughout the system as part of Hunter Water's process control strategy. The collective effect of the target criteria and critical limits at all identified control points can consistently and effectively control all significant hazards.

Monitoring of key parameters in water sourced from raw water storages is undertaken to identify possible sources of contamination. Hunter Water also uses continuous on-line monitoring equipment for the monitoring of target criteria and critical limit parameters wherever possible, particularly at the most important control points. This is carried out via telemetered Supervisory Control and Data Acquisition (SCADA) systems, Programmable Logic Controller (PLC), water quality sampling results, catchment observation reports and treatment plant operational spreadsheets. This operational data is collected and monitored in a form that allows rapid detection of trends and can act as a trigger for the correction of exceedances in treatment processes.

A planned sequence of measurements and observations throughout the supply system is used to assess and confirm the performance of preventive measures already in place. Hunter Water uses timely monitoring for operational parameters where continuous on-line monitoring is not possible or necessary. These include regular inspections of the catchments and reservoirs and monitoring of surrogate water quality parameters. Operational surrogates are another strategy that Hunter Water uses to monitor overall water treatment performance. These parameters include turbidity, chlorine residual, flow, rainfall events, pH, particle counts and conductivity.

On-line instrumentation used to monitor treated water quality at critical control points is shown in the following table.

**TABLE 5 On-line instrumentation at critical control points**

| Location / Instrument | Chlorine analyser | pH meter | Turbidity meter | Fluoride analyser |
|---|---|---|---|---|
| **Chichester Dam** | √ | | √ | |
| **Dungog WTP** | √ | √ | √ | √ |
| **Buttai Chlorinator** | √ | | | |
| **Grahamstown WTP** | √ | √ | √ | √ |
| **North Lambton Chlorinator** | √ | | | |
| **Toronto Chlorinator** | √ | | | |
| **Cardiff Chlorinator** | √ | | | |
| **Lemon Tree Passage WTP** | √ | √ | √ | √ |
| **Anna Bay WTP** | √ | √ | √ | √ |
| **Nelson Bay WTP** | √ | √ | | √ |
| **Gresford WTP** | √ | √ | √ | |

Data from on-line instruments is monitored 24 hours a day with alarms to alert the operator when an alarm limit has been exceeded to allow appropriate corrective action taken.

