Drinking Water Quality Report 2013

City West Water

Glossary of Terms

ADWG 2011	Australian Drinking Water Guidelines 2011. Published by the National Health & Medical Research Council of Australia.
DH	Victorian Department of Health
E. coli	*Escherichia coli*, a bacterium which is considered to indicate the presence of faecal contamination and therefore, health risk.
HACCP	Hazard Analysis and Critical Control Points certification for protecting drinking water quality.
mg/L	Milligrams per litre
MWC	Melbourne Water Corporation
NTU	Nephelometric Turbidity Units
orgs/100mL	Organisms per 100 millilitres
UCL	Upper confidence limit
<	'less than' symbol
>	'greater than' symbol

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From our Managing Director

City West Water's Annual Drinking Water Quality Report 2013 contains comprehensive information on the quality of drinking water supplied by City West Water in its service area which encompasses the inner and western suburbs of Melbourne and the central business district. It also describes how we collect, treat and distribute drinking water to our customers, with particular emphasis on the 12 month period between July 2012 and June 2013.

The information is provided to demonstrate how the quality of our drinking water meets the stringent standards set by Government.

The provision of safe drinking water in Victoria is regulated under the *Safe Drinking Water Act 2003*, which sets drinking water quality standards, as well as public disclosure and reporting requirements. Management of water quality under the Act is overseen and assessed by Victoria's Department of Health.

An extensive drinking water quality monitoring program has continued to confirm the safety of the water we provide to customers. Throughout 2012–13, we collected and tested some 4,000 water samples, almost all of which were obtained from the point of supply to customers' premises using special tap fittings adjacent to property water meters. Test results demonstrated that the quality of our drinking water supply was superior to that specified in the regulated quality standards.

In addition to continuing the supply of high quality drinking water to our customers, some of the highlights for 2012-13 include:

- retained certification of our HACCP plan for managing water quality
- a program of installation of approximately 100 new water sampling tap fittings, mainly in newly developed areas, to keep pace with urban and population growth
- a continued low level of water quality complaints (0.07 per 1000 properties) from customers.

Providing our customers with high quality, safe drinking water is a driving priority for City West Water. I have all confidence that we will continue successfully to do so.

Anne Barker
Managing Director

1. Introduction

City West Water is one of three metropolitan water corporations established under section 85(1A) of the *Water Act 1989 (Vic)*. Our Board of Directors is appointed by the Victorian Government and is responsible for setting and overseeing the implementation of the policies, objectives and strategies of the business. We provide drinking water, trade waste, recycled water, stormwater and sewerage services to approximately 389,000 residential and non residential customers in Melbourne's inner and western suburbs and central business district.

Melbourne Water provides City West Water with a bulk water supply and a waste water treatment service. Melbourne Water manages the water catchments and dams, as well as a network of large water mains that interconnects with our own water supply network. This interconnection means that risks associated with water supply are shared between the wholesaler (Melbourne Water) and retailer (City West Water). To manage these risks and to clearly assign the rights and obligations of both parties, we have a contractual arrangement (in terms of a Bulk Water Supply Agreement) with Melbourne Water, as well as cross business contingency plans and operational arrangements.

Our management of the water supply system and drinking water quality is given the highest priority to reflect public health considerations and community expectations, as well as continuing to provide one of the best drinking water qualities in the world. Our management of the drinking water supply closely follows the risk management principles outlined in Victoria's *Safe Drinking Water Act 2003*. This commitment to safeguarding drinking water quality has continued to be independently recognised through consistent retention of our internationally recognised Hazard Analysis and Critical Control Points (HACCP) certification.

1.1 Characterisation of the system

We distribute water to over 800,000 people and to businesses at some 389,000 properties. The water is distributed through an extensive network of over 4,500 kilometres of water mains, 10 pumping stations, eight service reservoirs and tanks and four secondary chlorination plants. This network encompasses central and western Melbourne, including inner suburbs such as Fitzroy, Collingwood, Richmond and the central business district, to outer western suburbs as far west as Little River. The network is totally enclosed, protecting the water from possible contamination during its delivery to customers.

Figure 1.1 shows our 580 square kilometre water district area. It is divided into 15 water sampling localities based on sources of water supply and similar pressure.

1.1.1 Source of water

The water supply originates from Melbourne's well established water supply catchment and reservoir system, which has provided the city with a reliable, high quality water supply for many years. This extensive system, managed by Melbourne Water, lies mainly to the east of Melbourne and extends as far as Thomson Reservoir, about 120 kilometres from our water district area.

More specifically, water is supplied to City West Water from three major storages within the system. Two of the storages, Silvan Reservoir (near Mount Dandenong) and Sugarloaf Reservoir (near Yarra Glen), are east of Melbourne. The third, Greenvale Reservoir, is to the north, near Somerton. On average, we have traditionally sourced about 40% of our bulk supply from Silvan, 30% from Greenvale and 30% from Sugarloaf. However, with the decade of below average rainfall that began in the late 1990s, and the need to rebalance storage levels, the percentages in recent years reflect increased emphasis on Sugarloaf Reservoir as the major source of water being supplied to City West Water.

	Supply source to City West Water (%)		
Period	**Silvan**	**Greenvale**	**Sugarloaf**
Prior to drought impact	40	30	30
2007-12	14	16	70
2012-13	9	13	78

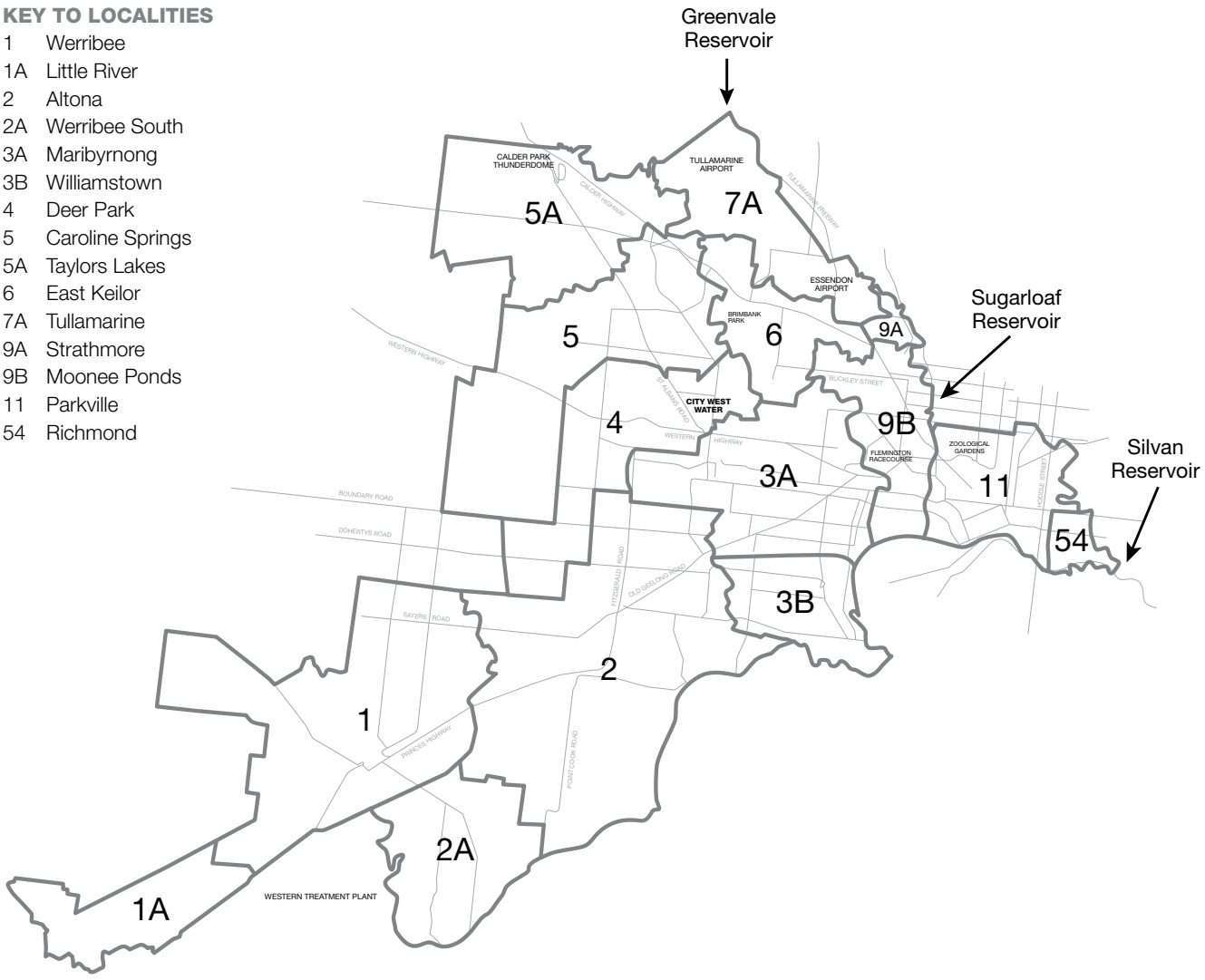
The supply from Silvan Reservoir originates from protected, natural catchments (including the Thomson and Upper Yarra catchments) where activities such as industry, farming, urbanisation and tourism (which could pollute the water supply) are highly restricted. Greenvale Reservoir which does not have a catchment, in turn receives its water supply from Silvan Reservoir. Long storage periods (ranging between months and years) in these pristine reservoirs enhance water quality. As a result, the only active water treatment process that is applied to this water is chlorination (gas) and pH correction with lime.

Sugarloaf Reservoir draws most of its water from the middle reaches of the Yarra River where the catchment is unprotected, containing urban areas, light industry and agricultural activities. A smaller proportion also comes from Maroondah Reservoir via the Maroondah Aqueduct. Between February and May 2010, water was also sourced for the first time from the Goulburn River via the North-South pipeline; however, use of this source has not been repeated since. On average, the source waters pumped into Sugarloaf Reservoir are stored for months before being treated (via aluminium-based coagulation, filtration, gas chlorination and pH correction with lime) at Melbourne Water's nearby Winneke water treatment plant.

Figure 1.1 City West Water's water district area showing its 15 water sampling localities

KEY TO LOCALITIES

1 Werribee
1A Little River
2 Altona
2A Werribee South
3A Maribyrnong
3B Williamstown
4 Deer Park
5 Caroline Springs
5A Taylors Lakes
6 East Keilor
7A Tullamarine
9A Strathmore
9B Moonee Ponds
11 Parkville
54 Richmond



Melbourne Water adds fluoride to all of City West Water's bulk water in line with requirements of the *Victorian Health (Fluoridation) Act* (1973). This is in the form of sodium fluorosilicate to the Silvan Reservoir supply and fluorosilicic acid at the Winneke water treatment plant.

The supply source(s) for each of our 15 water sampling localities are listed in Table 1.1

Table 1.1 2012-13 supply sources for our water sampling localities

Water sampling locality	Source water	Treatment plant	Population serviced (2011 census)
Altona	Yarra River; Maroondah, Silvan & Greenvale Reservoirs	Winneke, Silvan Greenvale	97,611
Caroline Springs	Yarra River; Maroondah & Greenvale Reservoirs	Winneke Greenvale	87,947
Deer Park	Yarra River; Maroondah, Silvan & Greenvale Reservoirs	Winneke, Silvan Greenvale	53,687
East Keilor	Yarra River; Maroondah, Silvan & Greenvale Reservoirs	Winneke, Silvan Greenvale	38,063
Little River	Yarra River; Maroondah, Silvan & Greenvale Reservoirs	Winneke, Silvan Greenvale	625
Maribyrnong	Yarra River; Maroondah & Silvan Reservoirs	Winneke Silvan	101,272
Moonee Ponds	Yarra River; Maroondah & Silvan Reservoirs	Winneke Silvan	68,395
Parkville	Yarra River; Maroondah & Silvan Reservoirs	Winneke Silvan	111,305
Richmond	Yarra River; Maroondah & Silvan Reservoirs	Winneke Silvan	20,646
Strathmore	Yarra River; Maroondah, Silvan & Greenvale Reservoirs	Winneke, Silvan Greenvale	8,917
Taylors Lakes	Yarra River; Maroondah & Greenvale Reservoirs	Winneke Greenvale	63,394
Tullamarine	Yarra River; Maroondah & Greenvale Reservoirs	Winneke Greenvale	9,833
Werribee	Yarra River; Maroondah, Silvan & Greenvale Reservoirs	Winneke, Silvan Greenvale	124,833
Werribee South	Yarra River; Maroondah, Silvan & Greenvale Reservoirs	Winneke, Silvan Greenvale	807
Williamstown	Yarra River; Maroondah & Silvan Reservoirs	Winneke Silvan	35,996

The quality of the bulk water supply is monitored by Melbourne Water before it enters City West Water's distribution system.

The overall water supply system and water delivery arrangements during the past year have continued unchanged from preceding years.

2. Water treatment and quality management system

2.1 Water treatment

The water quality treatment processes used for City West Water's source or bulk water supply are outlined in Section 1.1.1.

Notwithstanding Melbourne Water's source or bulk water disinfection by chlorination, additional secondary chlorination (using liquid sodium hypochlorite) is undertaken within our water district by:

- Melbourne Water, with four secondary chlorination plants servicing the water sampling localities of Werribee, Deer Park, Caroline Springs and Altona
- City West Water, with a further four secondary chlorination plants servicing the water sampling localities of Little River, Werribee South, East Keilor and Richmond.

In addition, the local water supply at Little River is dosed with gaseous carbon dioxide in order to assist with maintaining neutral pH levels.

2.2 Issues

No adverse issues took place with regard to water treatment during 2012-13.

2.3 Water Plan

Under Victoria's *Water Industry Act (1994)* water corporations are required produce a Water Plan, typically with a five year outlook that details projected annual expenditures, revenue requirements and therefore, pricing for services. The year 2012-13 was included in City West Water's Water Plan 2.

As can be seen from ensuing sections of this report, the quality of our drinking water supply continues to be very high and consistently meets water quality standards. As a result, provision was not included in our Water Plan 2 for any additional major capital or operational expenditure for further improving water quality. Our focus has been on maintaining water quality at its current high level.

3. Quality of drinking water for 2012-13

A significant part of our water supply activities are devoted to monitoring the quality of the water being supplied to customers. A day to day water monitoring program involves sampling and testing from many locations throughout the distribution network of 15 water sampling localities, including some 400 purpose built sampling fittings (referred to as 'customer taps') located at customers' properties across the water district area. In addition, Melbourne Water monitors the quality of bulk water supplies at points upstream of delivery points to City West Water. The results of all these tests are scrutinised under the Bulk Water Supply Agreement between the two corporations.

We have a program in place to install customer taps at 100 additional properties - mainly in newly developed areas - to keep pace with urban and population growth, such that by late 2013 there will be 460 sampling fittings in place.

Between July 2012 and June 2013, we collected and tested approximately 3,000 microbiological and 900 physical/chemical water samples from customer taps. This was undertaken under contract by a government approved, specialised and quality certified laboratory. The extent of this monitoring was based on requirements of the *Safe Drinking Water Regulations 2005*, as well as guidance of the *Australian Drinking Water Guidelines 2011 (ADWG 2011)*, including locality population numbers for bacterial monitoring.

As well as guiding the design of monitoring programs, *ADWG 2011* provides a basis for assessing the quality of drinking water. Microbiological assessment is based principally on the bacterium *Escherichia coli (E. coli)*, which is considered to definitively indicate the presence of faecal contamination and, therefore, health risk.

Physical/chemical assessment and monitoring is based on a combination of parameters that indicate physical/aesthetic characteristics, such as pH, colour and turbidity (the clarity of the water), as well as the chemical quality of the water (i.e. levels of chlorine, iron, fluoride, dissolved salts, aluminium, copper and other heavy metals). Contact information for obtaining further details of all water quality testing outlined in this report is provided in the *Further information* section on page 29.

Since 1 July 2004, the management of drinking water in Victoria has been governed by the *Safe Drinking Water Act 2003*. Under this Act, *Safe Drinking Water Regulations 2005* specifies water quality standards for a number of water quality parameters. The standards are as follows:

Water quality parameter	**Standard**
Escherichia coli (E. coli)	At least 98% of samples collected in any 12 month period to contain no *E. coli* per 100mL
Chloroacetic acid	Must not exceed 0.15 mg/L
Dichloroacetic acid	Must not exceed 0.1 mg/L
Trichloroacetic acid	Must not exceed 0.1 mg/L
Trihalomethanes	Must not exceed 0.25 mg/L
Bromate	Must not exceed 0.02 mg/L
Formaldehyde	Must not exceed 0.5 mg/L
Aluminium (acid soluble)	Must not exceed 0.2 mg/L
Turbidity	95% upper confidence limit of mean of drinking water samples collected in the preceding 12 month period must not exceed 5.0 Nephelometric Turbidity Units (NTU)

Further to monitoring water quality for compliance against these standards, we monitor additional parameters that provide a more comprehensive characterisation of the water, as well as assisting the needs of customers (e.g. industry, students and researchers). Detailed summary data for these parameters are provided in Appendices A and B.

The tables in sections 3.1 to 3.5 report the 2012-13 compliance of water quality standard parameters against the water quality standards specified in Victoria's *Safe Drinking Water Regulations 2005.*

3.1 *Escherichia coli (E. coli)*

3.1.1 Results

Table 3.1 ***E. coli* summary results in drinking water samples obtained from customer taps tested between 1 July 2012 and 30 June 2013**

Water sampling locality (locality number)	No. of samples	Sampling frequency	No. of samples containing *E. coli*	Max. Result (orgs/100mL)	% Samples with no *E. coli*	Complying (yes / no)
Altona (2)	246	>weekly	0	<1	100	yes
Caroline Springs (5)	273	>weekly	0	<1	100	yes
Deer Park (4)	162	>weekly	1	1	99.4	yes
East Keilor (6)	142	>weekly	0	<1	100	yes
Little River (1A)	65	>weekly	0	<1	100	yes
Maribyrnong (3A)	323	>weekly	0	<1	100	yes
Moonee Ponds (9B)	229	>weekly	0	<1	100	yes
Parkville (11)	322	>weekly	0	<1	100	yes
Richmond (54)	105	>weekly	0	<1	100	yes
Strathmore (9A)	79	>weekly	0	<1	100	yes
Taylors Lakes (5A)	187	>weekly	0	<1	100	yes
Tullamarine (7A)	79	>weekly	0	<1	100	yes
Werribee (1)	329	>weekly	0	<1	100	yes
Werribee South (2A)	65	>weekly	0	<1	100	yes
Williamstown (3B)	143	>weekly	0	<1	100	yes
Total	**2749**	**-**	**1**	**1**	**>99.9**	**yes**

E. coli data demonstrate compliance with the standard (at least 98% samples with no E. coli) in each of City West Water's 15 water sampling localities.

Sampling frequencies in each locality exceeded that prescribed by the Safe Drinking Water Regulations 2005 (i.e. one sample per week in each locality). This was done in order to meet the more intense surveillance of internationally recognised population-based frequencies, as advocated in ADWG 2011.