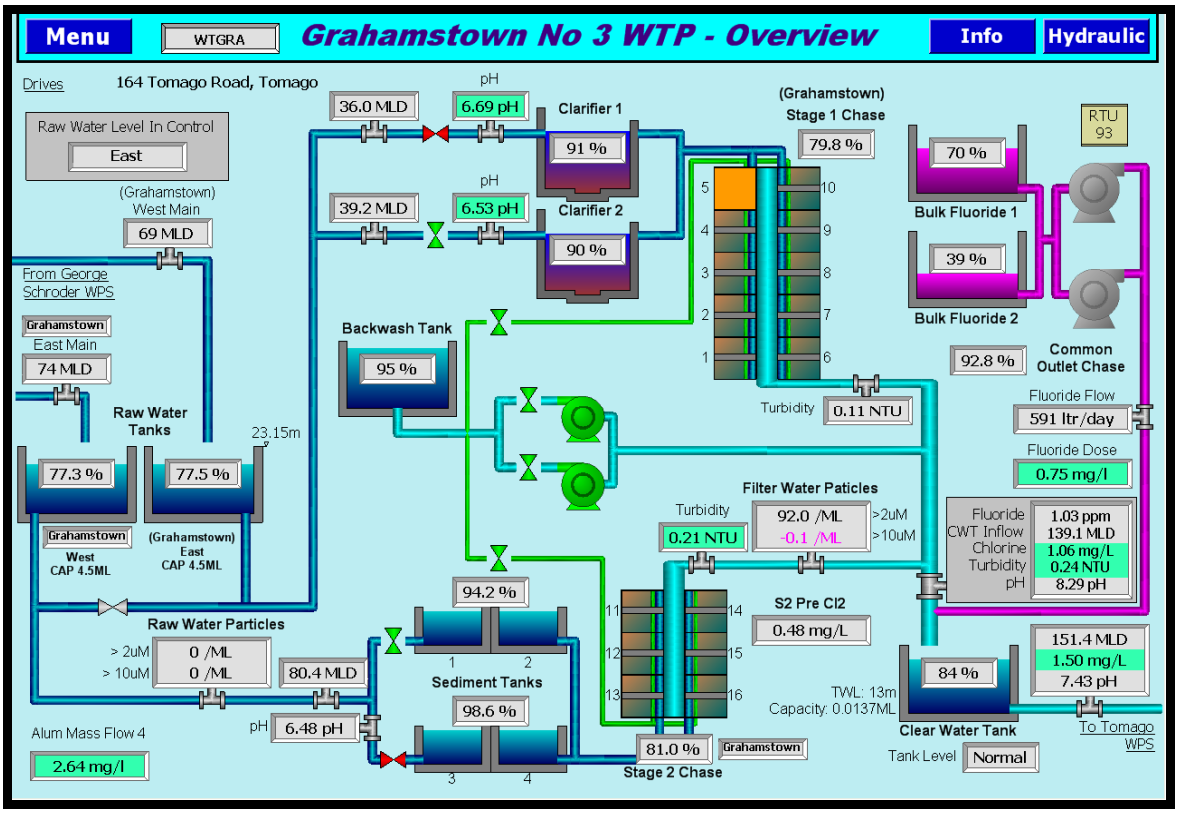


**FIGURE 1 SCADA diagram for Grahamstown Water Treatment Plant**

Other examples of on-line monitoring for operational control include on-line monitoring of rainfall in the Chichester catchment and turbidity at the dam. Due to increased solids loading on the filters, flow through Dungog Water Treatment Plant needs to be reduced during periods of elevated turbidity. Rainfall and turbidity data provides an early warning, or trigger, to reduce flow through the plant.

Various processes are used to ensure that any potentially adverse monitoring results are rapidly notified to operational staff authorised to initiate corrective action. These include Water Treatment Plant spreadsheets, automated alarms, data exception emails, as well as laboratory non-conformance procedures.

Hunter Water sets target criteria that are more stringent than critical limits and has in place procedures to ensure that the operational monitoring (process monitoring) is implemented effectively.

# 5 CUSTOMER-BASED MONITORING

Hunter Water undertakes its customer-based monitoring on a continual basis which includes a process for recording all customer water quality complaints and the actions undertaken in response to these complaints. Routine water quality complaints such as dirty water complaints that require a simple follow-up (e.g. flushing) are recorded in the Assets Operations Maintenance System (AOMS). Complaints that require more detailed follow-up (e.g. ongoing water quality problems) are dealt with under the Complaint Management System.

Hunter Water responds to customer water quality complaints based on standard operating procedures. These procedures include a clear definition of authorities and responsibilities.

A daily review of water quality monitoring results is made possible using internal data management systems. Figure 2 shows a screen shot of the "Hunter Water Systems Performance Dashboard."

**HWC Systems Performance Dashboard**

| Indicator | District | Period (click for details) | | | | | | | Limit | | Period Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | -6 | -5 | -4 | -3 | -2 | -1 | C | Low | High | |
| Sewer Gravity Main Break | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 Day(s) |
| Sewer Odour | A | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 Day(s) |
| Sewer Rising Main Breaks | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 Day(s) |
| Sewer Storm Surcharge | A | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 Day(s) |
| Sewer Surcharge - All | A | 6 | 16 | 8 | 5 | 14 | 9 | 0 | 0 | 10 | 1 Day(s) |
| Sewer Surcharge - East 1 | 2 | 0 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 4 | 1 Day(s) |
| Sewer Surcharge - East 2 | 3 | 2 | 5 | 2 | 2 | 2 | 1 | 0 | 0 | 4 | 1 Day(s) |
| Sewer Surcharge - East 3 | 4 | 2 | 5 | 3 | 2 | 2 | 3 | 0 | 0 | 4 | 1 Day(s) |
| Sewer Surcharge - West 1 | 5 | 1 | 0 | 3 | 1 | 4 | 3 | 0 | 0 | 4 | 1 Day(s) |
| Sewer Surcharge - West 2 | 6 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 4 | 1 Day(s) |
| Sewer Surcharge - West 3 | 7 | 1 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 1 Day(s) |
| Vacuum Sewer Problem - All | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 Day(s) |
| Water Breaks | A | 5 | 6 | 2 | 0 | 5 | 4 | 0 | 0 | 5 | 1 Day(s) |
| Water Breaks - Month (Calander) | A | 97 | 98 | 88 | 110 | 95 | 128 | 126 | 0 | 165 | 1 Calendar Month(s) |
| Water Breaks - Month (Rolling) | A | 97 | 102 | 85 | 107 | 106 | 99 | 169 | 100 | 165 | 1 Rolling Month(s) |
| Water Breaks - Year (Financial) | A | 1900 | 2032 | 1735 | 1427 | 1578 | 1561 | 863 | 0 | 1980 | 1 Financial Year(s) |
| Water Breaks - Year (Rolling) | A | 2075 | 1817 | 1967 | 1652 | 1499 | 1476 | 1469 | 1000 | 1980 | 1 Rolling Year(s) |
| Water Low Pressure | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 Day(s) |
| Water Quality - Air/White | A | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 Day(s) |
| Water Quality - Chlorine | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 Day(s) |
| Water Quality - Dirty Water | A | 1 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 3 | 1 Day(s) |
| Water Quality - Health | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 Day(s) |
| Water Quality - Other | A | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 1 Day(s) |
| Water Quality - Taste/Odour | A | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 1 Day(s) |

**FIGURE 2 Hunter Water data dashboard showing number of water quality complaints, by category, over the previous 7 days.**

The dashboard shows numbers of water quality complaints over the seven days, by category of complaint. The dashboard can act as a trigger for further investigation or operational response. For example, during a taste and odour event, feedback from customers may be used to trigger Powdered Activated Carbon (PAC) dosing. Feedback from customers can, at times, be quicker than laboratory analysis of the taste and odour compounds Methylisoborneol (MIB) and geosmin.

Daily taste testing of surface water is also undertaken by suitably qualified operators. These results are evaluated and exceptions may trigger further investigation or operational response

# 6 WATER QUALITY MONITORING IN RESPONSE TO INCIDENTS

Hunter Water ensures that appropriate water quality monitoring and assessment is completed in response to water quality incidents should they occur. Sampling and analysis of affected, or potentially affected, areas of the water supply system is done as soon as any situation is assessed with results required in the fastest possible turnaround time.

Procedures for corrective actions in response to water quality monitoring non-conformances are used to manage all such events and provide clear definitions of roles and responsibilities, including any notification requirements.

The water quality exception reporting procedures are centrally located on the Hunter Water intranet site. Hunter Water operations staff are trained in these procedures.

Hunter Water has developed contingency and emergency response plans including procedures for response to water quality incidents. Simulated emergency management exercises are conducted on a regular basis to ensure key staff familiarity with the required protocols. Hunter Water has involved NSW Health in understanding of potential incidents and emergencies and in developing response plans.

# 7 VERIFICATION MONITORING

## 7.1 Background

> *"Verification of drinking water quality provides an assessment of the overall performance of the system and the ultimate quality of drinking water being supplied to customers.*
>
> *…Verification monitoring provides*
>
> - *a useful indication of problems within the water supply system (particularly the distribution system) and the necessity for any immediate short-term corrective actions or incident and emergency response*
> - *confidence for consumers and regulators regarding the quality of the water supplied"*
>
> *(ADWG 2004, p. 3-19)*

Section 10 of ADWG *Monitoring for Specific Characteristics in Drinking Water* provides guidance on drinking water quality monitoring. Routine water quality monitoring is proposed to be undertaken by Hunter Water during 2011-12 in line with ADWG recommendations.

In addition to these routine samples Hunter Water will respond to specific water quality incidents with additional sampling targeted to identify levels and extent of specific water quality parameters as well as collecting data to identify trends.

Hunter Water currently has sixty-eight (68) licence sample points located throughout the distribution system for routine monitoring. The sample points are listed in Table 7 and the location of the points is shown on *Attachment 1: Plan Showing Water Quality Sample Points and Water Supply Zones*. The set of sampling points used for routine monitoring of water quality have been selected to be representative of the distribution system as a whole.

## 7.2 Sampling frequency

The ADWG Table 10.2 (ADWG 2004, p.10-5) sets out the recommended sampling frequency for microbiological monitoring. The sampling frequency is determined based on the population served. In assessing the number of samples to be collected, the water supply system is divided into monitoring zones as recommended in the ADWG outlined in Section 9.6.2 (ADWG 2004, p 9.6).

This effectively means that more samples are collected and analysed than would be collected if the number of samples was based on the total population.

Table 6 on the following page details the population and number of samples required in each zone.

**TABLE 6 Populations and no. samples required in zones**

| ZONE | ESTIMATED 2010 POPULATION | NO. OF SAMPLES REQUIRED PER FORTNIGHT * | NO. SAMPLES PER FORTNIGHT** (SHOWN IN TABLE 7) |
|---|---|---|---|
| Grahamstown | 370,628 | 26 | 36 |
| Chichester | 130,251 | 14 | 18 |
| Lemon Tree Passage | 7,536 | 3 | 6 |
| Nelson Bay / Anna Bay | 25,059 | 5 | 6 |
| Gresford | 331 | 2 | 2 |
| **TOTAL** | **533,805** | **50** | **68** |

* as set out in ADWG Table 10.2 (ADWG 2004, p.10-5)
** Note that fortnightly sampling is undertaken on a "week-about" basis, i.e. weekly sampling is undertaken.

## 7.3 Sample points to be representative of the system

ADWG (2004, p. 9-8) states that:

> *"The distribution of sample points throughout the system, including the extremities, must reflect the numbers of people supplied by the different parts of the system, especially for systems drawing on surface water. For instance, if five percent of consumers are serviced by distribution loops, then five percent of samples should be taken from distribution loops."*

The majority of customers within Hunter Water's area of operations are serviced by a network of distribution mains.

"Dead-end" mains can be differentiated from other, continuous components of the distribution system. An estimate of the number of Hunter Water's customers connected to dead-end supply mains has been calculated as outlined below:

> *Number of dead end mains is estimated at 4,600, counted from an overall facility information system (FIS) map of Hunter Water's water mains. The average number of connections to each dead-end main is estimated at 6. The total number of properties connected to water at 30 June 2009 was 221,694. The number of properties connected to dead end mains (i.e. 6 x 4,600) therefore equates to around 13% of the total properties. Therefore, if the number of proposed fortnightly sample points is 68, then 8 of these should be located at dead-end mains. These should also be distributed spatially within the system.*

The proposed 68 distribution system sample point locations is shown in Table 7, and of these, 9 are located at dead ends (as shown in Table 7).