3.1.2 Actions in relation to non compliance

Even though there was compliance with the *E. coli* standard in all localities, *E. coli* (one organism per 100 mL) was detected in a sample from the Deer Park locality in June 2013. The reason for the detection is not known. No other samples, whether upstream or downstream, including repeat sampling, showed presence of *E. coli.* In line with protocol, this was reported to the Victorian Department of Health as a Section 22 notification.

3.2 Chlorine based disinfection by-product chemicals

3.2.1 Results

In order to facilitate laboratory sample collections, monitoring for chlorine based disinfection by-product chemicals is scheduled on the basis of four week intervals. This strategy also aims to assist in ensuring that no less than 12 monthly samples are obtained for testing from each locality, as per the *Safe Drinking Water Regulations 2005.*

Chloroacetic acid

Table 3.2a Chloroacetic acid summary results in drinking water samples obtained from customers' taps tested between 1 July 2012 and 30 June 2013

Water sampling locality (locality number)	Sampling frequency (minimum)	No. of samples	No. of non complying samples	Max. mg/L	Complying (yes / no)
Altona (2)	monthly	13	0	<0.005	yes
Caroline Springs (5)	monthly	14	0	<0.005	yes
Deer Park (4)	monthly	13	0	<0.005	yes
East Keilor (6)	monthly	13	0	<0.005	yes
Little River (1A)	monthly	13	0	<0.005	yes
Maribyrnong (3A)	monthly	13	0	<0.005	yes
Moonee Ponds (9B)	monthly	13	0	<0.005	yes
Parkville (11)	monthly	13	0	<0.005	yes
Richmond (54)	monthly	14	0	<0.005	yes
Strathmore (9A)	monthly	13	0	<0.005	yes
Taylors Lakes (5A)	monthly	14	0	<0.005	yes
Tullamarine (7A)	monthly	14	0	<0.005	yes
Werribee (1)	monthly	14	0	<0.005	yes
Werribee South (2A)	monthly	13	0	<0.005	yes
Williamstown (3B)	monthly	13	0	<0.005	yes
Total	**-**	**200**	**0**	**<0.005**	**yes**

Chloroacetic acid data demonstrate compliance with the standard (0.15 mg/L) in each of City West Water's 15 water sampling localities.

Dichloroacetic acid

Table 3.2b Dichloroacetic acid summary results in drinking water samples obtained from customers' taps tested between 1 July 2012 and 30 June 2013

Water sampling locality (locality number)	Sampling frequency (minimum)	No. of samples	No. of non complying samples	Max. mg/L	Complying (yes / no)
Altona (2)	monthly	13	0	<0.005	yes
Caroline Springs (5)	monthly	14	0	0.007	yes
Deer Park (4)	monthly	13	0	0.008	yes
East Keilor (6)	monthly	13	0	0.020	yes
Little River (1A)	monthly	13	0	0.007	yes
Maribyrnong (3A)	monthly	13	0	0.006	yes
Moonee Ponds (9B)	monthly	13	0	0.006	yes
Parkville (11)	monthly	13	0	0.008	yes
Richmond (54)	monthly	14	0	0.008	yes
Strathmore (9A)	monthly	13	0	0.008	yes
Taylors Lakes (5A)	monthly	14	0	0.005	yes
Tullamarine (7A)	monthly	14	0	0.020	yes
Werribee (1)	monthly	14	0	<0.005	yes
Werribee South (2A)	monthly	13	0	<0.005	yes
Williamstown (3B)	monthly	13	0	0.007	yes
Total	**-**	**200**	**0**	**0.020**	**yes**

Dichloroacetic acid data demonstrate compliance with the standard (0.1 mg/L) in each of City West Water's 15 water sampling localities.

Trichloroacetic acid

Table 3.2c Trichloroacetic acid summary results in drinking water samples obtained from customers' taps tested between 1 July 2012 and 30 June 2013

Water sampling locality (locality number)	Sampling frequency (minimum)	No. of samples	No. of non complying samples	Max. mg/L	Complying (yes / no)
Altona (2)	monthly	13	0	0.031	yes
Caroline Springs (5)	monthly	14	0	0.013	yes
Deer Park (4)	monthly	13	0	0.040	yes
East Keilor (6)	monthly	13	0	0.034	yes
Little River (1A)	monthly	13	0	0.044	yes
Maribyrnong (3A)	monthly	13	0	0.042	yes
Moonee Ponds (9B)	monthly	13	0	0.043	yes
Parkville (11)	monthly	13	0	0.045	yes
Richmond (54)	monthly	14	0	0.042	yes
Strathmore (9A)	monthly	13	0	0.029	yes
Taylors Lakes (5A)	monthly	14	0	0.010	yes
Tullamarine (7A)	monthly	14	0	0.033	yes
Werribee (1)	monthly	14	0	0.037	yes
Werribee South (2A)	monthly	13	0	0.038	yes
Williamstown (3B)	monthly	13	0	0.043	yes
Total	**-**	**200**	**0**	**0.045**	**yes**

Trichloroacetic acid data demonstrate compliance with the standard (0.1 mg/L) in each of City West Water's 15 water sampling localities

Total trihalomethanes

Table 3.2d Trihalomethanes summary results in drinking water samples obtained from customers' taps tested between 1 July 2012 and 30 June 2013

Water sampling locality (locality number)	Sampling frequency (minimum)	No. of samples	No. of non complying samples	Max. mg/L	Complying (yes / no)
Altona (2)	monthly	13	0	0.068	yes
Caroline Springs (5)	monthly	14	0	0.043	yes
Deer Park (4)	monthly	13	0	0.084	yes
East Keilor (6)	monthly	13	0	0.079	yes
Little River (1A)	monthly	13	0	0.107	yes
Maribyrnong (3A)	monthly	13	0	0.084	yes
Moonee Ponds (9B)	monthly	13	0	0.077	yes
Parkville (11)	monthly	13	0	0.076	yes
Richmond (54)	monthly	14	0	0.093	yes
Strathmore (9A)	monthly	13	0	0.081	yes
Taylors Lakes (5A)	monthly	14	0	0.033	yes
Tullamarine (7A)	monthly	14	0	0.065	yes
Werribee (1)	monthly	14	0	0.093	yes
Werribee South (2A)	monthly	13	0	0.086	yes
Williamstown (3B)	monthly	13	0	0.083	yes
Total	**-**	**200**	**0**	**0.107**	**yes**

Total trihalomethanes data demonstrate compliance with the standard (0.25 mg/L) in each of City West Water's 15 water sampling localities.

3.2.2 Actions in relation to non compliance

With 100% compliance, no actions were necessary.

3.3 Ozone based disinfection by-product chemicals

3.3.1 Results

Safe Drinking Water Regulations 2005 refers to two ozone based disinfection by-product chemicals - bromate and formaldehyde. However, these two chemicals were not monitored on a regular basis for compliance purposes as our water supply is not treated with ozone (refer Section 2.1). Nevertheless, an annual customer tap water sample from each of the 15 water sampling localities was tested during May/June 2013. All 15 results for both bromate and formaldehyde showed levels lower than the respective standards of 0.02 mg/L and 0.5 mg/L (refer Appendix A).

3.3.2 Actions in relation to non compliance

As all 15 results for both bromate and formaldehyde showed levels lower than the respective standards of 0.02 mg/L and 0.5 mg/L, no actions were necessary.

3.4 Aluminium

3.4.1 Results

In order to facilitate laboratory sampling schedules, monitoring for aluminium was generally undertaken on at least a fortnightly basis as part of a suite of other physical/chemical parameters such as pH, colour, iron and manganese. This also assisted in ensuring that no less than the 12 monthly samples were obtained, as per the *Safe Drinking Water Regulations 2005*.

Table 3.3 Aluminium (acid soluble) summary results in drinking water samples obtained from customers' taps tested between 1 July 2012 and 30 June 2013

Water sampling locality (locality number)	Sampling frequency (minimum)	No. of samples	No. of non complying samples	Max. mg/L	Complying (yes / no)
Altona (2)	fortnightly	30	0	0.03	yes
Caroline Springs (5)	fortnightly	27	0	0.02	yes
Deer Park (4)	fortnightly	29	0	0.03	yes
East Keilor (6)	fortnightly	26	0	0.05	yes
Little River (1A)	fortnightly	26	0	0.08	yes
Maribyrnong (3A)	fortnightly	28	0	0.04	yes
Moonee Ponds (9B)	fortnightly	29	0	0.07	yes
Parkville (11)	fortnightly	27	0	0.11	yes
Richmond (54)	fortnightly	27	0	0.04	yes
Strathmore (9A)	fortnightly	26	0	0.04	yes
Taylors Lakes (5A)	fortnightly	30	0	0.02	yes
Tullamarine (7A)	fortnightly	27	0	0.04	yes
Werribee (1)	fortnightly	30	0	0.03	yes
Werribee South (2A)	fortnightly	26	0	0.03	yes
Williamstown (3B)	fortnightly	27	0	0.03	yes
Total	**-**	**415**	**0**	**0.11**	**yes**

Acid soluble aluminium data demonstrate compliance with the standard (0.2 mg/L) in each of City West Water's 15 water sampling localities.

3.4.2 Actions in relation to non compliance

With 100% compliance, no actions were necessary.

3.5 Turbidity

3.5.1 Results

Table 3.4 Turbidity summary results in drinking water samples obtained from customers' taps tested between 1 July 2012 and 30 June 2013

Water sampling locality (locality number)	Sampling frequency (minimum)	No. of samples	Max. NTU	95% UCL of mean	Complying (yes / no)
Altona (2)	weekly	52	1.6	0.5	yes
Caroline Springs (5)	weekly	52	1.6	1.1	yes
Deer Park (4)	weekly	52	1.3	0.6	yes
East Keilor (6)	weekly	52	1.6	0.5	yes
Little River (1A)	weekly	52	1.5	0.6	yes
Maribyrnong (3A)	weekly	52	1.2	0.5	yes
Moonee Ponds (9B)	weekly	52	2.5	0.6	yes
Parkville (11)	weekly	52	5.0	0.7	yes
Richmond (54)	weekly	53	1.6	1.0	yes
Strathmore (9A)	weekly	52	2.0	0.8	yes
Taylors Lakes (5A)	weekly	52	2.0	1.3	yes
Tullamarine (7A)	weekly	53	3.8	1.0	yes
Werribee (1)	weekly	53	1.2	0.5	yes
Werribee South (2A)	weekly	52	1.0	0.5	yes
Williamstown (3B)	weekly	52	1.2	0.3	yes
Total	**-**	**783**	**5.0**	**0.6**	**yes**

Turbidity data demonstrate compliance with the standard in each of City West Water's 15 water sampling localities.

3.5.2 Actions in relation to non compliance

With 100% compliance against the standard, no remedial water quality actions were necessary.

3.6 Fluoride

3.6.1 Results

Table 3.5 Fluoride summary results in drinking water samples obtained from customers' taps tested between 1 July 2012 and 30 June 2013

Water sampling locality (locality number)	Sampling frequency (minimum)	No. of samples	Max.	Max. mg/L	Min. mg/L	Complying (yes / no)
Altona (2)	fortnightly	32	0.96	0.60	0.87	yes
Caroline Springs (5)	fortnightly	29	0.98	0.90	0.93	yes
Deer Park (4)	fortnightly	31	0.96	0.62	0.88	yes
East Keilor (6)	fortnightly	28	0.97	0.83	0.90	yes
Little River (1A)	fortnightly	27	1.20	0.70	0.89	yes
Maribyrnong (3A)	fortnightly	30	0.96	0.69	0.89	yes
Moonee Ponds (9B)	fortnightly	31	0.95	0.82	0.89	yes
Parkville (11)	fortnightly	28	0.97	0.68	0.90	yes
Richmond (54)	fortnightly	28	0.97	0.63	0.89	yes
Strathmore (9A)	fortnightly	28	1.00	0.82	0.92	yes
Taylors Lakes (5A)	fortnightly	32	0.98	0.90	0.93	yes
Tullamarine (7A)	fortnightly	28	0.99	0.85	0.92	yes
Werribee (1)	fortnightly	31	0.95	0.60	0.87	yes
Werribee South (2A)	fortnightly	28	0.96	0.63	0.88	yes
Williamstown (3B)	fortnightly	29	0.96	0.63	0.89	yes
Total	**-**	**440**	**1.20**	**0.60**	**0.90**	**yes**

For fluoridated supplies, compliance means all individual sample results are less than or equal to 1.5 mg/L and the annual average does not exceed 1.0 mg/L. Fluoride data demonstrate compliance in each of City West Water's 15 water sampling localities.

3.6.2 Actions in relation to non compliance

With 100% fluoride compliance, no remedial water quality actions were necessary.

3.7 Other algae, pathogen, chemical or substance not specified above that may pose a risk to human health

3.7.1 Results

In addition to the water quality parameters designated as standards by the *Safe Drinking Water Regulations 2005*, we also monitor a range of other microbiological and chemical parameters that provide further information on the overall quality of our drinking water supply. Among such other parameters that were monitored in 2012-13, those that could potentially represent a health risk (if present above *ADWG 2011* health guideline levels), are listed in Table 3.6.

Table 3.6 Potential health risk water quality parameters monitored during 2012-13

Parameter	Frequency of testing	Results
Microbiological		
Vibrio spp. *Shigella* spp. *Yersinia* spp. *Salmonella* spp. *Campylobacter* spp. *Giardia* spp. *Cryptosporidium* spp. Adenovirus Hepatitis A virus Reovirus Enterovirus Rotavirus	3 to 4 samples per month (3 samples per locality per year)	None detected (therefore, consistent with *ADWG 2011* which states that these parameters should not be present in drinking water)
Chemical*		
Arsenic	annually per locality	within guideline (not detected)
Cadmium	annually per locality	within guideline (not detected)
Chromium	annually per locality	within guideline (not detected)
Copper	annually per locality	within guideline
Cyanide	annually per locality	within guideline (not detected)
Fluoride	fortnightly per locality	within guideline
Lead	annually per locality	within guideline (not detected)
Manganese	fortnightly per locality	within guideline
Mercury	annually per locality	within guideline (not detected)
Nitrate	annually per locality	within guideline
Sulphate	annually per locality	within guideline
Zinc	annually per locality	within guideline (not detected)

ADWG 2011 health-related guidelines are shown in Appendix A tables.

Further details of monitoring results for manganese, lead, copper and arsenic are contained in Table 3.7.

Table 3.7 Detailed monitoring results for manganese, lead, copper and arsenic during 2012-13

Water sampling locality (locality number)	Parameter	Sampling frequency	No. of samples	No. of non complying results*	Max. mg/L	Complying (yes / no)
Altona (2)	Manganese	fortnightly	30	0	0.005	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Caroline Springs (5)	Manganese	fortnightly	27	0	0.006	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Deer Park (4)	Manganese	fortnightly	29	0	0.008	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	0.02	yes
	Arsenic	annually	1	0	<0.01	yes
East Keilor (6)	Manganese	fortnightly	26	0	0.007	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Little River (1A)	Manganese	fortnightly	26	0	0.010	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	0.07	yes
	Arsenic	annually	1	0	<0.01	yes
Maribyrnong (3A)	Manganese	fortnightly	28	0	0.007	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Moonee Ponds (9B)	Manganese	fortnightly	29	0	0.023	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Parkville (11)	Manganese	fortnightly	27	0	0.036	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Richmond (54)	Manganese	fortnightly	27	0	0.007	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Strathmore (9A)	Manganese	fortnightly	26	0	0.012	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes

Table 3.7 Detailed monitoring results for manganese, lead, copper and arsenic during 2012-13 (cont.)

Water sampling locality (locality number)	Parameter	Sampling frequency	No. of samples	No. of non complying results*	Max. mg/L	Complying (yes / no)
Taylors Lakes (5A)	Manganese	fortnightly	30	0	0.007	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Tullamarine (7A)	Manganese	fortnightly	27	0	0.007	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Werribee (1)	Manganese	fortnightly	30	0	0.007	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Werribee South (2A)	Manganese	fortnightly	26	0	0.006	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes
Williamstown (3B)	Manganese	fortnightly	26	0	0.007	yes
	Lead	annually	1	0	<0.01	yes
	Copper	annually	1	0	<0.01	yes
	Arsenic	annually	1	0	<0.01	yes

** as defined in the health-related guideline values in ADWG 2011.*

3.7.2 Actions in relation to non compliance

Since levels of all health-related parameters tested satisfied *ADWG 2011* guideline values at customer taps sites, no related remedial water quality actions were necessary.

As our water supply distribution network is completely enclosed, any monitoring for organic industrial chemicals, pesticides and radioactivity focuses on locations upstream of this network. Thus Melbourne Water tests for these substances with respect to its major storage reservoirs such as Silvan and Sugarloaf, where the potential for contamination is greater. Results of this monitoring are provided to us. No significant detections (with respect to *ADWG 2011* guidelines) in the bulk water supply took place in 2012-13.

A comprehensive outline of our monitoring data for individual localities, together with monitoring frequencies, Victorian standards and *ADWG 2011* guidelines for both health-related and aesthetic water quality data, is contained in Appendix A tables. Contact information for obtaining further details of all water quality testing outlined in this report is provided in the Further Information section on page 29.

3.8 Aesthetics

3.8.1 Results

Monitoring results for the aesthetic water quality parameters comprising pH, colour, hardness and iron are shown in Table 3.8. Note that our colour tests are undertaken as apparent colour while the *ADWG 2011* guideline of 15 platinum cobalt units (PCU) refers to true colour. Due to the omission of a filtering step in the test for apparent colour, the subsequent result values are at least equal to, but not less than, the equivalent true colour values. As a result, true colour compliance with respect to the *ADWG 2011* guideline is assured in all cases where apparent colour levels are within the guideline. Past investigations have shown that for Melbourne's water supply, an apparent colour level of 25 PCU is equivalent to a true colour level of 15 PCU.