## TABLE 7 DISTRIBUTION SYSTEM WATER QUALITY SAMPLE POINTS FOR 2011-12

| No | Sample Point | Dead End Main? | Zone |
|---|---|---|---|
| 1 | Hamilton | No | Grahamstown |
| 2 | Tighes Hill | No | Grahamstown |
| 3 | Lambton | No | Grahamstown |
| 4 | Adamstown | No | Grahamstown |
| 5 | Georgetown | No | Grahamstown |
| 6 | Tomago | No | Grahamstown |
| 7 | New Lambton | No | Grahamstown |
| 8 | Newcastle | Dead End | Grahamstown |
| 9 | Hamilton | No | Grahamstown |
| 10 | Merewether | No | Grahamstown |
| 11 | Birmingham Gardens | No | Grahamstown |
| 12 | Stockton | No | Grahamstown |
| 13 | Waratah West | Effectively a dead end: located near a shut zone valve | Grahamstown |
| 14 | Old Raymond Terrace Office | No | Grahamstown |
| 15 | Medowie | Dead End | Grahamstown |
| 16 | Rankin Park | No | Grahamstown |
| 17 | Wangi | No | Grahamstown |
| 18 | Belmont | No | Grahamstown |
| 19 | Swansea | No | Grahamstown |
| 20 | Balcolyn | No | Grahamstown |
| 21 | Warners Bay | No | Grahamstown |
| 22 | Edgeworth | Dead End | Grahamstown |
| 23 | Mt Hutton | No | Grahamstown |
| 24 | Cardiff | No | Grahamstown |
| 25 | Eleebana | No | Grahamstown |
| 26 | Toronto | No | Grahamstown |
| 27 | Morisset | No | Grahamstown |
| 28 | Caves Beach | No | Grahamstown |
| 29 | West Wallsend | No | Grahamstown |
| 30 | Redhead | No | Grahamstown |
| 31 | Charlestown | No | Grahamstown |
| 32 | Dudley | No | Grahamstown |
| 33 | Garden Suburbs | No | Grahamstown |
| 34 | Redhead | No | Grahamstown |
| 35 | Tingira Heights | Dead End | Grahamstown |
| 36 | Maitland | No | Chichester |
| 37 | East Maitland | No | Chichester |
| 38 | Thornton | No | Chichester |
| 39 | Kurri | No | Chichester |
| 40 | Bellbird | Dead End | Chichester |
| 41 | Pelaw Main | No | Chichester |
| 42 | Cessnock | No | Chichester |
| 43 | Heddon Greta | Dead End | Chichester |
| 44 | Metford | No | Chichester |
| 45 | Tarro | No | Chichester |
| 46 | Rutherford | No | Chichester |

| No | Sample Point | Dead End Main? | Zone |
|---|---|---|---|
| 47 | Branxton | No | Chichester |
| 48 | Tanilba Bay | No | Lemon Tree Passage |
| 49 | Karuah | No | Lemon Tree Passage |
| 50 | Nelson Bay | No | Nelson Bay / Anna Bay |
| 51 | Fingal Bay | No | Nelson Bay / Anna Bay |
| 52 | Soldiers Point | No | Nelson Bay / Anna Bay |
| 53 | Boat Harbour | Dead End | Nelson Bay / Anna Bay |
| 54 | Maryland | No | Grahamstown |
| 55 | Anna Bay | No | Nelson Bay / Anna Bay |
| 56 | Shoal Bay | No | Nelson Bay / Anna Bay |
| 57 | Lemon Tree Passage | No | Lemon Tree Passage |
| 58 | Seaham | No | Chichester |
| 59 | Lemon Tree Passage | Dead End | Lemon Tree Passage |
| 60 | Lemon Tree Passage | No | Lemon Tree Passage |
| 61 | Tanilba Bay | No | Lemon Tree Passage |
| 62 | Gresford | No | Gresford |
| 63 | Gresford | No | Gresford |
| 64 | Paterson | No | Chichester |
| 65 | Vacy | No | Chichester |
| 66 | Dungog | No | Chichester |
| 67 | Dungog | No | Chichester |
| 68 | Clarence Town | No | Chichester |

The locations of the sample points are shown on:

*Attachment 1: Plan showing water quality sample points and water supply zones*

## 7.4 Assessing compliance

### 7.4.1 Assessing compliance for Chichester, Grahamstown, Lemon Tree Passage and Anna Bay/Nelson Bay water supply systems

Assessing performance for compliance purposes will be carried out on a corporate and water quality zone basis for 2011-12 for key parameters using the assessment methods specified in the ADWG for microbiological, physical and chemical parameters respectively. Zones are based on areas supplied by Water Treatment Plants.

Key parameters and criteria used to assess drinking water quality compliance for 2011-12 for Chichester, Grahamstown, Lemon Tree Passage and Anna Bay/Nelson Bay zones are shown below.