Table 3.8 Detailed monitoring results for pH, apparent colour, hardness and iron during 2012-13

Water sampling locality (locality number)	Parameter	Sampling frequency	No. of samples	Max*	Min*	Average*
Altona (2)	pH	fortnightly	30	8.5	7.0	7.4
	apparent colour	fortnightly	30	8	<2	3
	hardness	annually	1	21	21	21
	iron	fortnightly	30	0.12	<0.01	0.03
Caroline Springs (5)	pH	fortnightly	27	9.3	6.9	7.4
	apparent colour	fortnightly	27	10	2	5
	hardness	annually	1	18	18	18
	iron	fortnightly	27	0.16	<0.01	0.11
Deer Park (4)	pH	fortnightly	29	8.9	7.1	7.6
	apparent colour	fortnightly	29	8	<2	3
	hardness	annually	1	19	19	19
	iron	fortnightly	29	0.14	0.01	0.04
East Keilor (6)	pH	fortnightly	26	8.2	7.1	7.5
	apparent colour	fortnightly	26	8	<2	3
	hardness	annually	1	18	18	18
	iron	fortnightly	26	0.10	0.01	0.03
Little River (1A)	pH	fortnightly	26	9.6	6.4	7.1
	apparent colour	fortnightly	26	10	<2	3
	hardness	annually	1	57	57	57
	iron	fortnightly	26	0.17	0.02	0.06
Maribyrnong (3A)	pH	fortnightly	28	7.5	7.1	7.3
	apparent colour	fortnightly	28	8	<2	3
	hardness	annually	1	19	19	19
	iron	fortnightly	28	0.09	0.01	0.04
Moonee Ponds (9B)	pH	fortnightly	29	7.4	7.1	7.2
	apparent colour	fortnightly	29	10	<2	4
	hardness	annually	1	17	17	17
	iron	fortnightly	29	0.17	0.01	0.04
Parkville (11)	pH	fortnightly	27	7.4	6.9	7.2
	apparent colour	fortnightly	27	28	<2	4
	hardness	annually	1	22	22	22
	iron	fortnightly	27	0.27	0.01	0.05
Richmond (54)	pH	fortnightly	27	7.7	7.1	7.3
	apparent colour	fortnightly	27	12	4	7
	hardness	annually	1	16	16	16
	iron	fortnightly	27	0.12	0.05	0.07
Strathmore (9A)	pH	fortnightly	26	8.3	7.1	7.6
	apparent colour	fortnightly	26	10	<2	6
	hardness	annually	1	17	17	17
	iron	fortnightly	26	0.10	<0.01	0.06

Table 3.8 Detailed monitoring results for pH, apparent colour, hardness and iron during 2012-13 (cont.)

Water sampling locality (locality number)	Parameter	Sampling frequency	No. of samples	Max*	Min*	Average*
Taylors Lakes (5A)	pH	fortnightly	30	7.7	6.9	7.2
	apparent colour	fortnightly	30	10	4	6
	hardness	annually	1	18	18	18
	iron	fortnightly	30	0.16	0.08	0.12
Tullamarine (7A)	pH	fortnightly	27	8.1	6.9	7.2
	apparent colour	fortnightly	27	10	<2	5
	hardness	annually	1	26	26	26
	iron	fortnightly	27	0.15	<0.01	0.07
Werribee (1)	pH	fortnightly	30	8.9	7.1	7.5
	apparent colour	fortnightly	30	8	<2	3
	hardness	annually	1	22	22	22
	iron	fortnightly	30	0.12	0.01	0.04
Werribee South (2A)	pH	fortnightly	26	8.2	7.1	7.7
	apparent colour	fortnightly	26	8	<2	3
	hardness	annually	1	23	23	23
	iron	fortnightly	26	0.07	0.01	0.04
Williamstown (3B)	pH	fortnightly	27	7.9	6.9	7.3
	apparent colour	fortnightly	27	7	<2	3
	hardness	annually	1	26	26	26
	iron	fortnightly	27	0.08	0.01	0.02

** Units: pH (units); apparent colour (platinum cobalt units); hardness (mg/L as calcium carbonate); iron (mg/L).*

All 2012-13 water colour, hardness and iron monitoring data complied with the respective *ADWG 2011* guideline levels of 15 PCU, 200 mg/L and 0.3 mg/L.

Of the 415 samples tested for pH, there were nine instances where pH readings were not within the *ADWG 2011* guideline range of 6.5 to 8.5, including three instances that exceeded the tolerable upper value of 9.2 (based on the presence of cement lined water mains, generally within more sparsely populated areas experiencing low water flows).

In association with water industry partners, we have investigated variations in pH throughout Melbourne's water supply system and their possible significance.

A 1999-2000 Melbourne study concluded that widespread remedial treatment would be complex and would involve adding chemicals to Melbourne's water supply, with uncertain benefits. A joint water industry study by researchers at Melbourne's Alfred Hospital in 2000 concluded 'there was no indication of the health effects on skin for weakly buffered water, such as that found in Melbourne, over all pH ranges'. A 2003 joint study provided an updated review of the possible effects of elevated pH, weakly buffered (soft) drinking water on health, water supply assets and industrial processes. This study found that for such water there was:

- virtually an absence of published material indicating any adverse impact on human health, either from contact or ingestion
- no apparent adverse impact on water industry assets
- no evidence of deleterious effects on domestic appliances
- no apparent adverse impact on industrial users.

Nevertheless, we are continuing our practice of avoiding, where possible, the use of new water main materials that could impact upon water pH.

3.9 Analysis of results - trends

This section of the report examines:

(a) trends over time of water quality parameters tested that are designated as standards by the *Safe Drinking Water Regulations 2005*.

(b) trends over time and between localities of parameters listed in Appendix A tables that have a corresponding Victorian standard or *ADWG 2011* guideline.

3.9.1 Historical compliance of standard parameters

Table 3.9 summarises trends over time (and extent of compliance) of water quality parameters designated as standards by the *Safe Drinking Water Regulations 2005*.

Table 3.9 Compliance time trends of standard parameters

Parameter	**Standard** (2005 Regulations)	**Localities compliant (% of customers supplied with compliant water)**			
		2012-13	**2011-12**	**2010-2011**	**2009-2010**
E. coli	<1 per 100mL in 98% of samples	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)
Chloroacetic acid	0.15 mg/L	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)
Dichloroacetic acid	0.1 mg/L	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)
Trichloroacetic acid	0.1 mg/L	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)
Trihalomethanes	0.25 mg/L	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)
Bromate	0.02 mg/L	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)
Formaldehyde	0.5 mg/L	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)
Aluminium	0.2 mg/L	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)
Turbidity	95% UCL of mean <= 5.0 NTU*	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)	15 / 15 (100%)

** 95% upper confidence level of mean not to exceed 5.0 NTU*

3.9.2 Parameter trends over time and between localities

This section of the report provides a three year overview of drinking water quality in our area, in terms of trends over time and between localities. Parameters considered are those listed in Appendix A tables that have a corresponding Victorian standard or *ADWG 2011* guideline and have been monitored for at least the last two years. Graphical representations of trends are contained in Appendix B and briefly discussed below.

E. coli ***(refer Figure B.1 in Appendix B)***

E. coli performance in our drinking water has consistently complied with the current Victorian standard (requiring "at least 98% of samples collected in any 12 month period to contain no *E. coli* per 100mL") in all water sampling localities.

Free chlorine (refer Figure B.2 in Appendix B)

All of our drinking water supply is disinfected with chlorine. As a result, the more active form (free chlorine) is present in all water sampling localities, with levels well within the maximum *ADWG 2011* guideline of 5 mg/L. Nevertheless, average levels amongst individual localities can be markedly different; this being largely due to relative proximity to chlorine dosing points. For example, the Taylors Lakes and Tullamarine localities are situated close to primary chlorination at Greenvale Reservoir, while the Little River locality is served by a secondary re-chlorination plant.

Aluminium (refer Figure B.3 in Appendix B)

Overall aluminium levels in the water supply are low. Apparent variations at these levels are considered to be related to natural variations in the catchments rather than from artificial treatment dosing. For example, aluminium is only used in water treatment at the Winneke Treatment Plant, yet the water sampling localities more likely to receive water from this source (Moonee Ponds, Parkville, Altona, Werribee) do not exhibit higher aluminium levels as compared with other localities.

Arsenic, cadmium, chromium, cyanide, lead, mercury, zinc

These substances have been monitored on an annual basis. As can be seen in the Appendix A tables, test results have consistently been either within guideline levels or below analytical detection limits.

Chloride (refer Figure B.4 in Appendix B)

Chloride levels are quite low and relatively consistent amongst the water sampling localities.

Colour (refer Figure B.5 in Appendix B)

ADWG 2011 refers to' true colour' of water; however we have continued the historical practice of measuring the more conservative 'apparent colour', which gives higher readings. Nevertheless, our average apparent colour levels have been within the *ADWG 2011* True Colour guideline of 15 PCU. Higher colour levels in the Richmond locality are associated with its traditional bulk supply source from Silvan Reservoir.

Copper (refer Figure B.6 in Appendix B)

Copper levels in the water supply are low and consistently well within the *ADWG 2011* health and aesthetic guidelines.

Electrical conductivity (EC) – (refer Figure B.7 in Appendix B)

We measure EC as a surrogate for total dissolved solids (TDS). *ADWG 2011* advises that its TDS guideline level of 600 mg/L can be substituted by an EC level of approximately 900 µs/cm. EC levels are quite low and relatively consistent within each water sampling locality. Localities with higher EC levels tend to reflect a larger proportion of supply from the higher EC Sugarloaf/Winneke source.

Fluoride (refer Figure B.8 in Appendix B)

Fluoride levels in the water supply are the result of fluoridation of the bulk supply. Dosing is controlled such that levels are generally maintained between approximately 0.9 and 1.0 mg/L.

Hardness (refer Figure B.9 in Appendix B)

Water hardness levels are quite low and relatively consistent within each water quality locality.

The higher hardness levels in most localities reflect supply into our area from Sugarloaf Reservoir.

Iron (refer Figure B.10 in Appendix B)

Overall, slightly higher iron levels in the Caroline Springs, Taylors Lakes, Tullamarine and Richmond water quality localities are consistent with their source water including the relatively greater iron containing water from Silvan and Greenvale reservoirs.

Manganese (refer Figure B.11 in Appendix B)

Manganese levels in the water supply are low and consistently well within the guidelines.

Nitrate (refer Figure B.12 in Appendix B)

Nitrate levels in the water supply are low and consistently well within the guidelines.

pH (refer Figure B.13 in Appendix B)

Average pH levels in all localities are between 7 and 8.

Sodium (refer Figure B.14 in Appendix B)

Sodium levels are quite low and relatively consistent among the water sampling localities.

Turbidity (refer Figure B.15 in Appendix B)

Overall turbidity levels in all localities continue to be less than 1.5 NTU. Variations between individual water sampling localities are a reflection of their source waters. For example, localities with lower turbidity tend to be supplied more from Sugarloaf/Winneke, while higher turbidity localities tend to be supplied more from Silvan and Greenvale reservoirs.

Sulphate (refer Figure B.16 in Appendix B)

Sulphate levels are quite low and relatively consistent within each water quality locality. Lower sulphate (as well as sodium, hardness, conductivity and chloride – as per earlier Figures) levels in Caroline Springs, Richmond and Taylors Lakes localities are a reflection of the Silvan reservoir source. At the same time, higher turbidity, iron and colour in these localities also reflects Silvan as the source of the water.

Total trihalomethanes – (refer Figure B.17 in Appendix B)

Total trihalomethanes concentrations are relatively low (in comparison with the Victorian standard) and consistent among water sampling localities. Highest levels in Little River and Richmond reflect their remoteness from primary chlorination.

Chloroacetic acids

The readings in the water supply are low and consistently well within the Victorian standards (refer Section 3.2.1).

4. Emergency and incident management

This section outlines events involving actual or potential adverse changes in water supply quality during 2012-13, including those that were reported to Victoria's Department of Health in line with Section 22 of the *Safe Drinking Water Act 2003*.

Despite full compliance with the *E. coli* standard at customer tap supplies throughout 2012-13, monitoring within our water supply network resulted in two instances of *E. coli* detection. These were as follows:

- one detection (one organism per 100mL) in a non-routine sample from Moonee Ponds locality on 22 May 2013. The detection is considered to have been caused by use of a portable standpipe to obtain the water sample under non-aseptic conditions. Repeat sampling the next day from a nearby front garden tap, confirmed the absence of *E. coli* in the water supply.
- as mentioned in Section 3.1.2, one detection (one organism per 100mL) in a routine customer tap sample from Deer Park locality on 3 June 2013. A cause for the detection is not known. No other samples, whether upstream or downstream, including repeat sampling, showed presence of *E. coli*.

In addition, an event occurred on 24 March 2013 in which reports of tainted water were received from four essentially adjacent properties in Aberfeldie. City West Water immediately undertook extensive flushing of local water mains and continued this for several days. A water sample from one of the properties on 24 March showed presence of the hydrocarbons benzene (0.007 mg/L) and toluene (0.005 mg/L). The related health-based guideline values in *ADWG 2011* for benzene and toluene are 0.001 mg/L and 0.8 mg/L, respectively. A sample taken on 28 March still showed a trace of toluene (0.001 mg/L). Further samples on 2 April did not reveal presence of hydrocarbons. Extensive local area inspections, including enquiries with the Metropolitan Fire Brigade on whether it had knowledge of possible related hydrocarbon spills, failed to indicate a possible cause for the localised hydrocarbon taint. City West Water has had on-going communication with the affected property occupiers and provided advice on emergency contact and sample collection in the event of a reoccurrence.

Each of the above instances and follow-up actions were immediately reported to Victoria's Department of Health as Section 22 notifications, in line with our water quality Risk Management Plan.

5. Complaints relating to water quality

In 2012-13, City West Water received 268 complaints related to water supply quality. The various categories of complaints were distributed as shown in Table 5.1.

Table 5.1 Water quality related customer complaints received in 2012-13

Complaint category	Number of complaints	No. of complaints per 100 customers supplied*
Discoloured water	204	0.052
Alleged illness	0	<0.001
Air in water	10	0.003
Blue-green water	4	0.001
Taste/odour	49	0.013
Other	1	<0.001

** Number of customers (properties) at 30 June 2013 determined as 389,000.*

The number of complaints did not exceed 10 per 100 customers in any of the 15 localities.

A historical comparison of water quality related complaints received over the last five years is contained in Table 5.2.

Table 5.2 Water quality related customer complaints received over the last five years

Complaint category	Number received in 2012-13	Number received in 2011-12	Number received in 2010-2011	Number received in 2009-2010	Number received in 2008-2009
Discoloured water	204	159	155	230	167
Alleged illness	-	1	2	-	-
Air in water	10	5	7	10	65
Blue-green water	4	7	3	7	3
Taste/odour	49 (16 chlorine)*	92 (20 chlorine)*	51 (24 chlorine)*	69 (27 chlorine)*	53 (6 chlorine)*
Other	1 (staining)	3 (1 staining) (2 blocked filter)	2 (staining)	1 (staining)	3 (blocked filter)
Total	**268**	**267**	**220**	**317**	**291**
No. of properties	389,000	379,000	368,000	357,000	345,000
Complaints per 100 properties	0.069	0.070	0.060	0.089	0.084

** Number of complaints received of chlorine taste or odour.*

Complaints and responses

We provide individual responses to water quality related complaints. These can range between verbal clarification of perceived issues, to onsite investigations and remedial action. In terms of the major complaint categories, our responses are as follows.

Discoloured (e.g. brown) water

Discoloured water is generally caused by the suspension of accumulated natural sediments in water mains. This can be triggered by the opening or closing of valves and reinstatement of mains into service following repairs. Discoloured water can also result from older, rusting internal galvanised iron pipes. Calls to City West Water are assessed by trained staff and, where the discoloured water is deemed to be originating from the water main, targeted mains flushing is generally undertaken.

Alleged illness

Complaints of water related illness are referred to our Water Quality Scientist for detailed discussion, analysis and investigation. Customers may be advised to seek medical advice.

White water (air in water)

White water (water with a cloudy appearance that clarifies within a few minutes) indicates the presence of tiny, harmless air bubbles. It tends to be associated with maintenance and repair works, when air can enter water pipes. As the aerated water is used by customers, its appearance returns to normal. In the past we often responded to customers' concerns with targeted mains flushing, however since the recent drought and water restrictions, greater emphasis is placed on better explaining the phenomenon and obtaining customers' agreements to not flush water mains.

Blue-green water

On a seemingly random basis, customers at a small number of properties report blue-green water (water that has a cloudy to blue-green appearance, possibly containing blue-green particles, and having an unpleasant bitter taste). This is caused by accelerated corrosion of customers' internal copper water pipes and appears to be restricted to cold water pipes.

Blue-green water must not be consumed (by drinking or in the preparation of food) because it can cause vomiting. The prolonged consumption of water containing elevated copper levels can have adverse health effects.

As blue-green water originates from a property's internal copper pipes, customers can manage the problem by flushing their tap with fresh mains water. This means running their tap until the water becomes "crystal clear".

In certain cases, corrosion of copper pipes can lead to perforation and leakage.

Neither the cause of, nor solution to this international and Australia wide copper corrosion phenomenon are known (apart from replacement of corroding pipes).

We assist customers experiencing copper pipe corrosion by testing copper levels in their water and providing advice on how to best manage the issue of blue-green water. If customers are experiencing blue-green water or have other water quality concerns, they are asked to call us on 132 642 for further information and advice.

Taste or odour

A change in taste or odour of tap water can occur occasionally and is generally apparent as a chlorine-like or earthy, musty sensation. Fluctuations in chlorine levels (and hence, the perception of chlorine taste or odour) occur from time to time, largely due to changed water demands and flow rates. Our response to customers reporting chlorine taste/odour involves providing an explanation, as well as considering changes to chlorine dosing.

Other tastes/odours can result when water flows are slower and during flow reversals in large pipes. In such cases the cause is identified and, where appropriate, a combination of targeted flushing and/or changes to flow regimes are implemented.

6. Findings of the most recent risk management plan audit

Pursuant to the *Safe Drinking Water Act 2003*, we have a documented water quality Risk Management Plan which is subject to independent audit in terms of its content and implementation. Our plan was audited for the third time in April 2012 and again found to be compliant with all requirements. A copy of the audit certificate is in Appendix C.

Notwithstanding the plan's compliance with the Act, the audit identified several opportunities for improvement. An outline of these opportunities for improvement, together with actions to address these is contained in Appendix C.

Significant portions of the Risk Management Plan are based on our pre-existing HACCP plan which itself is audited internally on a quarterly basis, as well as annually by an external, independent auditor. The HACCP plan specifically addresses issues such as staff training and development, calibration of equipment and maintenance and inspections of assets. Each of these is examined during independent annual audits. The HACCP system is highly regarded and well known in the food industry for protecting the welfare and safety of consumers. It is based on the identification and management of risks (to quality) at key points within a production or product delivery process.

The HACCP certification demonstrates that we attend to those parts of our network and operations that have an impact on water quality. Maintenance of HACCP certification requires continual vigilance and improvements to our water quality management operations. City West Water aims to continue meeting the HACCP requirements.

7. Undertakings under Section 30 of the *Safe Water Drinking Act 2003*

City West Water has not entered into any undertakings with the Department of Health, pursuant to section 30 of the *Safe Drinking Water Act 2003*.

8. Exemptions from water quality standards under Section 20 and conditions imposed under Section 21 of the *Safe Water Drinking Act 2003*

City West Water did not have any Section 20 or 21 exemptions in place.

9. Variation to aesthetic standards under Section 19 of the Act and conditions imposed under Section 21 of the *Safe Water Drinking Act 2003*

City West Water did not have any Section 19 variations.

10. Regulated water

Regulated water is water that is the subject of a declaration made by the Minister for Health concerning water that is not drinking water. We do not manage any water supplies that have been declared as 'regulated water'.

In certain cases however, we do supply water from our water distribution mains to customers with privately owned off-takes. Such supplies are provided under a private agreement between City West Water and the customer. The agreement does not guarantee the pressure or quality of the supply downstream of the off-take point, albeit that we endeavour to maintain these. City West Water has embarked on a program to reduce the number of such private supplies.