**TABLE 8 Key parameters and criteria used to assess drinking water quality compliance for 2011-12 – Chichester, Grahamstown, Lemon Tree Passage and Anna Bay/Nelson Bay zones.**

| *Parameter* | *Microbiological / Physical / Chemical* | *Health-Related or Aesthetic* | *Guideline Value* | *Method of Assessing Compliance** |
|---|---|---|---|---|
| *E. coli* | Microbiological | Health | At least 98% of scheduled samples contain 0 CFU per 100 ml | At least 98% of scheduled samples contain 0 CFU per 100 ml |
| pH | Physical | Aesthetic | 6.5 to 9.2 | The upper bound of the 95% confidence interval for the mean should be less than the guideline value |
| True colour | | | < 25 HU | |
| Turbidity | | | < 5 NTU | |
| Aluminium | Chemical | | < 0.2 mg/L | |
| Iron | | | < 0.3 mg/L | |
| Zinc | | | < 3 mg/L | |
| Chlorine | | Health | < 5 mg/L | The upper bound of the 95% confidence interval for the 95$^{th}$ percentile should be less than the guideline value |
| Copper | | | < 1 mg/L | |
| Lead | | | < 0.01 mg/L | |
| Manganese | | | < 0.1 mg/L | |
| Trihalomethanes | | | <0.25 mg/L | |
| Fluoride | | | < 1.5 mg/L | |

* Assessing performance for compliance purposes will be carried out on a **corporate** and **zone** basis for all key compliance parameters

### 7.4.2 Assessing compliance for Gresford water supply system

The ADWG (2004, p 10-14) advise that:

> *"Monitoring of small water supplies should be based on the principle that it is much more effective to test for a narrow range of key characteristics as frequently as possible, supplementing this with sanitary inspection, than to conduct comprehensive but lengthy (and possibly largely irrelevant) analyses less often. In addition to health-related characteristics, small communities need to include other analyses relevant to the operation and maintenance of water treatment and distribution systems.*
>
> *As a minimum, small community supplies should be monitored for the four characteristics that best establish the hygienic state of the water and the potential for other problems to occur:*
>
> *• indicator microorganisms*
> *• disinfectant residual*
> *• pH*
> *• turbidity."*

In line with this recommendation, key parameters and criteria used to assess drinking water quality for compliance purposed for Gresford zone during 2011-12 are in Table 9.

**TABLE 9 Key parameters and criteria to be used to assess drinking water quality compliance for Gresford zone for 2011-12**

| *Parameter* | *Microbiological / Physical / Chemical* | *Health-Related or Aesthetic* | *Guideline Value* | *Method of Assessing Compliance** |
|---|---|---|---|---|
| *E. coli* | Microbiological | Health | At least 98% of scheduled samples contain <1 CFU per 100 ml | At least 98% of scheduled samples contain 0 CFU per 100 ml |
| pH | Physical | Aesthetic | 6.5 to 9.2 | The upper bound of the 95% confidence interval for the mean should be less than the guideline value |
| Turbidity | | | < 5 NTU | |
| Chlorine | Chemical | Health | < 5 mg/L | The upper bound of the 95% confidence interval for the 95$^{th}$ percentile should be less than the guideline value |

## 7.5 Comprehensive program for sampling and analysis

A comprehensive program of sampling and analysis for health and aesthetic water quality parameters is proposed to be undertaken as recommended in ADWG:

- in raw waters;
- within the distribution system; and
- in treated waters at water treatment plants.

The number of sampling locations and frequency of sampling for health and aesthetic parameters to be tested are shown in tables 2,3,10,11,12 and 13 for raw, treated and distribution system monitoring.

### 7.5.1 Chichester, Grahamstown, Lemon Tree Passage and Nelson Bay / Anna Bay systems

Sampling frequencies for most parameters[2] for Chichester, Grahamstown, Lemon Tree Passage and Nelson Bay / Anna Bay systems are at least equal to the frequency recommended in Table 10.7 of the ADWG (2004, p.10-16). The last columns of Table 2, 10 and 12 indicates characteristics that are recommended in Table 10.7 for monitoring in raw and treated waters.

Where the recommended sampling frequency is “annually if at all”, Hunter Water has adopted (as a minimum) a default frequency of once every 5 years.