11. Further Information

For further information on the details of this report or on general water quality matters can be obtained by contacting our Water Quality Scientist, Georges Ruta directly on (03) 9313 8388 or email gruta@citywestwater.com.au. Written enquiries can be addressed to Mr Georges Ruta, City West Water, Locked Bag 350, Sunshine, Victoria, 3020.

Appendix A. Water quality data by locality

Water Sampling Locality	Altona	Locality No.	2
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	97,611

Parameter	Unit	Guideline Value *(ADWG 2011)*	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	34	>weekly	245	245	100%
Total Coliforms	orgs/100mL	N	<1	<1	1	>weekly	246	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	246	246	within standard (actual 100%)
Free Chlorine	mg/L	5	<0.01	0.10	0.39	>weekly	246	246	100%
Total Chlorine	mg/L	5	0.02	0.20	0.61	>weekly	246	246	100%
Alkalinity (as $CaCO_3$)	mg/L	N	13	13	13	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.02	0.02	0.03	fortnightly	30	30	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	5.6	5.6	5.6	annually	1	-	-
Chloride	mg/L	250	14	14	14	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	3	8	fortnightly	30	30	100%
Conductivity	µS/cm	~900	66	105	130	fortnightly	26	26	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.60	0.87	0.96	fortnightly	32	32	100%
Hardness (as $CaCO_3$)	mg/L	200	21	21	21	annually	1	1	100%
Iron	mg/L	0.3	<0.01	0.03	0.12	fortnightly	30	30	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.6	1.6	1.6	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.002	0.005	fortnightly	30	30	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	1.11	1.11	1.11	annually	1	1	100%
pH	units	6.5-8.5	7.0	7.4	8.5	fortnightly	30	30	100%
pH	units	6.5-9.2	7.0	7.4	8.5	fortnightly	30	30	100%
Potassium	mg/L	N	0.9	0.9	0.9	annually	1	-	-
Silica (SiO_2)	mg/L	80	4.0	4.0	4.0	annually	1	1	100%
Sodium	mg/L	180	6.9	6.9	6.9	annually	1	1	100%
Sulphate	mg/L	250	5.8	5.8	5.8	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.005	0.005	0.005	annually	1	-	-
Total Dissolved Solids	mg/L	600	70	70	70	annually	1	1	100%
Turbidity	NTU	5[1]	0.1	0.5[1]	1.6	weekly	52	-	within standard
Zinc	mg/L	3	0.010	0.010	0.010	annually	1	1	100%
Dibromochloromethane	mg/L	N	0.001	0.007	0.010	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.008	0.013	0.016	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	13	-	-
Chloroform	mg/L	N	0.018	0.028	0.053	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.040	0.049	0.068	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	<0.005	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	0.007	0.013	0.031	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N *No guideline/standard value set for this parameter.*

\# *Victorian standard: that 98% of samples must not contain any E.coli/100mL.*

G *Geometric means shown for bacterial parameters.*

1 *Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.*

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Caroline Springs	Locality No.	5
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	87,947

Parameter	Unit	Guideline Value (ADWG 2011)	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	1	200	>weekly	273	273	100%
Total Coliforms	orgs/100mL	N	<1	<1	200	>weekly	273	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	273	273	within standard (actual 100%)
Free Chlorine	mg/L	5	<0.01	0.15	0.60	>weekly	273	273	100%
Total Chlorine	mg/L	5	0.01	0.25	0.87	>weekly	273	273	100%
Alkalinity (as $CaCO_3$)	mg/L	N	15	15	15	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	<0.01	0.01	0.02	fortnightly	27	27	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	5.1	5.1	5.1	annually	1	-	-
Chloride	mg/L	250	10	10	10	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	2	5	10	fortnightly	27	27	100%
Conductivity	µS/cm	~900	67	79	120	fortnightly	26	26	100%
Copper	mg/L	1	0.01	0.01	0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.90	0.93	0.98	fortnightly	29	29	100%
Hardness (as $CaCO_3$)	mg/L	200	18	18	18	annually	1	1	100%
Iron	mg/L	0.3	<0.01	0.11	0.16	fortnightly	27	27	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.2	1.2	1.2	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.003	0.006	fortnightly	27	27	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	0.80	0.80	0.80	annually	1	1	100%
pH	units	6.5-8.5	6.9	7.4	9.3	fortnightly	27	25	92.6%
pH	units	6.5-9.2	6.9	7.4	9.3	fortnightly	27	26	96.3%
Potassium	mg/L	N	0.6	0.6	0.6	annually	1	-	-
Silica (SiO_2)	mg/L	80	6.6	6.6	6.6	annually	1	1	100%
Sodium	mg/L	180	5.2	5.2	5.2	annually	1	1	100%
Sulphate	mg/L	250	2.8	2.8	2.8	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.008	0.008	0.008	annually	1	-	-
Total Dissolved Solids	mg/L	600	100	100	100	annually	1	1	100%
Turbidity	NTU	5[1]	0.1	1.1[1]	1.6	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.001	0.002	0.006	monthly	14	-	-
Dichlorobromomethane	mg/L	N	0.004	0.007	0.011	monthly	14	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	14	-	-
Chloroform	mg/L	N	0.012	0.018	0.029	monthly	14	-	-
Total Trihalomethanes	mg/L	0.25	0.017	0.028	0.043	monthly	14	14	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	14	14	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.007	monthly	14	14	100%
Trichloroacetic acid	mg/L	0.1	<0.005	0.008	0.013	monthly	14	14	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N *No guideline/standard value set for this parameter.*

\# *Victorian standard: that 98% of samples must not contain any E.coli/100mL.*

G *Geometric means shown for bacterial parameters.*

1 *Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.*

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Deer Park	Locality No.	4
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	53,687

Parameter	Unit	Guideline Value (ADWG 2011)	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	63	>weekly	162	162	100%
Total Coliforms	orgs/100mL	N	<1	<1	200	>weekly	162	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	1	>weekly	162	161	within standard (actual 99.4%)
Free Chlorine	mg/L	5	<0.01	0.13	0.49	>weekly	162	162	100%
Total Chlorine	mg/L	5	0.02	0.23	0.60	>weekly	162	162	100%
Alkalinity (as $CaCO_3$)	mg/L	N	13	13	13	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.01	0.02	0.03	fortnightly	29	29	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	5.1	5.1	5.1	annually	1	-	-
Chloride	mg/L	250	11	11	11	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	3	8	fortnightly	29	29	100%
Conductivity	µS/cm	~900	59	99	130	fortnightly	29	29	100%
Copper	mg/L	1	0.02	0.02	0.02	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.62	0.88	0.96	fortnightly	29	29	100%
Hardness (as $CaCO_3$)	mg/L	200	19	19	19	annually	1	1	100%
Iron	mg/L	0.3	0.01	0.04	0.14	fortnightly	29	29	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.5	1.5	1.5	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.002	0.008	fortnightly	29	29	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	0.71	0.71	0.71	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.6	8.9	fortnightly	29	26	89.7%
pH	units	6.5-9.2	7.1	7.6	8.9	fortnightly	29	29	100%
Potassium	mg/L	N	0.9	0.9	0.9	annually	1	-	-
Silica (SiO_2)	mg/L	80	6.4	6.4	6.4	annually	1	1	100%
Sodium	mg/L	180	6.5	6.5	6.5	annually	1	1	100%
Sulphate	mg/L	250	2.6	2.6	2.6	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.010	0.010	0.010	annually	1	-	-
Total Dissolved Solids	mg/L	600	52	52	52	annually	1	1	100%
Turbidity	NTU	5[1]	<0.1	0.6[1]	1.3	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.001	0.006	0.011	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.006	0.012	0.017	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	13	-	-
Chloroform	mg/L	N	0.012	0.026	0.072	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.029	0.046	0.084	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.008	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	<0.005	0.011	0.040	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N No guideline/standard value set for this parameter.

 # Victorian standard: that 98% of samples must not contain any E.coli/100mL.

G Geometric means shown for bacterial parameters.

1 Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	East Keilor	Locality No.	6
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	38,063

Parameter	Unit	Guideline Value *(ADWG 2011)*	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	62	>weekly	142	142	100%
Total Coliforms	orgs/100mL	N	<1	<1	200	>weekly	142	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	142	142	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.27	0.85	>weekly	142	142	100%
Total Chlorine	mg/L	5	0.05	0.39	1.00	>weekly	142	142	100%
Alkalinity (as $CaCO_3$)	mg/L	N	14	14	14	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.02	0.02	0.05	fortnightly	26	26	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	4.8	4.8	4.8	annually	1	-	-
Chloride	mg/L	250	11	11	11	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	3	8	fortnightly	26	26	100%
Conductivity	µS/cm	~900	58	103	130	fortnightly	26	26	100%
Copper	mg/L	1	0.01	0.01	0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.83	0.90	0.97	fortnightly	28	28	100%
Hardness (as $CaCO_3$)	mg/L	200	18	18	18	annually	1	1	100%
Iron	mg/L	0.3	0.01	0.03	0.10	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.5	1.5	1.5	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.002	0.007	fortnightly	26	26	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	0.84	0.84	0.84	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.5	8.2	fortnightly	26	26	100%
pH	units	6.5-9.2	7.1	7.5	8.2	fortnightly	26	26	100%
Potassium	mg/L	N	0.8	0.8	0.8	annually	1	-	-
Silica (SiO_2)	mg/L	80	6.3	6.3	6.3	annually	1	1	100%
Sodium	mg/L	180	5.5	5.5	5.5	annually	1	1	100%
Sulphate	mg/L	250	2.5	2.5	2.5	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.010	0.010	0.010	annually	1	-	-
Total Dissolved Solids	mg/L	600	28	28	28	annually	1	1	100%
Turbidity	NTU	5[1]	<0.1	0.5[1]	1.6	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.001	0.005	0.010	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.008	0.011	0.017	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	13	-	-
Chloroform	mg/L	N	0.010	0.030	0.070	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.028	0.047	0.079	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.020	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	<0.005	0.012	0.034	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N *No guideline/standard value set for this parameter.*

\# *Victorian standard: that 98% of samples must not contain any E.coli/100mL.*

G *Geometric means shown for bacterial parameters.*

1 *Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.*

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Little River	Locality No.	1A
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	625

Parameter	Unit	Guideline Value (ADWG 2011)	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	7	>weekly	65	65	100%
Total Coliforms	orgs/100mL	N	<1	<1	<1	>weekly	65	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	65	65	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.25	0.58	>weekly	65	65	100%
Total Chlorine	mg/L	5	0.05	0.36	0.71	>weekly	65	65	100%
Alkalinity (as $CaCO_3$)	mg/L	N	48	48	48	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	<0.01	0.02	0.08	fortnightly	26	26	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.0002	<0.0002	<0.0002	annually	1	1	100%
Calcium	mg/L	N	21.0	21.0	21.0	annually	1	-	-
Chloride	mg/L	250	15	15	15	annually	1	1	100%
Chromium	mg/L	0.05	<0.001	<0.001	<0.001	annually	1	1	100%
Colour	Pt/Co	25**	<2	3	10	fortnightly	26	26	100%
Conductivity	µS/cm	~900	92	127	170	fortnightly	25	25	100%
Copper	mg/L	1	0.072	0.072	0.072	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.70	0.89	1.20	fortnightly	27	27	100%
Hardness (as $CaCO_3$)	mg/L	200	57	57	57	annually	1	1	100%
Iron	mg/L	0.3	0.02	0.06	0.17	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	1.3	1.3	1.3	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.003	0.010	fortnightly	26	26	100%
Mercury	mg/L	0.001	<0.0001	<0.0001	<0.0001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	1.11	1.11	1.11	annually	1	1	100%
pH	units	6.5-8.5	6.4	7.1	9.6	fortnightly	26	23	88.5%
pH	units	6.5-9.2	6.4	7.1	9.6	fortnightly	26	24	92.3%
Potassium	mg/L	N	1.1	1.1	1.1	annually	1	-	-
Silica (SiO_2)	mg/L	80	7.3	7.3	7.3	annually	1	1	100%
Sodium	mg/L	180	8.6	8.6	8.6	annually	1	1	100%
Sulphate	mg/L	250	6.5	6.5	6.5	annually	1	1	100%
Total Organic Carbon	mg/L	N	3.0	3.0	3.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.008	0.008	0.008	annually	1	-	-
Total Dissolved Solids	mg/L	600	78	78	78	annually	1	1	100%
Turbidity	NTU	5[1]	0.2	0.6[1]	1.5	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	0.002	0.008	0.014	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.009	0.018	0.025	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	13	-	-
Chloroform	mg/L	N	0.023	0.043	0.082	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.041	0.069	0.107	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.007	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	0.008	0.018	0.044	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N No guideline/standard value set for this parameter.

 # Victorian standard: that 98% of samples must not contain any E.coli/100mL.

G Geometric means shown for bacterial parameters.

1 Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Maribyrnong	Locality No.	3A
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	101,272

Parameter	Unit	Guideline Value *(ADWG 2011)*	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	650	>weekly	322	322	100%
Total Coliforms	orgs/100mL	N	<1	<1	200	>weekly	323	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	323	323	within standard (actual 100%)
Free Chlorine	mg/L	5	<0.01	0.14	0.52	>weekly	323	323	100%
Total Chlorine	mg/L	5	0.02	0.24	0.66	>weekly	323	323	100%
Alkalinity (as $CaCO_3$)	mg/L	N	12	12	12	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.02	0.02	0.04	fortnightly	28	28	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	5.0	5.0	5.0	annually	1	-	-
Chloride	mg/L	250	11	11	11	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	3	8	fortnightly	28	28	100%
Conductivity	µS/cm	~900	60	101	130	fortnightly	26	26	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.69	0.89	0.96	fortnightly	30	30	100%
Hardness (as $CaCO_3$)	mg/L	200	19	19	19	annually	1	1	100%
Iron	mg/L	0.3	0.01	0.04	0.09	fortnightly	28	28	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.5	1.5	1.5	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.002	0.007	fortnightly	28	28	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	0.98	0.98	0.98	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.3	7.5	fortnightly	28	28	100%
pH	units	6.5-9.2	7.1	7.3	7.5	fortnightly	28	28	100%
Potassium	mg/L	N	0.7	0.7	0.7	annually	1	-	-
Silica (SiO_2)	mg/L	80	5.1	5.1	5.1	annually	1	1	100%
Sodium	mg/L	180	6.0	6.0	6.0	annually	1	1	100%
Sulphate	mg/L	250	4.6	4.6	4.6	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.006	0.006	0.006	annually	1	-	-
Total Dissolved Solids	mg/L	600	50	50	50	annually	1	1	100%
Turbidity	NTU	5[1]	0.1	0.5[1]	1.2	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	0.001	0.006	0.008	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.008	0.012	0.017	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	13	-	-
Chloroform	mg/L	N	0.019	0.032	0.074	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.038	0.050	0.084	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.006	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	0.009	0.015	0.042	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N *No guideline/standard value set for this parameter.*

\# *Victorian standard: that 98% of samples must not contain any E.coli/100mL.*

G *Geometric means shown for bacterial parameters.*

1 *Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.*

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Moonee Ponds	Locality No.	9B
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	68,395

Parameter	Unit	Guideline Value *(ADWG 2011)*	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	68	>weekly	229	229	100%
Total Coliforms	orgs/100mL	N	<1	<1	12	>weekly	229	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	229	229	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.12	0.56	>weekly	229	229	100%
Total Chlorine	mg/L	5	0.02	0.22	0.66	>weekly	229	229	100%
Alkalinity (as $CaCO_3$)	mg/L	N	13	13	13	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.02	0.02	0.07	fortnightly	29	29	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	4.5	4.5	4.5	annually	1	-	-
Chloride	mg/L	250	11	11	11	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	4	10	fortnightly	29	29	100%
Conductivity	µS/cm	~900	66	95	130	fortnightly	28	28	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.82	0.89	0.95	fortnightly	31	31	100%
Hardness (as $CaCO_3$)	mg/L	200	17	17	17	annually	1	1	100%
Iron	mg/L	0.3	0.01	0.04	0.17	fortnightly	29	29	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.5	1.5	1.5	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.004	0.023	fortnightly	29	29	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	0.98	0.98	0.98	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.2	7.4	fortnightly	29	29	100%
pH	units	6.5-9.2	7.1	7.2	7.4	fortnightly	29	29	100%
Potassium	mg/L	N	0.8	0.8	0.8	annually	1	-	-
Silica (SiO_2)	mg/L	80	4.5	4.5	4.5	annually	1	1	100%
Sodium	mg/L	180	5.5	5.5	5.5	annually	1	1	100%
Sulphate	mg/L	250	3.4	3.4	3.4	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.005	0.005	0.005	annually	1	-	-
Total Dissolved Solids	mg/L	600	50	50	50	annually	1	1	100%
Turbidity	NTU	5[1]	0.2	0.6[1]	2.5	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	0.002	0.005	0.009	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.009	0.012	0.015	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	13	-	-
Chloroform	mg/L	N	0.018	0.034	0.059	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.040	0.051	0.077	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.006	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	<0.005	0.018	0.043	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N No guideline/standard value set for this parameter.

 # Victorian standard: that 98% of samples must not contain any E.coli/100mL.

G Geometric means shown for bacterial parameters.

1 Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Parkville	Locality No.	11
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	111,305

Parameter	Unit	Guideline Value (ADWG 2011)	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	200	>weekly	322	322	100%
Total Coliforms	orgs/100mL	N	<1	<1	38	>weekly	322	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	322	322	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.18	0.60	>weekly	322	322	100%
Total Chlorine	mg/L	5	0.02	0.28	0.73	>weekly	322	322	100%
Alkalinity (as $CaCO_3$)	mg/L	N	11	11	11	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.01	0.03	0.11	fortnightly	27	27	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	6.0	6.0	6.0	annually	1	-	-
Chloride	mg/L	250	15	15	15	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	4	28	fortnightly	27	26	96.3%
Conductivity	µS/cm	~900	60	107	130	fortnightly	26	26	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.68	0.90	0.97	fortnightly	28	28	100%
Hardness (as $CaCO_3$)	mg/L	200	22	22	22	annually	1	1	100%
Iron	mg/L	0.3	0.01	0.05	0.27	fortnightly	27	27	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.8	1.8	1.8	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.004	0.036	fortnightly	27	27	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	1.28	1.28	1.28	annually	1	1	100%
pH	units	6.5-8.5	6.9	7.2	7.4	fortnightly	27	27	100%
pH	units	6.5-9.2	6.9	7.2	7.4	fortnightly	27	27	100%
Potassium	mg/L	N	1.0	1.0	1.0	annually	1	-	-
Silica (SiO_2)	mg/L	80	3.6	3.6	3.6	annually	1	1	100%
Sodium	mg/L	180	8.3	8.3	8.3	annually	1	1	100%
Sulphate	mg/L	250	8.8	8.8	8.8	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.009	0.009	0.009	annually	1	-	-
Total Dissolved Solids	mg/L	600	60	60	60	annually	1	1	100%
Turbidity	NTU	5[1]	0.1	0.7[1]	5.0	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	0.001	0.007	0.009	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.008	0.012	0.015	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	13	-	-
Chloroform	mg/L	N	0.013	0.024	0.066	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.036	0.044	0.076	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.008	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	<0.005	0.012	0.045	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N No guideline/standard value set for this parameter.

 # Victorian standard: that 98% of samples must not contain any E.coli/100mL.

G Geometric means shown for bacterial parameters.

1 Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Richmond	Locality No.	54
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	20,646

Parameter	Unit	Guideline Value *(ADWG 2011)*	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	29	>weekly	105	105	100%
Total Coliforms	orgs/100mL	N	<1	<1	12	>weekly	105	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	105	105	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.08	0.46	>weekly	105	105	100%
Total Chlorine	mg/L	5	0.01	0.15	0.56	>weekly	105	105	100%
Alkalinity (as $CaCO_3$)	mg/L	N	14	14	14	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.02	0.02	0.04	fortnightly	27	27	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	4.5	4.5	4.5	annually	1	-	-
Chloride	mg/L	250	8	8	8	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	4	7	12	fortnightly	27	27	100%
Conductivity	µS/cm	~900	55	60	66	fortnightly	26	26	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.63	0.89	0.97	fortnightly	28	28	100%
Hardness (as $CaCO_3$)	mg/L	200	16	16	16	annually	1	1	100%
Iron	mg/L	0.3	0.05	0.07	0.12	fortnightly	27	27	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.2	1.2	1.2	annually	1	-	-
Manganese	mg/L	0.1	0.004	0.006	0.007	fortnightly	27	27	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	0.75	0.75	0.75	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.3	7.7	fortnightly	27	27	100%
pH	units	6.5-9.2	7.1	7.3	7.7	fortnightly	27	27	100%
Potassium	mg/L	N	0.5	0.5	0.5	annually	1	-	-
Silica (SiO_2)	mg/L	80	6.0	6.0	6.0	annually	1	1	100%
Sodium	mg/L	180	4.4	4.4	4.4	annually	1	1	100%
Sulphate	mg/L	250	1.7	1.7	1.7	annually	1	1	100%
Total Organic Carbon	mg/L	N	3.0	3.0	3.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.009	0.009	0.009	annually	1	-	-
Total Dissolved Solids	mg/L	600	48	48	48	annually	1	1	100%
Turbidity	NTU	5[1]	0.1	1.0[1]	1.6	weekly	53	-	within standard
Zinc	mg/L	3	0.020	0.020	0.020	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.001	<0.001	0.001	monthly	14	-	-
Dichlorobromomethane	mg/L	N	0.008	0.010	0.013	monthly	14	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	14	-	-
Chloroform	mg/L	N	0.046	0.060	0.083	monthly	14	-	-
Total Trihalomethanes	mg/L	0.25	0.059	0.071	0.093	monthly	14	14	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	14	14	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.008	monthly	14	14	100%
Trichloroacetic acid	mg/L	0.1	0.014	0.027	0.042	monthly	14	14	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N No guideline/standard value set for this parameter.

 # Victorian standard: that 98% of samples must not contain any E.coli/100mL.

G Geometric means shown for bacterial parameters.

1 Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Strathmore	Locality No.	9A
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	8917

Parameter	Unit	Guideline Value *(ADWG 2011)*	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	58	>weekly	79	79	100%
Total Coliforms	orgs/100mL	N	<1	<1	29	>weekly	79	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	79	79	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.06	0.33	>weekly	79	79	100%
Total Chlorine	mg/L	5	0.04	0.13	0.46	>weekly	79	79	100%
Alkalinity (as $CaCO_3$)	mg/L	N	13	13	13	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.02	0.03	0.04	fortnightly	26	26	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	4.3	4.3	4.3	annually	1	-	-
Chloride	mg/L	250	9	9	9	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	6	10	fortnightly	26	26	100%
Conductivity	µS/cm	~900	56	75	120	fortnightly	26	26	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.82	0.92	1.0	fortnightly	28	28	100%
Hardness (as $CaCO_3$)	mg/L	200	17	17	17	annually	1	1	100%
Iron	mg/L	0.3	<0.01	0.06	0.10	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.4	1.4	1.4	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.005	0.012	fortnightly	26	26	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	0.75	0.75	0.75	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.6	8.3	fortnightly	26	26	100%
pH	units	6.5-9.2	7.1	7.6	8.3	fortnightly	26	26	100%
Potassium	mg/L	N	0.7	0.7	0.7	annually	1	-	-
Silica (SiO_2)	mg/L	80	6.0	6.0	6.0	annually	1	1	100%
Sodium	mg/L	180	4.7	4.7	4.7	annually	1	1	100%
Sulphate	mg/L	250	1.9	1.9	1.9	annually	1	1	100%
Total Organic Carbon	mg/L	N	3.0	3.0	3.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.006	0.006	0.006	annually	1	-	-
Total Dissolved Solids	mg/L	600	50	50	50	annually	1	1	100%
Turbidity	NTU	5[1]	0.1	0.8[1]	2.0	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.001	0.002	0.006	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.007	0.011	0.015	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	13	-	-
Chloroform	mg/L	N	0.033	0.050	0.073	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.055	0.063	0.081	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.008	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	0.005	0.018	0.027	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N No guideline/standard value set for this parameter.

 # Victorian standard: that 98% of samples must not contain any E.coli/100mL.

G Geometric means shown for bacterial parameters.

1 Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Taylors Lakes	Locality No.	5A
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	63,394

Parameter	Unit	Guideline Value (ADWG 2011)	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	270	>weekly	187	187	100%
Total Coliforms	orgs/100mL	N	<1	<1	200	>weekly	187	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	187	187	within standard (actual 100%)
Free Chlorine	mg/L	5	<0.01	0.37	0.76	>weekly	187	187	100%
Total Chlorine	mg/L	5	0.02	0.51	0.98	>weekly	187	187	100%
Alkalinity (as $CaCO_3$)	mg/L	N	14	14	14	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	<0.01	0.01	0.02	fortnightly	30	30	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	5.0	5.0	5.0	annually	1	-	-
Chloride	mg/L	250	10	10	10	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	4	6	10	fortnightly	30	30	100%
Conductivity	µS/cm	~900	66	70	75	fortnightly	29	29	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.90	0.93	0.98	fortnightly	32	32	100%
Hardness (as $CaCO_3$)	mg/L	200	18	18	18	annually	1	1	100%
Iron	mg/L	0.3	0.08	0.12	0.16	fortnightly	30	30	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.3	1.3	1.3	annually	1	-	-
Manganese	mg/L	0.1	0.001	0.003	0.007	fortnightly	30	30	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	0.84	0.84	0.84	annually	1	1	100%
pH	units	6.5-8.5	6.9	7.2	7.7	fortnightly	30	30	100%
pH	units	6.5-9.2	6.9	7.2	7.7	fortnightly	30	30	100%
Potassium	mg/L	N	0.7	0.7	0.7	annually	1	-	-
Silica (SiO_2)	mg/L	80	6.5	6.5	6.5	annually	1	1	100%
Sodium	mg/L	180	5.4	5.4	5.4	annually	1	1	100%
Sulphate	mg/L	250	2.7	2.7	2.7	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.006	0.006	0.006	annually	1	-	-
Total Dissolved Solids	mg/L	600	48	48	48	annually	1	1	100%
Turbidity	NTU	5[1]	0.5	1.3[1]	2.0	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.001	0.001	0.002	monthly	14	-	-
Dichlorobromomethane	mg/L	N	0.003	0.005	0.008	monthly	14	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	14	-	-
Chloroform	mg/L	N	0.006	0.015	0.023	monthly	14	-	-
Total Trihalomethanes	mg/L	0.25	0.011	0.021	0.033	monthly	14	14	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	14	14	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.005	monthly	14	14	100%
Trichloroacetic acid	mg/L	0.1	<0.005	0.007	0.010	monthly	14	14	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N No guideline/standard value set for this parameter.

 # Victorian standard: that 98% of samples must not contain any E.coli/100mL.

G Geometric means shown for bacterial parameters.

1 Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Tullamarine	Locality No.	7A
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	9833

Parameter	Unit	Guideline Value *(ADWG 2011)*	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	1	1900	>weekly	79	77	97.5%
Total Coliforms	orgs/100mL	N	<1	<1	53	>weekly	79	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	79	79	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.33	0.78	>weekly	79	79	100%
Total Chlorine	mg/L	5	0.03	0.48	0.96	>weekly	79	79	100%
Alkalinity (as $CaCO_3$)	mg/L	N	13	13	13	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	<0.01	0.02	0.04	fortnightly	27	27	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	6.9	6.9	6.9	annually	1	-	-
Chloride	mg/L	250	17	17	17	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	5	10	fortnightly	27	27	100%
Conductivity	µS/cm	~900	58	86	130	fortnightly	27	27	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.85	0.92	0.99	fortnightly	28	28	100%
Hardness (as $CaCO_3$)	mg/L	200	26	26	26	annually	1	1	100%
Iron	mg/L	0.3	<0.01	0.07	0.15	fortnightly	27	27	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	2.1	2.1	2.1	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.003	0.007	fortnightly	27	27	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	1.42	1.42	1.42	annually	1	1	100%
pH	units	6.5-8.5	6.9	7.2	8.1	fortnightly	27	27	100%
pH	units	6.5-9.2	6.9	7.2	8.1	fortnightly	27	27	100%
Potassium	mg/L	N	1.3	1.3	1.3	annually	1	-	-
Silica (SiO_2)	mg/L	80	2.6	2.6	2.6	annually	1	1	100%
Sodium	mg/L	180	9.6	9.6	9.6	annually	1	1	100%
Sulphate	mg/L	250	9.6	9.6	9.6	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	<0.005	<0.005	<0.005	annually	1	-	-
Total Dissolved Solids	mg/L	600	72	72	72	annually	1	1	100%
Turbidity	NTU	5[1]	<0.1	1.0[1]	3.8	weekly	53	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.001	0.004	0.008	monthly	14	-	-
Dichlorobromomethane	mg/L	N	0.004	0.008	0.013	monthly	14	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	14	-	-
Chloroform	mg/L	N	0.009	0.021	0.056	monthly	14	-	-
Total Trihalomethanes	mg/L	0.25	0.021	0.034	0.065	monthly	14	14	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	14	14	100%
Dichloroacetic acid	mg/L	0.1	<0.005	0.006	0.020	monthly	14	14	100%
Trichloroacetic acid	mg/L	0.1	<0.005	0.011	0.033	monthly	14	14	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N *No guideline/standard value set for this parameter.*

\# *Victorian standard: that 98% of samples must not contain any E.coli/100mL.*

G *Geometric means shown for bacterial parameters.*

1 *Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.*

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Werribee	Locality No.	1
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	124,833

Parameter	Unit	Guideline Value *(ADWG 2011)*	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	42	>weekly	329	329	100%
Total Coliforms	orgs/100mL	N	<1	<1	<1	>weekly	329	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	329	329	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.20	0.43	>weekly	329	329	100%
Total Chlorine	mg/L	5	0.02	0.30	0.68	>weekly	329	329	100%
Alkalinity (as $CaCO_3$)	mg/L	N	16	16	16	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.02	0.02	0.03	fortnightly	30	30	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	6.6	6.6	6.6	annually	1	-	-
Chloride	mg/L	250	13	13	13	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	3	8	fortnightly	30	30	100%
Conductivity	µS/cm	~900	67	103	130	fortnightly	27	27	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.60	0.87	0.95	fortnightly	31	31	100%
Hardness (as $CaCO_3$)	mg/L	200	22	22	22	annually	1	1	100%
Iron	mg/L	0.3	0.01	0.04	0.12	fortnightly	30	30	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.4	1.4	1.4	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.002	0.007	fortnightly	30	30	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	1.02	1.02	1.02	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.5	8.9	fortnightly	30	29	96.7%
pH	units	6.5-9.2	7.1	7.5	8.9	fortnightly	30	30	100%
Potassium	mg/L	N	0.9	0.9	0.9	annually	1	-	-
Silica (SiO_2)	mg/L	80	5.0	5.0	5.0	annually	1	1	100%
Sodium	mg/L	180	6.6	6.6	6.6	annually	1	1	100%
Sulphate	mg/L	250	4.6	4.6	4.6	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.006	0.006	0.006	annually	1	-	-
Total Dissolved Solids	mg/L	600	72	72	72	annually	1	1	100%
Turbidity	NTU	5[1]	0.1	0.5[1]	1.2	weekly	53	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	0.002	0.007	0.010	monthly	14	-	-
Dichlorobromomethane	mg/L	N	0.007	0.015	0.018	monthly	14	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	14	-	-
Chloroform	mg/L	N	0.014	0.035	0.072	monthly	14	-	-
Total Trihalomethanes	mg/L	0.25	0.036	0.057	0.093	monthly	14	14	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	14	14	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	<0.005	monthly	14	14	100%
Trichloroacetic acid	mg/L	0.1	0.006	0.016	0.037	monthly	14	14	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N No guideline/standard value set for this parameter.

 # Victorian standard: that 98% of samples must not contain any E.coli/100mL.

G Geometric means shown for bacterial parameters.

1 Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Werribee South	Locality No.	2A
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	807

Parameter	Unit	Guideline Value (ADWG 2011)	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	20	>weekly	65	65	100%
Total Coliforms	orgs/100mL	N	<1	<1	<1	>weekly	65	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	65	65	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.31	0.94	>weekly	65	65	100%
Total Chlorine	mg/L	5	0.03	0.43	1.00	>weekly	65	65	100%
Alkalinity (as $CaCO_3$)	mg/L	N	15	15	15	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	<0.01	0.02	0.03	fortnightly	26	26	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	6.6	6.6	6.6	annually	1	-	-
Chloride	mg/L	250	13	13	13	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	3	8	fortnightly	26	26	100%
Conductivity	µS/cm	~900	68	108	160	fortnightly	26	26	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.63	0.88	0.96	fortnightly	28	28	100%
Hardness (as $CaCO_3$)	mg/L	200	23	23	23	annually	1	1	100%
Iron	mg/L	0.3	0.01	0.04	0.07	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	1.6	1.6	1.6	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.002	0.006	fortnightly	26	26	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	0.89	0.89	0.89	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.7	8.2	fortnightly	26	26	100%
pH	units	6.5-9.2	7.1	7.7	8.2	fortnightly	26	26	100%
Potassium	mg/L	N	1.0	1.0	1.0	annually	1	-	-
Silica (SiO_2)	mg/L	80	5.4	5.4	5.4	annually	1	1	100%
Sodium	mg/L	180	7.4	7.4	7.4	annually	1	1	100%
Sulphate	mg/L	250	4.4	4.4	4.4	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.014	0.014	0.014	annually	1	-	-
Total Dissolved Solids	mg/L	600	64	64	64	annually	1	1	100%
Turbidity	NTU	5[1]	0.1	0.5[1]	1.0	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	0.002	0.007	0.011	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.004	0.015	0.019	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	13	-	-
Chloroform	mg/L	N	0.006	0.035	0.066	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.014	0.057	0.086	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	<0.005	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	<0.005	0.016	0.038	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N *No guideline/standard value set for this parameter.*

\# *Victorian standard: that 98% of samples must not contain any E.coli/100mL.*

G *Geometric means shown for bacterial parameters.*

1 *Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.*

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	Williamstown	Locality No.	3B
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	35,996

Parameter	Unit	Guideline Value (ADWG 2011)	Concentration or value (all samples)			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	<1	200	>weekly	143	143	100%
Total Coliforms	orgs/100mL	N	<1	<1	2	>weekly	143	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	<1	>weekly	143	143	within standard (actual 100%)
Free Chlorine	mg/L	5	0.01	0.18	0.46	>weekly	143	143	100%
Total Chlorine	mg/L	5	0.04	0.30	0.56	>weekly	143	143	100%
Alkalinity (as $CaCO_3$)	mg/L	N	12	12	12	annually	1	-	-
Aluminium (acid soluble)	mg/L	0.2	0.02	0.02	0.03	fortnightly	27	27	100%
Arsenic	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Cadmium	mg/L	0.002	<0.002	<0.002	<0.002	annually	1	1	100%
Calcium	mg/L	N	6.6	6.6	6.6	annually	1	-	-
Chloride	mg/L	250	17	17	17	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	3	7	fortnightly	27	27	100%
Conductivity	µS/cm	~900	60	106	130	fortnightly	26	26	100%
Copper	mg/L	1	<0.01	<0.01	<0.01	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.63	0.89	0.96	fortnightly	29	29	100%
Hardness (as $CaCO_3$)	mg/L	200	25	25	25	annually	1	1	100%
Iron	mg/L	0.3	0.01	0.02	0.08	fortnightly	27	27	100%
Lead	mg/L	0.01	<0.01	<0.01	<0.01	annually	1	1	100%
Magnesium	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Manganese	mg/L	0.1	<0.001	0.002	0.004	fortnightly	27	27	100%
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	annually	1	1	100%
Nitrate (NO_3)	mg/L	50	1.37	1.37	1.37	annually	1	1	100%
pH	units	6.5-8.5	6.9	7.3	7.9	fortnightly	27	27	100%
pH	units	6.5-9.2	6.9	7.3	7.9	fortnightly	27	27	100%
Potassium	mg/L	N	1.1	1.1	1.1	annually	1	-	-
Silica (SiO_2)	mg/L	80	3.2	3.2	3.2	annually	1	1	100%
Sodium	mg/L	180	9.3	9.3	9.3	annually	1	1	100%
Sulphate	mg/L	250	9.4	9.4	9.4	annually	1	1	100%
Total Organic Carbon	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Total Phosphorus	mg/L	N	0.007	0.007	0.007	annually	1	-	-
Total Dissolved Solids	mg/L	600	65	65	65	annually	1	1	100%
Turbidity	NTU	5[1]	0.1	0.3[1]	1.2	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	0.001	0.007	0.011	monthly	13	-	-
Dichlorobromomethane	mg/L	N	0.009	0.013	0.016	monthly	13	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	13	-	-
Chloroform	mg/L	N	0.015	0.026	0.072	monthly	13	-	-
Total Trihalomethanes	mg/L	0.25	0.037	0.048	0.083	monthly	13	13	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	13	13	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.007	monthly	13	13	100%
Trichloroacetic acid	mg/L	0.1	0.006	0.013	0.043	monthly	13	13	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	<0.1	annually	1	1	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N No guideline/standard value set for this parameter.

 # Victorian standard: that 98% of samples must not contain any E.coli/100mL.

G Geometric means shown for bacterial parameters.

1 Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.