*[2] The exceptions are minor, e.g. ADWG Table 10.7 suggests weekly monitoring for temperature, however, monthly monitoring is undertaken, as operational experience shows that monthly monitoring is adequate to track change in temperature in the distribution system over time.*

## TABLE 10 ROUTINE DRINKING WATER MONITORING PARAMETERS TREATED WATER – CHICHESTER, GRAHAMSTOWN, LEMON TREE PASSAGE AND NELSON BAY / ANNA BAY ZONES

| Parameter | Frequency | No. of locations | Analysis by: | ADWG Table 10.7 |
|---|---|---|---|---|
| pH | Daily | 5 | HWA Water Treatment | √ |
| Turbidity | Daily | 5 | HWA Water Treatment | √ |
| Hardness | Monthly | 5 | HWA | √ |
| Total Dissolved Solids | Quarterly | 5 | HWA | √ |
| Fluoride | Daily | 5 | HWA Water Treatment | √ |
| Iron | Daily at Grahamstown and Weekly at Lemon Tree Passage, Anna Bay and Nelson Bay | 6 | HWA Water Treatment | √ |
| Manganese | | | HWA Water Treatment | √ |
| Aluminium | Weekly | 5 | HWA Water Treatment | √ |
| Chlorine | Daily | 5 | HWA Water Treatment | √ |
| Particle Count | On-Line | Grahamstown and Dungog | HWA Water Treatment | |
| Cryptosporidium | Analysis is routinely undertaken quarterly for treated surface waters.<br><br>Note that treated water samples are taken for all sources at same frequency as for raw waters. Analysis is undertaken if Cryptosporidium or Giardia is detected in corresponding raw water. | Grahamstown and Dungog | HWA | |
| Giardia | | | | |
| Heterotrophic Plate Count | Weekly | 5 | HWA | √ |
| *E. coli* | Weekly | 5 | HWA | √ |
| Total Coliforms | Weekly | 5 | HWA | √ |
| Free Ammonia | Monthly | 5 | HWA | |
| Nitrites | Monthly | 5 | HWA | |
| Nitrates | Monthly | 5 | HWA | |
| Cyanide | Quarterly | 5 | ALS | |
| Sulphide | Quarterly | 5 | HWA | |
| Iodide | Quarterly | 5 | AWQC | |
| Antimony | Quarterly | 5 | HWA | |
| Aluminium | Quarterly | 5 | HWA | √ |
| Arsenic | Quarterly | 5 | HWA | |
| Barium | Quarterly | 5 | HWA | |
| Beryllium | Quarterly | 5 | HWA | |
| Boron | Quarterly | 5 | ALS | |
| Cadmium | Quarterly | 5 | HWA | |
| Chloride | Quarterly | 5 | HWA | √ |
| Chromium | Quarterly | 5 | HWA | |
| Copper | Quarterly | 5 | HWA | |
| Lead | Quarterly | 5 | HWA | |
| Molybdenum | Quarterly | 5 | HWA | |
| Mercury | Quarterly | 5 | HWA | |
| Nickel | Quarterly | 5 | HWA | |
| Selenium | Quarterly | 5 | HWA | |
| Silver | Quarterly | 5 | HWA | |

| Parameter | Frequency | No. of Locations | Analysis by: | ADWG Table 10.7 |
|---|---|---|---|---|
| Sodium | Quarterly | 5 | HWA | √ |
| Sulphate | Quarterly | 5 | HWA | √ |
| Zinc | Quarterly | 5 | HWA | |
| Acrylamide | Quarterly | 3 | ARL | √ |
| Carbon Tetrachloride | Quarterly | 5 | ARL | √ |
| Epichlorohydrin | Once every five years | 5 | ARL | √ |

ALS = Australian Laboratory Services (Sydney)
AGAL = Australian Government Analytical Laboratories (Sydney)
ARL = Analytical Reference Laboratory (WA)
AWQC = Australian Water Quality Centre
HWA = Hunter Water Australia Laboratories
HWA Water Treatment = Hunter Water Australia Process and Operations i.e. analysis is carried out at Water Treatment Plants
*(Hunter Water Australia is a fully owned subsidiary of Hunter Water Corporation)*

### 7.5.2 Gresford Water Treatment Plant (WTP)

An operator attends Gresford Water Treatment plant three times a week. The plant is telemetered, with on-line monitoring and appropriate alarms set for pH, turbidity and chlorine.

Routine water quality monitoring for the Gresford WTP is shown below.

**TABLE 11 Routine drinking water monitoring parameters for Gresford WTP treated water**

| Parameter | Frequency | No. of Locations | Analysis by: |
|---|---|---|---|
| *E.coli* | Weekly | 1 (CWT) | HWA Laboratories |
| Total Coliforms | Weekly | 1 (CWT) | HWA Laboratories |
| pH | 3 times a week | 1 (CWT) | HWA Water Treatment |
| Chlorine | 3 times a week | 1 (CWT) | HWA Water Treatment |
| Turbidity | 3 times a week | 1 (CWT) | HWA Water Treatment |
| Colour | 3 times a week | 1 (CWT) | HWA Water Treatment |
| Conductivity | 3 times a week | 1 (CWT) | HWA Water Treatment |
| Iron | 3 times a week | 1 (CWT) | HWA Water Treatment |
| Manganese | 3 times a week | 1 (CWT) | HWA Water Treatment |
| Aluminium | 3 times a week | 1 (CWT) | HWA Water Treatment |