Appendix A. Water quality data by locality (cont'd)

Water Sampling Locality	ALL WATER QUALITY LOCALITIES	Locality No.	
For period	1 July 2012 to 30 June 2013	Population (2011 Census)	823,331

Parameter	Unit	Guideline Value *(ADWG 2011)*	Concentration or value (all samples)			No. of Samples		Performance against standard / guideline
			Min	Mean[G]	Max	Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	1	1,900	2747	2745	99.9%
Total Coliforms	orgs/100mL	N	<1	<1	200	2749	-	-
E. coli	orgs/100mL	98%<1#	<1	<1	1	2749	2748	within standard (actual 99.9%)
Free Chlorine	mg/L	5	<0.01	0.18	0.94	2749	2749	100%
Total Chlorine	mg/L	5	0.01	0.28	1.0	2749	2749	100%
Alkalinity (as $CaCO_3$)	mg/L	N	11	16	48	15	-	-
Aluminium (acid soluble)	mg/L	0.2	<0.01	0.02	0.11	415	415	100%
Arsenic	mg/L	0.01	<0.001	<0.01	<0.01	15	15	100%
Cadmium	mg/L	0.002	<0.0002	<0.002	<0.002	15	15	100%
Calcium	mg/L	N	4.3	6.5	21.0	15	-	-
Chloride	mg/L	250	8.0	12.3	17.0	15	15	100%
Chromium	mg/L	0.05	<0.001	<0.01	<0.01	15	15	100%
Colour	Pt/Co	25**	<2	4	28	415	414	99.8%
Conductivity	µS/cm	~900	55	95	170	399	399	100%
Copper	mg/L	1	<0.01	0.011	0.072	15	15	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	15	15	100%
Dissolved Oxygen	mg/L	N	8.3	9.9	11.0	26	-	-
Fluoride	mg/L	1.5	0.60	0.90	1.2	440	440	100%
Hardness (as $CaCO_3$)	mg/L	200	16	23	57	15	15	100%
Iron	mg/L	0.3	<0.01	0.06	0.27	415	415	100%
Lead	mg/L	0.01	<0.001	<0.01	<0.01	15	15	100%
Magnesium	mg/L	N	1.2	1.5	2.1	15	-	-
Manganese	mg/L	0.1	<0.001	0.003	0.036	415	415	100%
Mercury	mg/L	0.001	<0.0001	<0.001	<0.001	15	15	100%
Nitrate (NO_3)	mg/L	50	0.69	0.95	1.4	15	15	100%
pH	units	6.5-8.5	6.4	7.4	9.6	415	406	97.8%
pH	units	6.5-9.2	6.4	7.4	9.6	415	412	99.3%
Potassium	mg/L	N	0.5	0.9	1.3	15	-	-
Silica (SiO_2)	mg/L	80	2.6	5.2	7.3	15	15	100%
Sodium	mg/L	180	4.4	6.7	9.6	15	15	100%
Sulphate	mg/L	250	1.7	4.8	9.6	15	15	100%
Temperature	°C	N	10.5	17.1	24.9	26	-	-
Total Organic Carbon	mg/L	N	2.0	2.2	3.0	15	-	-
Total Phosphorus	mg/L	N	<0.005	0.007	0.014	15	-	-
Total Dissolved Solids	mg/L	600	28	61	100	15	15	100%
Turbidity	NTU	5[1]	<0.1	0.6[1]	5.0	783	-	within standard
Zinc	mg/L	3	<0.01	<0.01	0.02	15	15	100%
Dibromochloromethane	mg/L	N	<0.001	0.005	0.014	200	-	-
Dichlorobromomethane	mg/L	N	0.003	0.012	0.025	200	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	200	-	-
Chloroform	mg/L	N	0.006	0.032	0.083	200	-	-
Total Trihalomethanes	mg/L	0.25	0.011	0.049	0.107	200	200	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	200	200	100%
Dichloroacetic acid	mg/L	0.1	<0.005	<0.005	0.020	200	200	100%
Trichloroacetic acid	mg/L	0.1	<0.005	0.014	0.045	200	200	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	15	15	100%
Formaldehyde	mg/L	0.5	<0.1	<0.1	0.1	15	15	100%

* *Internal City West Water guideline.*

** *Guideline set for "True Colour" (15 PCU) however "Apparent Colour" is measured (with a benchmark guideline of 25 PCU).*

N *No guideline/standard value set for this parameter.*

\# *Victorian standard: that 98% of samples must not contain any E.coli/100mL.*

G *Geometric means shown for bacterial parameters.*

1 *Victorian standard: 95% upper confidence limit of mean (shown) less than or equal to 5 NTU.*

Appendix B. Spatial and time based water quality summaries

Table B.1 ***E. coli*** **performance in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)**

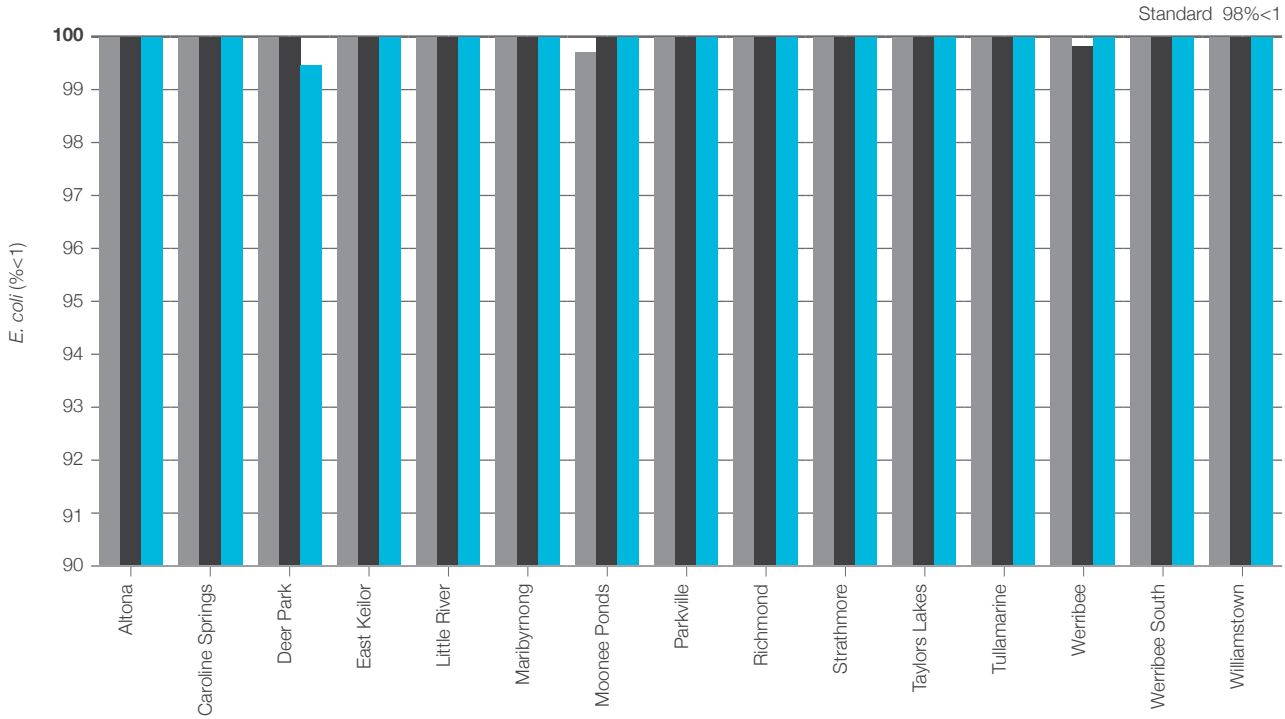
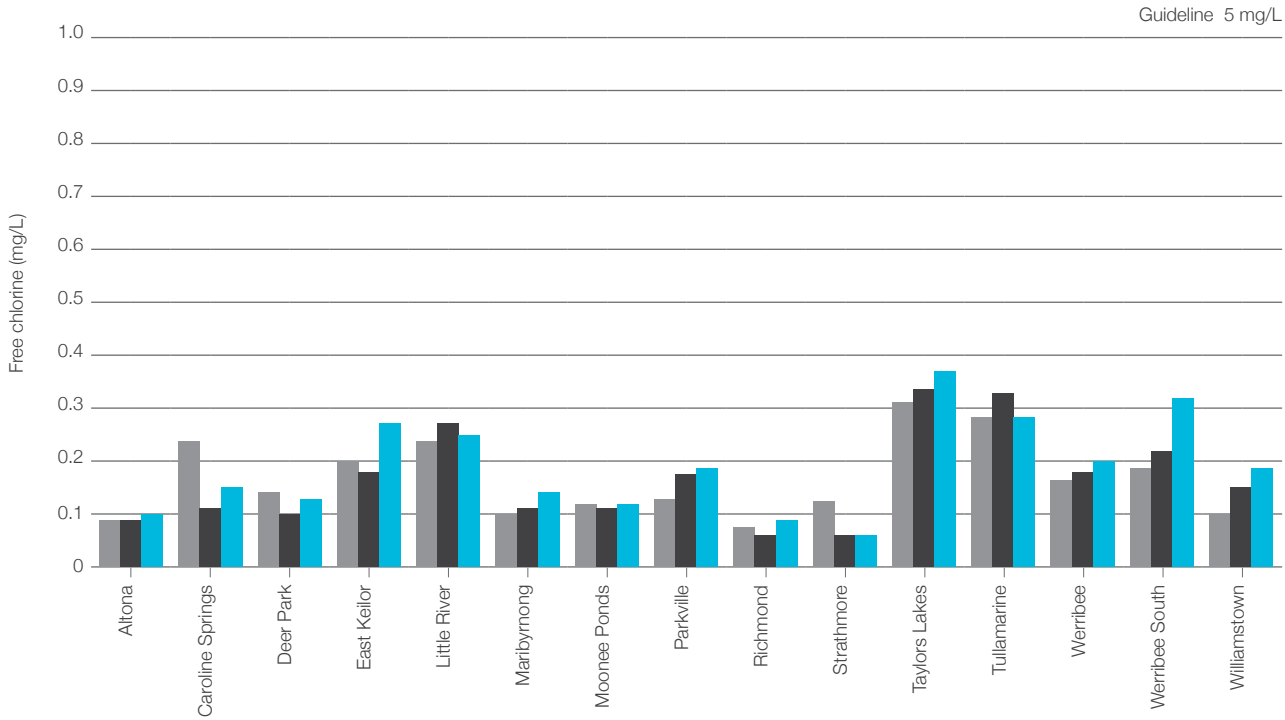


Figure B.2 **Annual average free chlorine concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)**



Appendix B. Spatial and time based water quality summaries (cont'd)

Figure B.3 **Average aluminium concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)**

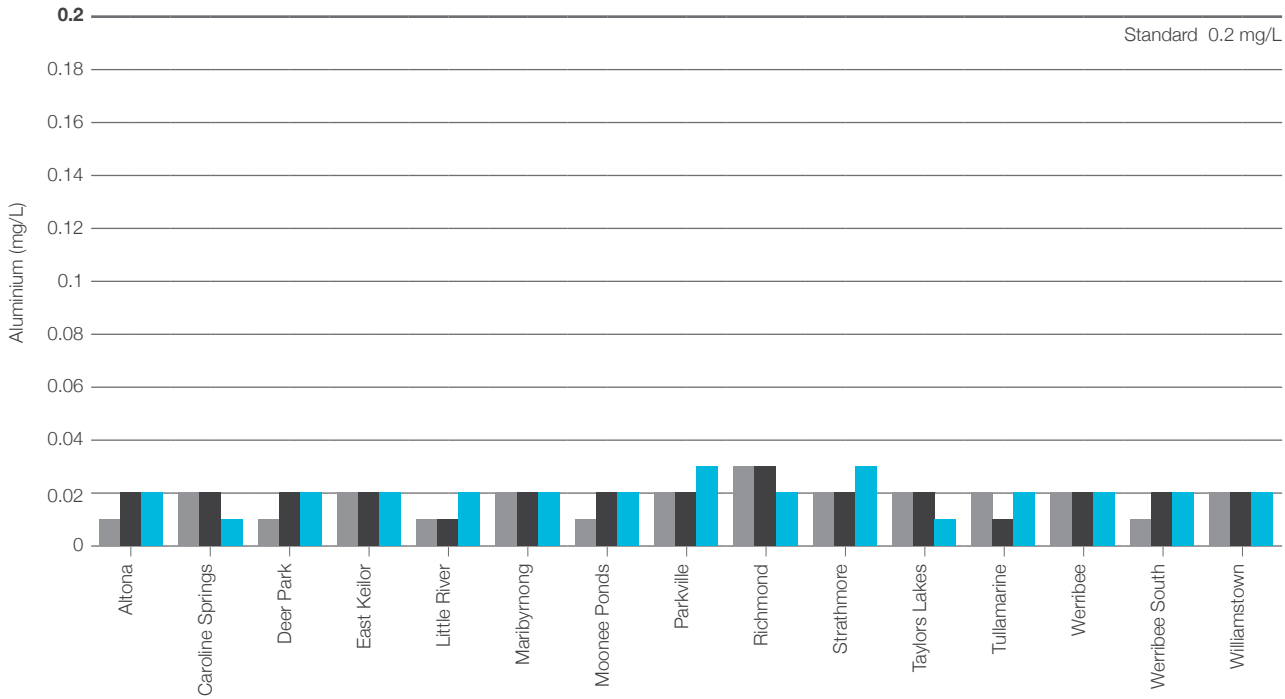
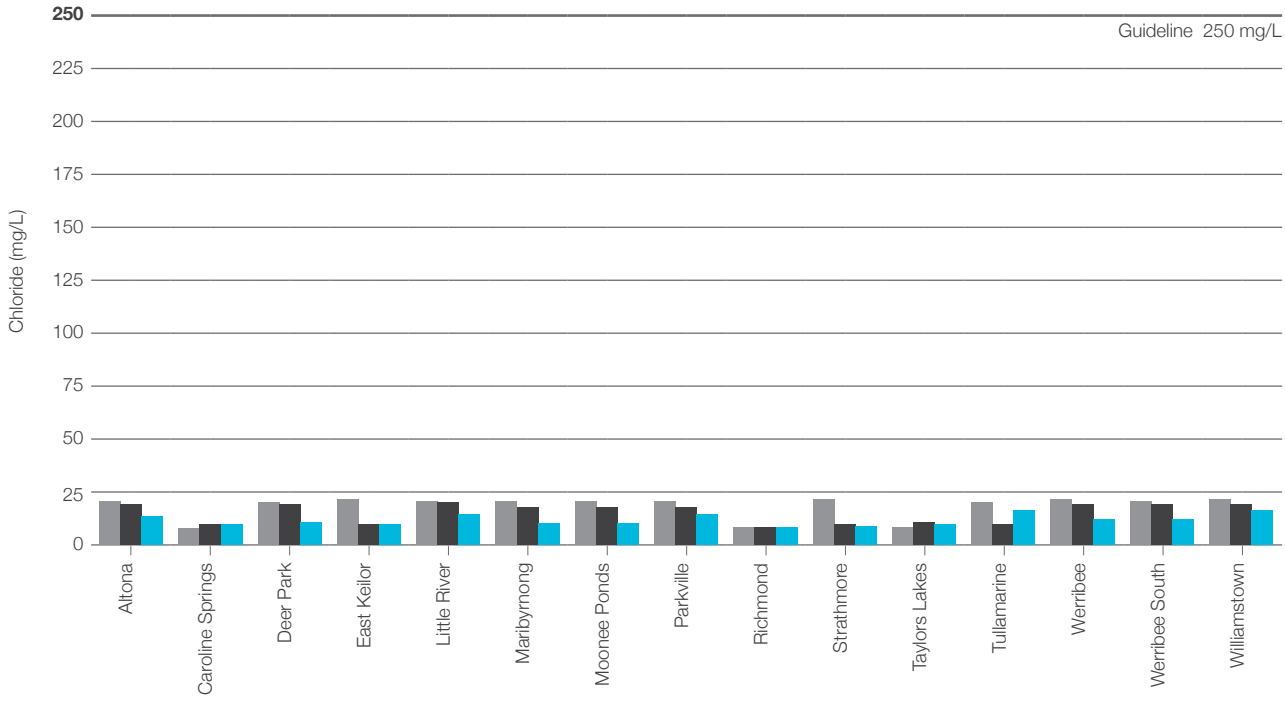


Figure B.4 **Chloride concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)**



Appendix B. Spatial and time based water quality summaries (cont'd)

Figure B.5 **Average apparent colour levels in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)**

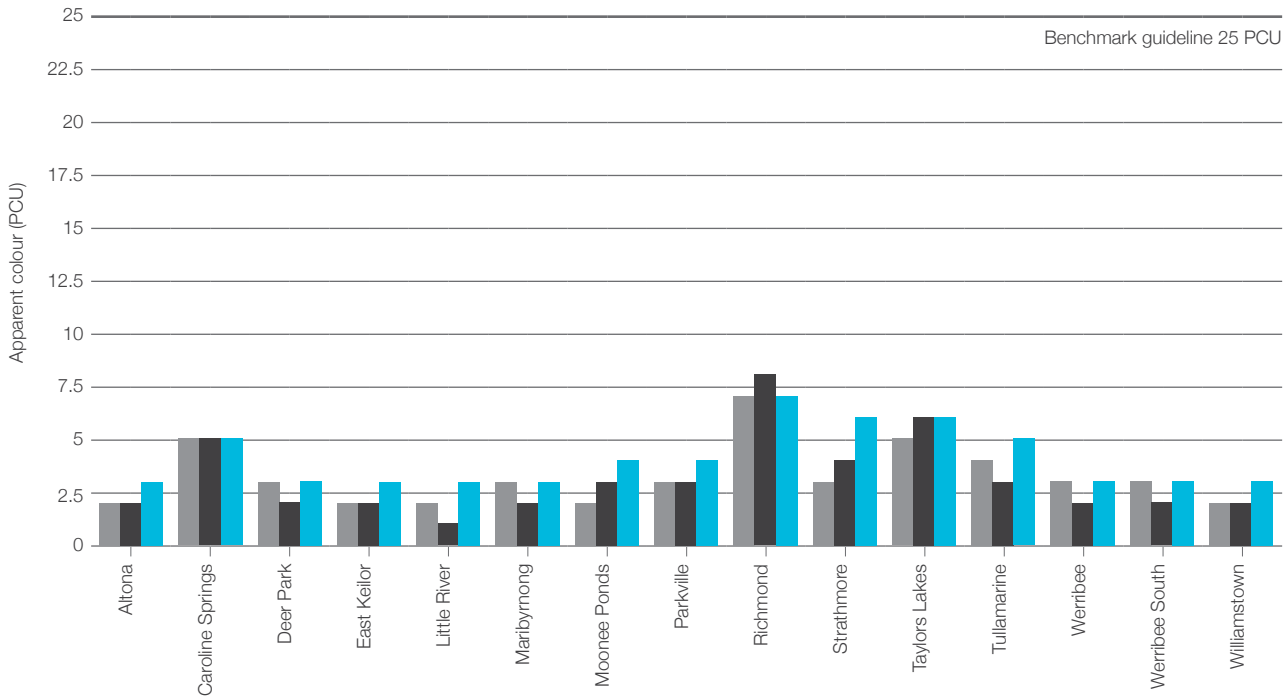
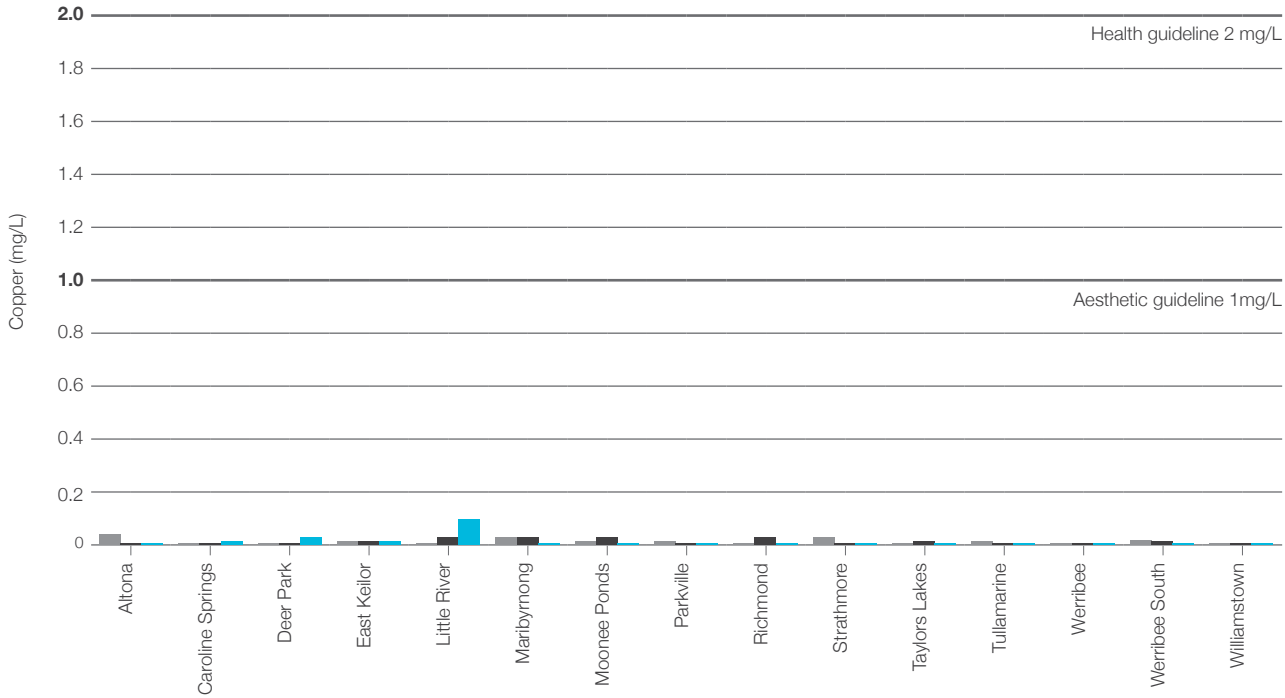