## TABLE 12 ROUTINE ANALYSIS DISTRIBUTION SYSTEM – SAMPLE POINTS AT CUSTOMERS' WATER SERVICES – CHICHESTER, GRAHAMSTOWN, LEMON TREE PASSAGE AND NELSON BAY / ANNA BAY ZONES

| Parameter | Frequency | No. of locations | Analysis by: | ADWG Table 10.7 |
|---|---|---|---|---|
| Total Coliforms | Fortnightly[3] | 66 | HWA | √ |
| *E. coli* | Fortnightly[3] | 66 | HWA | √ |
| Heterotrophic Plate Count | Fortnightly[3] | 66 | HWA | √ |
| Free Chlorine | Fortnightly[3] | 66 | HWA | √ |
| Iron | Fortnightly[3] | 66 | HWA | √ |
| Manganese | Fortnightly[3] | 66 | HWA | √ |
| Fluoride | Fortnightly[3] at 8 locations / Weekly at 6 locations | 8 / 6 | HWA | |
| Turbidity | Fortnightly[3] | 66 | HWA | √ |
| pH | Fortnightly[3] | 66 | HWA | √ |
| Conductivity | Fortnightly[3] | 66 | HWA | |
| Temperature | Monthly | 15 | HWA | √ |
| Dissolved Oxygen | Monthly | 15 | HWA | √ |
| True Colour | Monthly | 15 | HWA | √ |
| Aluminium Total | Fortnightly at 8 locations / Weekly at 6 locations | 8 / 6 | HWA | √ |
| Aluminium Soluble | | 8 / 6 | HWA | √ |
| Lead | Monthly | 15 | HWA | √ |
| Copper | Monthly | 15 | HWA | √ |
| Zinc | Monthly | 15 | HWA | √ |
| Trihalomethanes | Monthly | 9 | Labmark | √ |
| Ammonia | Monthly | 16 | HWA | √ |
| Sulphide | Monthly | 16 | HWA | √ |
| Nitrates | Monthly | 16 | HWA | √ |
| Nitrites | Monthly | 16 | HWA | √ |
| Antimony | Quarterly | 15 | HWA | √ |
| Cadmium | Quarterly | 15 | HWA | √ |
| Nickel | Quarterly | 15 | HWA | √ |
| Chromium | Quarterly | 15 | HWA | √ |
| Asbestos | Annually | 16 | Adelaide Microscopy | √ |
| Cyanide | Annually | 16 | ALS | √ |
| Benzo-(a)-pyrene | Annually | 5 | SGS | √ |
| Toluene | Once every five years | 9 | ARL | √ |
| Xylene | Once every five years | 9 | ARL | √ |
| Plasticisers<br>Di(2-etylhexyl)phthalate<br>Di(2-etylhexyl)adipate | Once every five years | 9 | ARL | √ |

ALS = Australian Laboratory Services (Sydney)
Labmark (Asquith)
Adelaide Microscopy
ARL = Analytical Reference Laboratory (WA)
SGS = SGS Laboratories Melbourne
HWA = Hunter Water Australia Laboratories
*(Hunter Water Australia is a fully owned subsidiary of Hunter Water Corporation)*

[3] *Note that fortnightly sampling is undertaken on a "week about" basis, i.e. weekly sampling is undertaken.*

### 7.5.3 Gresford distribution system

Hunter Water undertakes the following routine verification monitoring within the distribution system at Gresford as shown in the following table.

**TABLE 13 ROUTINE ANALYSIS DISTRIBUTION SYSTEM – SAMPLE POINTS AT CUSTOMERS' WATER SERVICES – GRESFORD**

| Parameter | Frequency |
|---|---|
| Total Coliforms | Fortnightly |
| *E. coli* | Fortnightly |
| Free Chlorine | Fortnightly |
| pH | Fortnightly |
| Turbidity | Fortnightly |
| Total Dissolved Solids (TDS) | Six-monthly |
| Antimony | Six-monthly |
| Arsenic | Six-monthly |
| Barium | Six-monthly |
| Boron | Six-monthly |
| Cadmium | Six-monthly |
| Calcium | Six-monthly |
| Chloride | Six-monthly |
| Chromium | Six-monthly |
| Copper | Six-monthly |
| Iodine | Six-monthly |
| Iron | Six-monthly |
| Lead | Six-monthly |
| Magnesium | Six-monthly |
| Manganese | Six-monthly |
| Mercury | Six-monthly |
| Molybdenum | Six-monthly |
| Nickel | Six-monthly |
| Nitrate | Six-monthly |
| Nitrite | Six-monthly |
| Selenium | Six-monthly |
| Silver | Six-monthly |
| Sodium | Six-monthly |
| Sulfate | Six-monthly |
| Total Hardness as CaCO3 | Six-monthly |
| Zinc | Six-monthly |

## 7.6 Laboratory testing and reporting processes

### 7.6.1 Quality assurance

Independently accredited testing methods and a NATA accredited laboratory, operating with NATA accredited methods are used for all parameters for verification monitoring (with two exceptions[4]). Hunter Water ensures that testing methods used for verification monitoring have the required sensitivity and that samples are taken in a manner necessary to ensure no contamination or degradation of the samples.