Figure B.6 **Copper concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)**



Appendix B. Spatial and time based water quality summaries (cont'd)

Figure B.7 **Average electrical conductivity levels in water sampling localities (between 2010/2011 and 2012/2013, from left to right within each locality)**

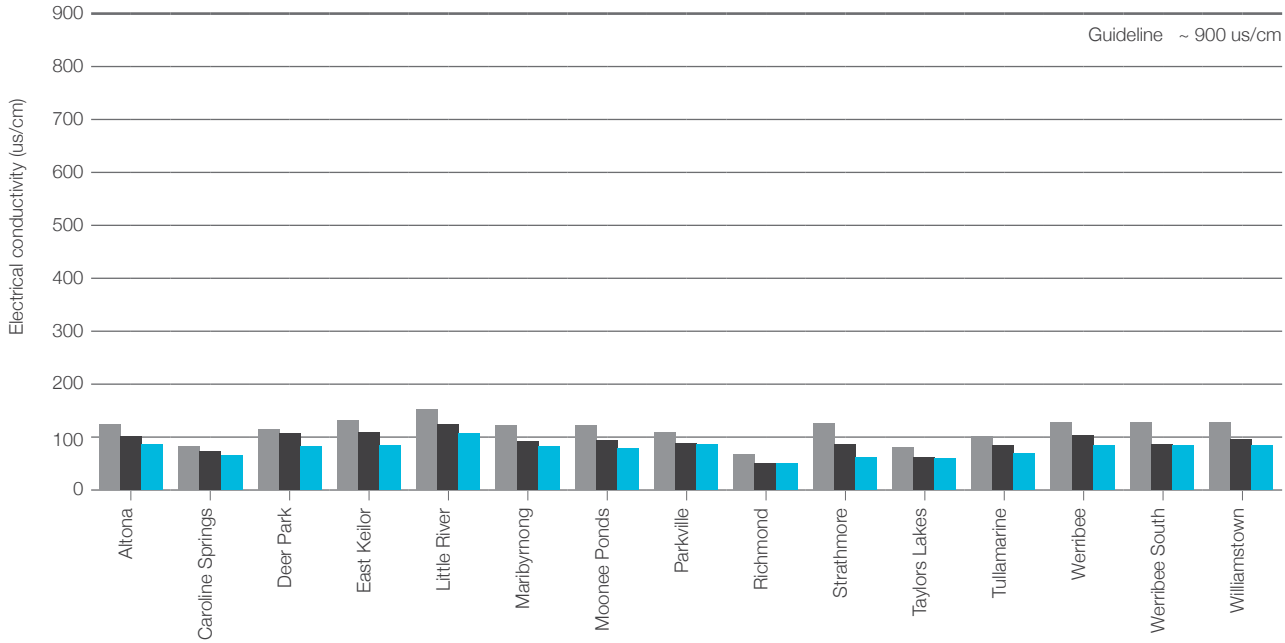
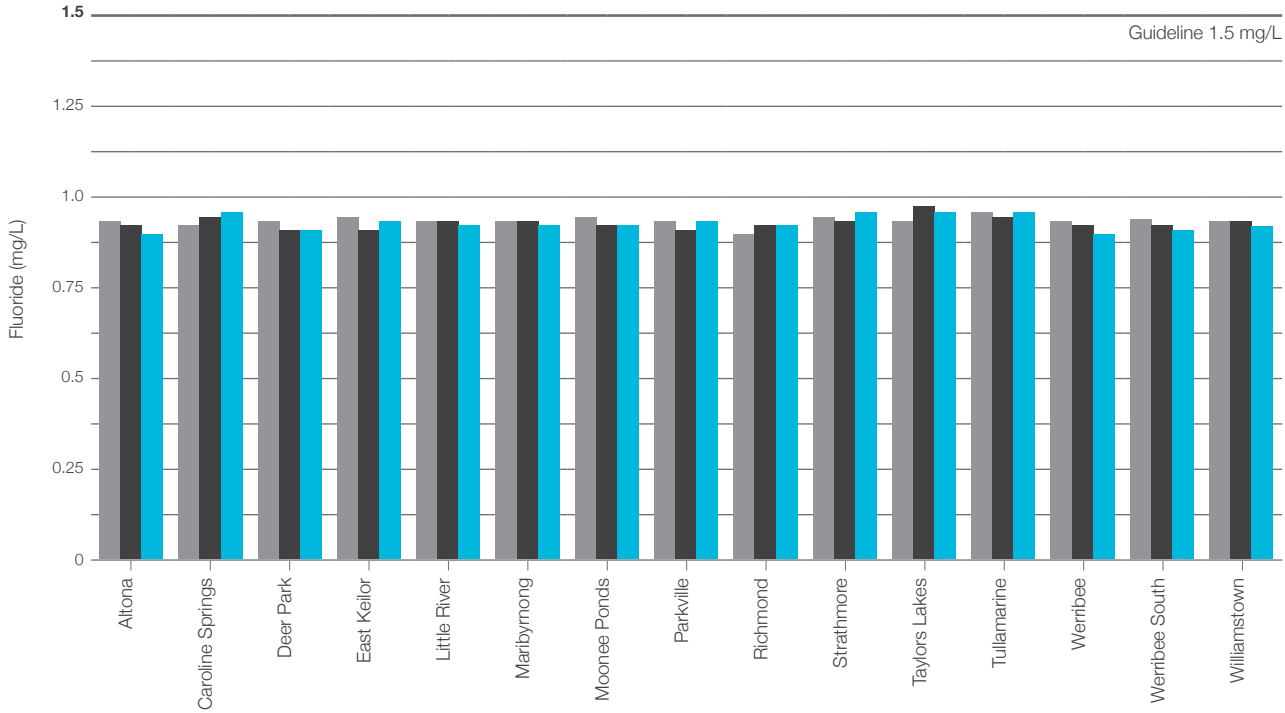


Figure B.8 **Average fluoride concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)**



Appendix B. Spatial and time based water quality summaries (cont'd)

Figure B.9 Hardness concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)

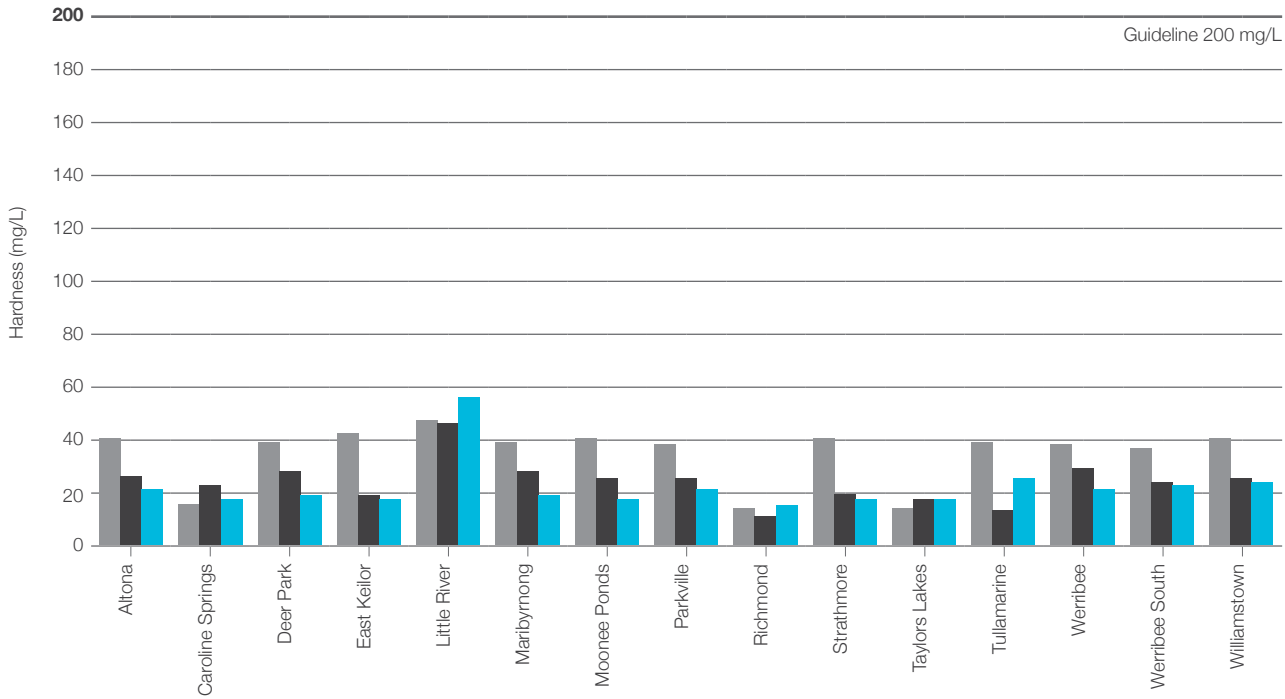
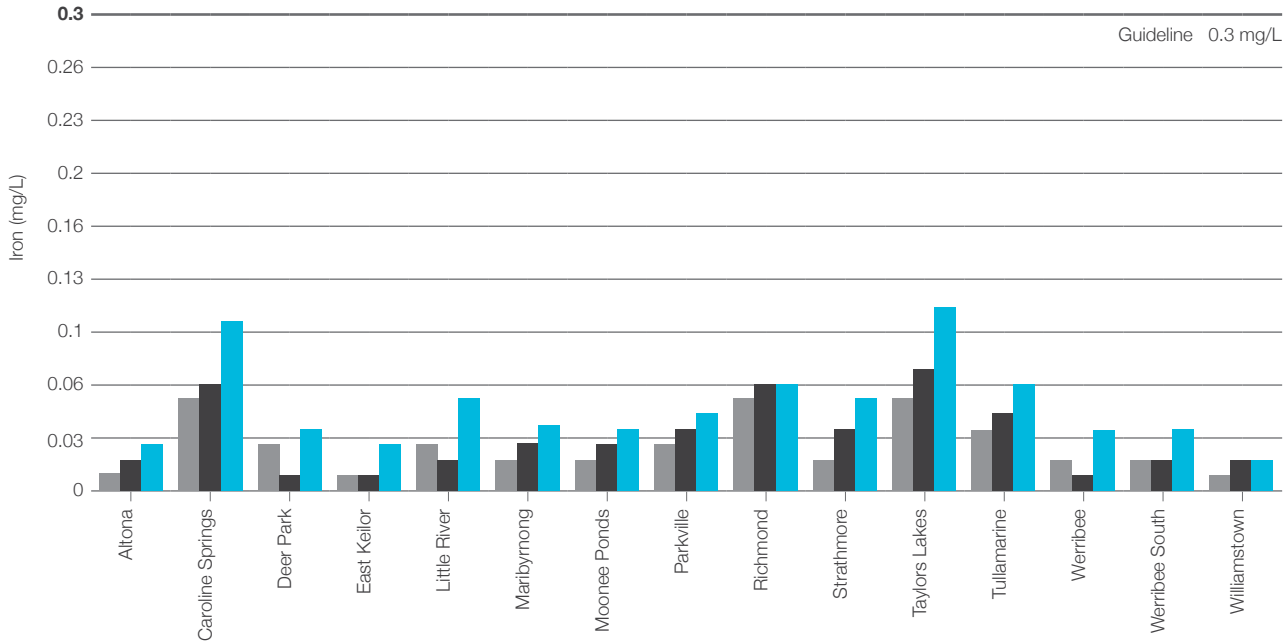


Figure B.10 Average iron concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)



Appendix B. Spatial and time based water quality summaries (cont'd)

Figure B.11 Average manganese concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)

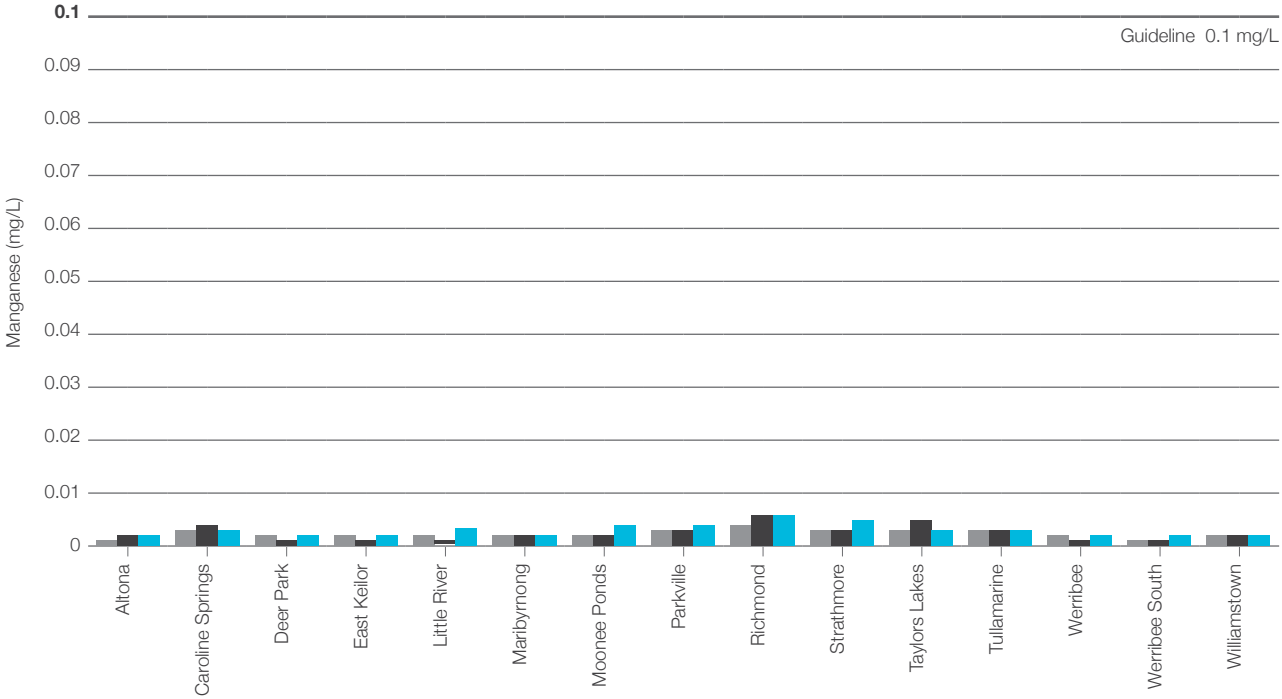
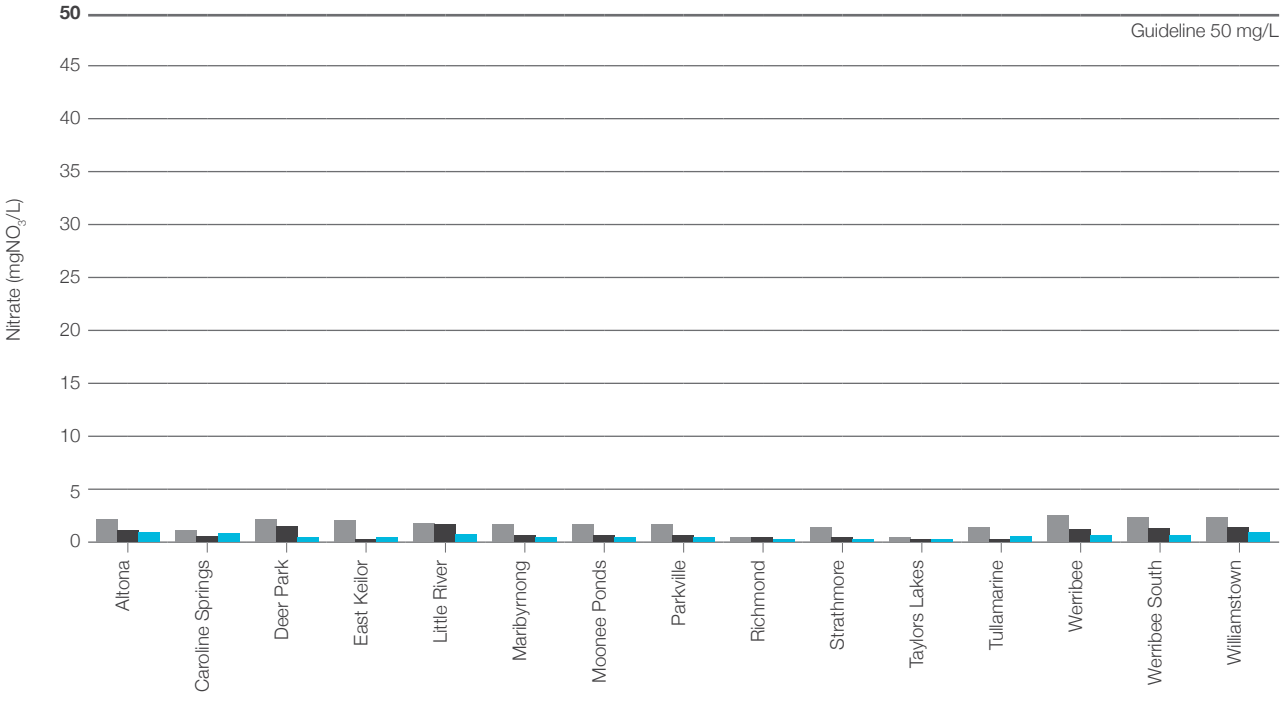


Figure B.12 Nitrate concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)



Appendix B. Spatial and time based water quality summaries (cont'd)

Figure B.13 Average pH values in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)

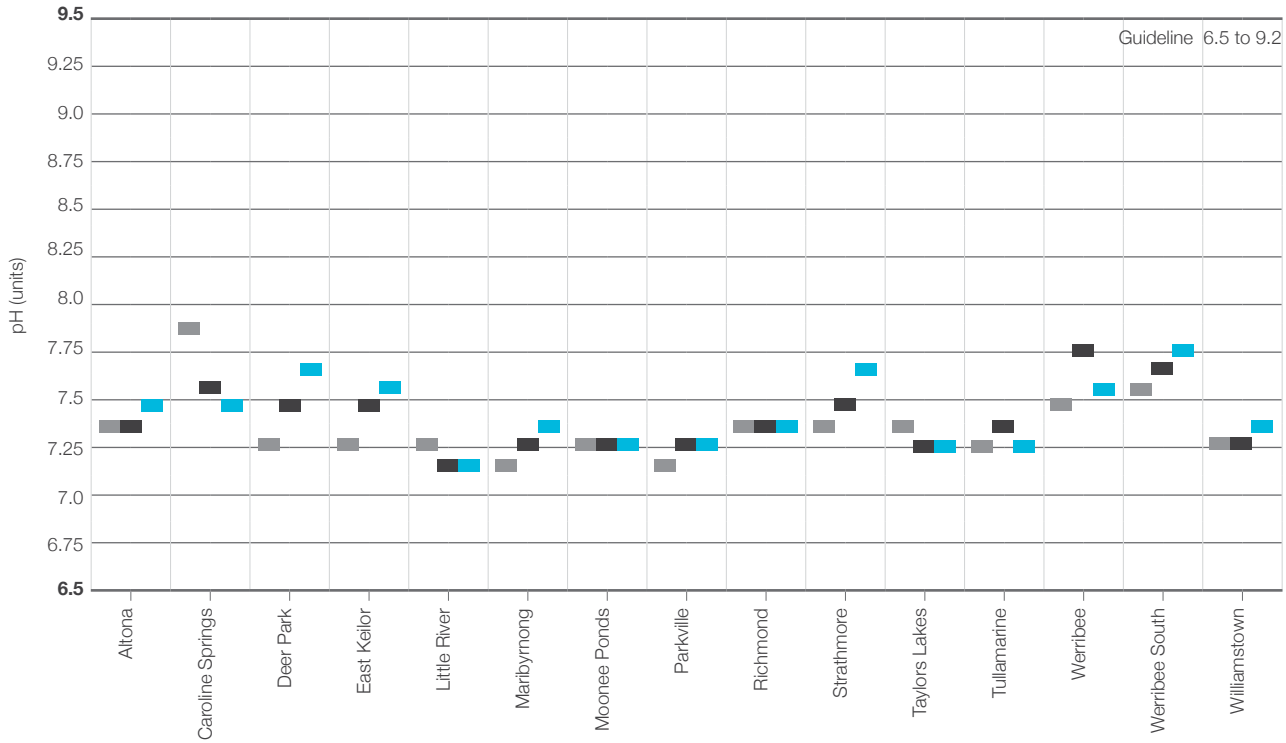
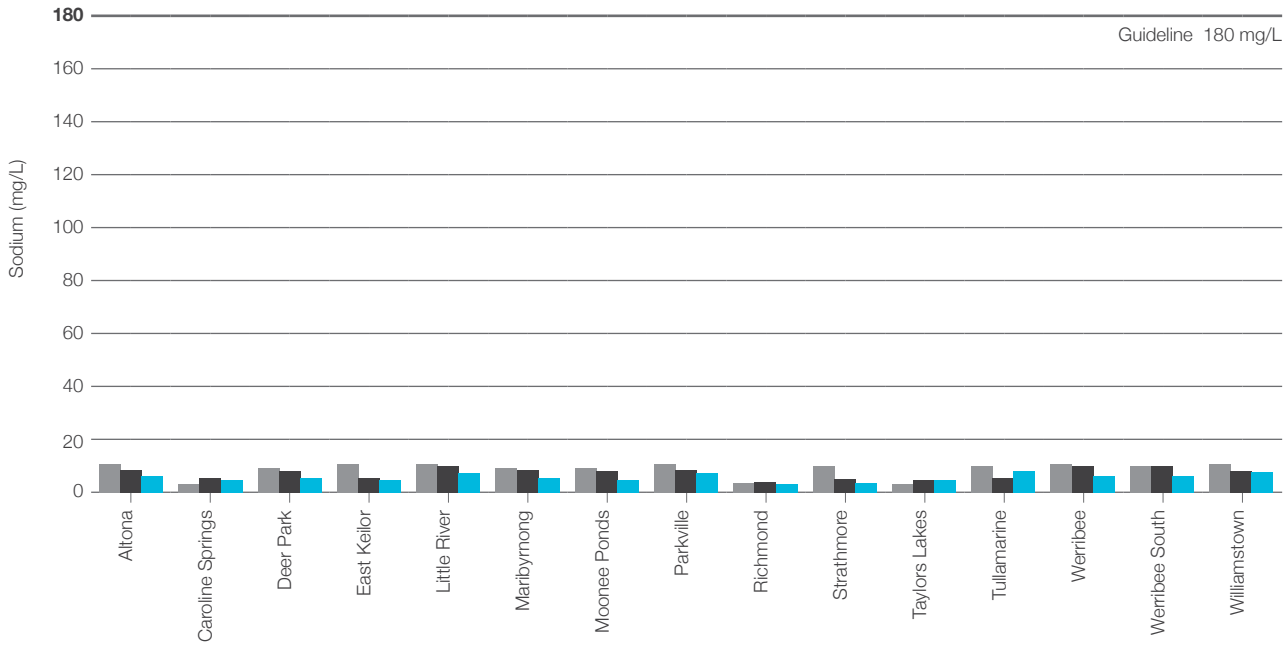


Figure B.14 Sodium concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)



Appendix B. Spatial and time based water quality summaries (cont'd)

Figure B.15 Summary turbidity levels in water sampling zones (between 2010-2011 and 2012-2013, from left to right within each locality)

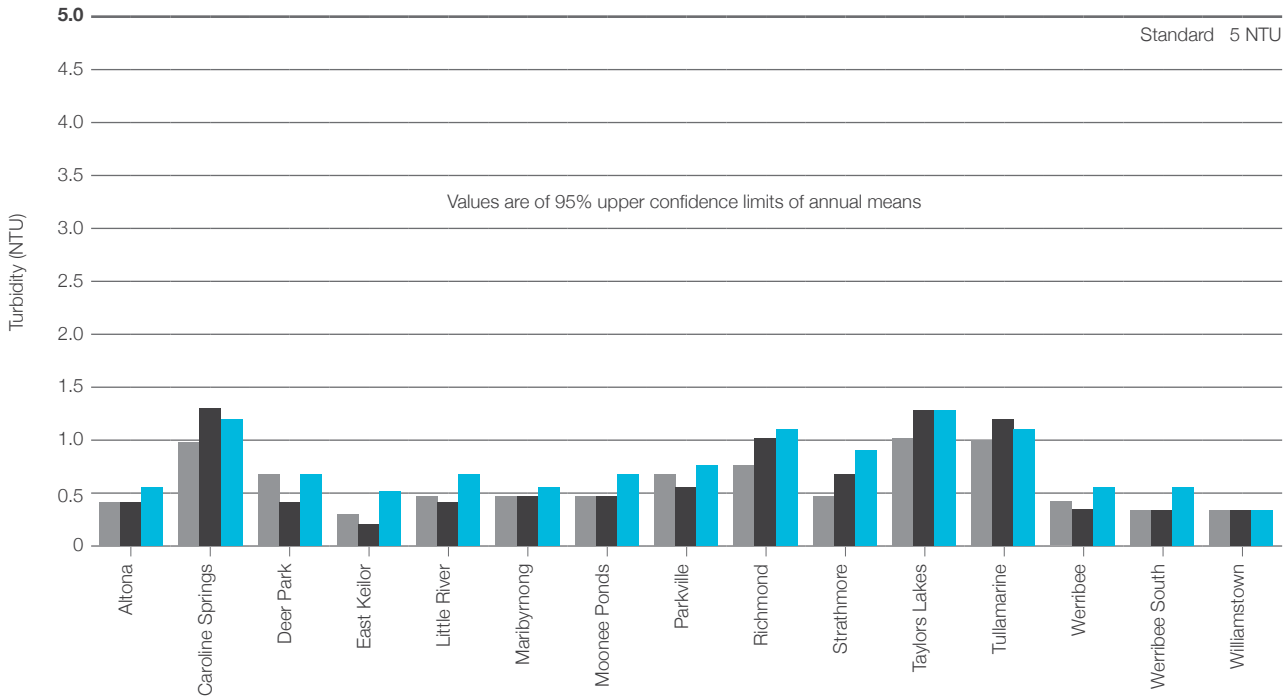
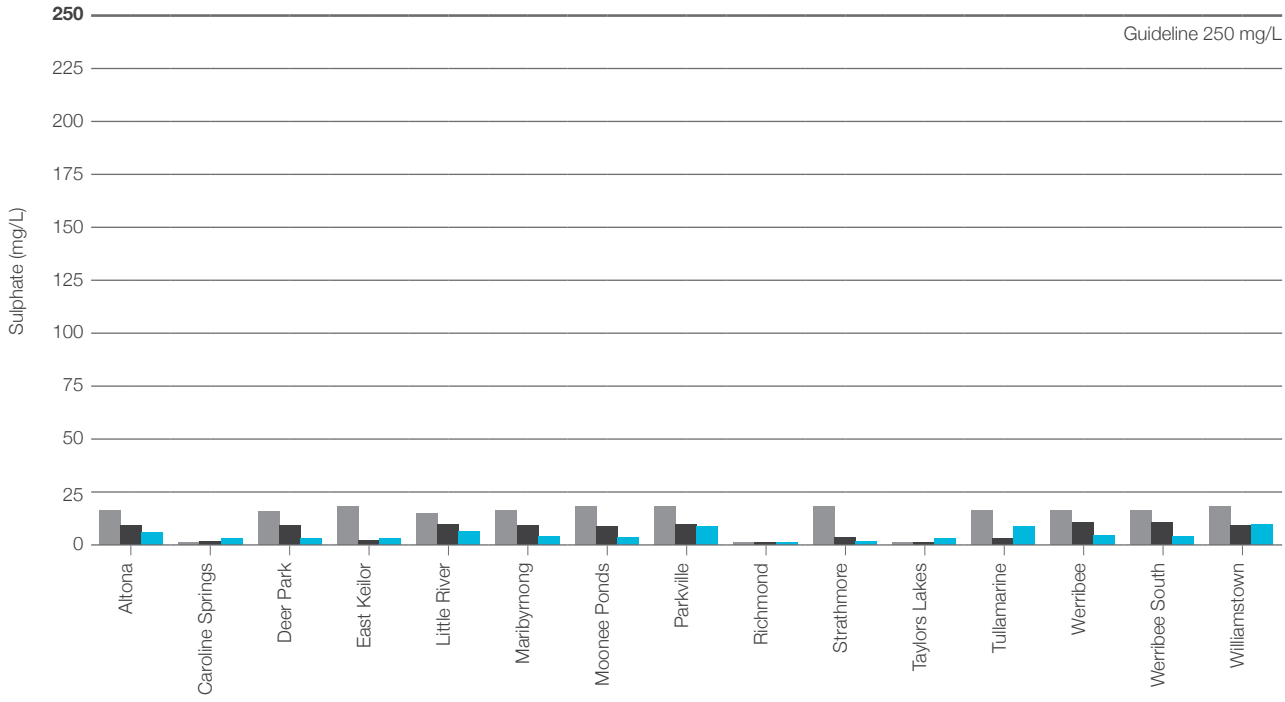
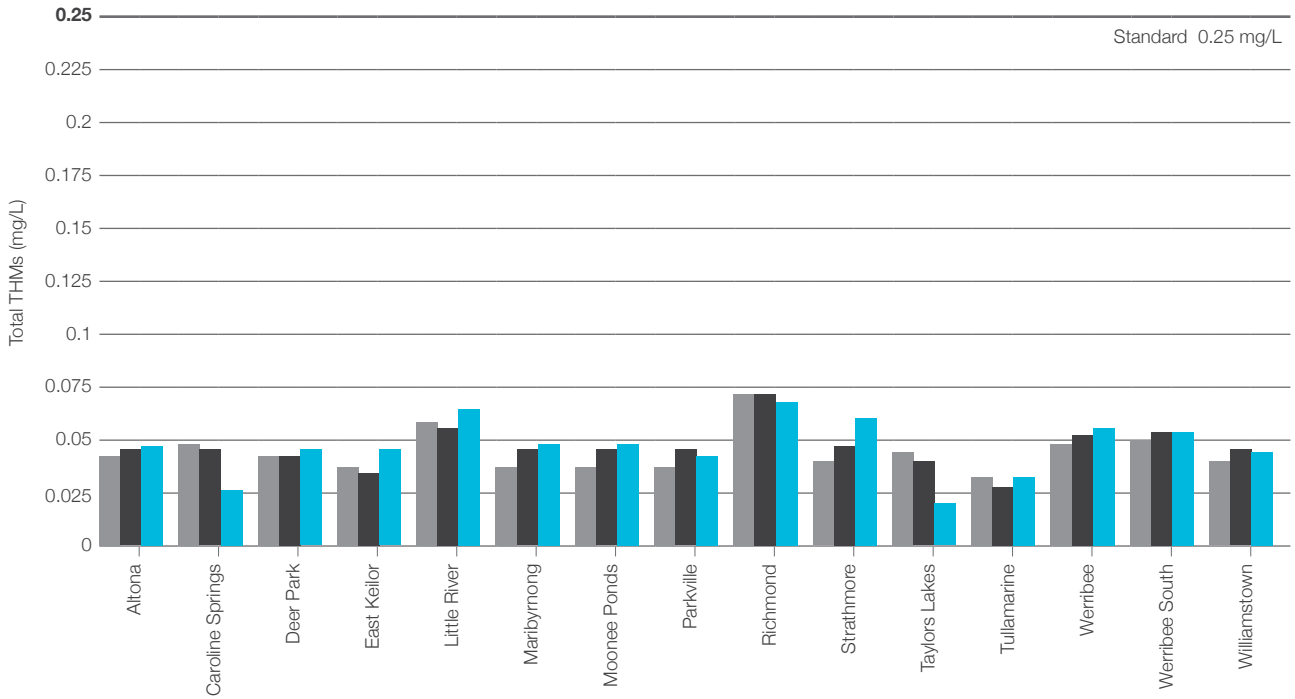


Figure B.16 Sulphate concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)



Appendix B. Spatial and time based water quality summaries (cont'd)

Figure B.17 Average total trihalomethane concentrations in water sampling localities (between 2010-2011 and 2012-2013, from left to right within each locality)



Appendix C. 2012 Risk Management Plan Regulatory Audit Certificate and opportunities for improvement

Schedule 1

Regulation 8

Safe Drinking Water Regulations 2005

RISK MANAGEMENT PLAN AUDIT CERTIFICATE

Certificate Number: 57

Audit period: 17th December 2009 to 30th April 2012

To: Ms Anne Barker
Managing Director
City West Water Limited
Locked Bag 350
Sunshine Vic 3020

Australian Business Number (ABN): 70 066 902 467

I, Dr.Pararajasegram (Dharma) Dharmabalan, after conducting a risk management plan audit of the water supplied by City West Water Limited, am of the opinion that—

City West Water Limited has complied with the obligations imposed by section 7(1) of the ***Safe Drinking Water Act* 2003** during the audit period.

Signature of approved auditor: _____

Dr.P. (Dharma) Dharmabalan

Date: 30th April 2012

RABQSA International Certified Auditor
Drinking Water QMS Scheme
Certificate Number 14555

Appendix C 2012 Risk Management Plan Regulatory Audit Certificate and opportunities for improvement (cont'd)

CWW 2012 drinking water risk management plan audit: Opportunities for improvement

ADWG Element / Component / Action	Opportunity for Improvement	Comments / Corrective Actions Undertaken
E2 / C2.1 / A2.1.4	CWW should initiate additional integrity checks on their key assets as appropriate when conditions change and keep records of reviews and field audits of the condition of water supply assets.	CWW undertakes biannual inspections of water supply tanks and associated fixtures. This work is programmed by, and recorded in CWW's electronic job scheduling and dispatch system. Extent of inspections will take into account asset condition and environment. Inspection details have commenced to be included in the records.
E2 / C2.3 / A2.3.4	CWW should be provided with data on the performance of selected water quality parameters on water leaving Melbourne Water's Winneke Treatment Plant eg. Turbidity, Ct, UV254, and Microbial)	CWW will negotiate with Melbourne Water the availability of water quality data with respect to the Winneke Treatment Plant. This item to be formally raised at the next Bulk Water Supply Agreement meeting in August 2012.
E3 / C3.1 / A3.1.1	CWW should review performance data for individual water filters at Melbourne Water's Winneke Treatment Plant. This is primarily to assess risk with respect to protozoa.	CWW will review and assess Winneke Treatment Plant filter performance data when this becomes available. This item to be formally raised at the next Bulk Water Supply Agreement meeting in August 2012.
E4 / C4.2 / A4.2.1	Include Winneke Treatment Plant performance in Melbourne Water's monthly reports.	CWW will endeavour to have the monthly reports modified. CWW will assess and document microbial (including protozoan) risks associated with Melbourne Water's Winneke Treatment Plant. This item to be formally raised at the next Bulk Water Supply Agreement meeting in August 2012.
E6 / C6.1 / A6.1.1	Improve processes for publication of water quality information to prevent data errors.	Improved processes have been implemented.
E9 / C9.2 / A9.2.1	Improve identification of source water origin to water sampling localities.	This is currently being addressed with Melbourne Water.
E10 / C10.2 / A10.2.1	Allocate appropriate staff responsibilities to prevent data errors in Annual Drinking Water Quality report.	Appropriate staff responsibilities have been allocated.

City West Water

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