Sampling and analysis for drinking water quality compliance is arranged by Hunter Water Australia Laboratories (HWAL). Sampling is undertaken in compliance with NATA accreditation to ensure a representative sample is taken. Analysis for some parameters is outsourced to other laboratories by HWAL. NATA accredited laboratories used for outsources analysis include Australian Laboratory Services (ALS), Australian Government Analytical Laboratories (AGAL), Labmark, Analytical Reference Laboratory (ARL) and the Australian Water Quality Centre (AWQC).

Analysis for operational purposes is undertaken by Hunter Water Australia Process and Operations (HWAPO) and is not NATA accredited. However, an appropriate system of quality assurance is used for this analysis

### 7.6.2 Data verification and record keeping

HWA Labs have QA systems in place for data verification and record keeping. All original records are kept for a minimum of five years. Checks are undertaken on transfer of data from one system to another. Verification by a senior officer is required for results which are outside of “normal” range. Laboratory data is stored on a Laboratory Information Management System (LIMS). This data is copied to Hunter Water’s data warehouse. Data may be extracted for reporting purposes and trend analysis, either directly from the LIMS, or from the data warehouse.

[4] *Except for asbestos and radiological analysis. NATA accreditation for these parameters is not available in Australia. Analysis for these parameters is undertaken using quality-assured procedures, which have been reviewed and found to be satisfactory by Hunter Water.*

# 8 DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

| | |
|---|---|
| **ADWG** | National Health and Medical Research Council (NHMRC) and Natural Resource Management Ministerial Council (NRMMC) **2004 AUSTRALIAN DRINKING WATER GUIDELINES** |
| **AESTHETIC GUIDELINE VALUES** | **AESTHETIC GUIDELINE VALUES** are contained in the Australian Drinking Water Guidelines and mean the concentration or measure of a water quality characteristic (a physical property of the water or a chemical) that is associated with good quality water. |
| **CWT** | **CLEAR WATER TANK** |
| **DRINKING WATER** | **DRINKING WATER** means water that, (following water treatment to the standard for use as drinking water specified in the Australian Drinking Water Guidelines), is supplied via the Water Supply System primarily for human consumption but which has other personal, domestic or household uses such as bathing and showering. |
| **FRAMEWORK** | **FRAMEWORK FOR MANAGEMENT OF DRINKING WATER QUALITY** |
| **HEALTH-RELATED GUIDELINE VALUES** | **HEALTH-RELATED GUIDELINE VALUES** are contained in the Australian Drinking Water Guidelines and mean the concentration or measure of a water quality characteristic, based on present knowledge that does not result in any significant risk to the health of the consumer over a lifetime of consumption. |
| **HWA** | **HUNTER WATER AUSTRALIA**<br>HWA is a fully owned subsidiary of HWC. HWA operates all HWC's water treatment plants, and undertakes Laboratory services for HWC. |
| **HWC** | **HUNTER WATER CORPORATION** |
| **IPART** | **INDEPENDENT PRICING AND REGULATORY TRIBUNAL** |
| **MOU** | **MEMORANDUM OF UNDERSTANDING**<br>Memorandum of Understanding between HUNTER WATER and NSW Health |
| **NATA** | **NATIONAL ASSOCIATION OF TESTING AUTHORITIES** |
| **NHMRC** | **NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL** |
| **NRMMC** | **NATURAL RESOURCE MANAGEMENT MINISTERIAL COUNCIL** |
| **NSW HEALTH** | **NSW HEALTH** means Hunter New England Area Health Service and the New South Wales Department of Health. |
| **OPERATING LICENCE** | **HUNTER WATER CORPORATION OPERATING LICENCE** is granted by the State Government and administered by the Independent Pricing and Regulatory Tribunal (IPART). The operating licence is the major customer protection instrument and prescribes standards of service that must be met in relation to water quality, continuity, pressure and wastewater transportation. |
| **RWT** | **RAW WATER TANK** |
| **SCADA** | **SUPERVISORY CONTROL AND DATA ACQUISITION** |
| **WTP** | **WATER TREATMENT PLANT** |

# 9 REFERENCES

Rizak S and Hrudey SE, 2007 *Strategic Water Quality Monitoring for Drinking Water Safety.* Cooperative Research Centre for Water Quality and Treatment Research Report No 37.
http://www.wqra.com.au/publications/report37_strategic_water_monitoring.pdf

*2004 Australian Drinking Water Guidelines*
National Health and Medical Research Council (NHMRC) and Natural Resource Management Ministerial Council (NRMMC)
http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm

*Hunter Water Corporation Operating Licence 2007-2012*
http://www.hunterwater.com.au/files/HWC_Operating_Licence__190607.pdf

# 10 ATTACHMENTS

**Attachment 1: Plan showing water quality sample points and water supply zones for Newcastle, Lake Macquarie, Maitland, Cessnock, Port Stephens and Dungog areas.**