



City West Water
LIMITED

ABN 70 066 902 467.

Drinking Water Quality **Report 2006**



Water
People
Life

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FROM OUR MANAGING DIRECTOR

On behalf of City West Water, I am pleased to present our eleventh Annual Drinking Water Quality Report. This report describes the quality of drinking water supplied between July 2005 and June 2006 to customers in City West Water's service area. It also provides information on related issues, such as the sources of our water supply, drinking water quality regulations, operations, research, and the water quality feedback we receive from customers.

Since July 2004 the provision of safe drinking water in Victoria has been regulated under the Safe Drinking Water Act 2003. This resulted in the establishment of Victoria-wide water quality standards and a requirement for water suppliers to prepare and implement risk management plans for the protection of water supplied to the public. The Act also stipulates water quality reporting requirements which are reflected in the content of this Annual Drinking Water Quality Report.

I am pleased to report that during 2005/2006 we continued to satisfy all applicable government drinking water standards, supplying our customers with the safe, high quality water to which they have been accustomed. For example, our *Escherichia coli* compliance rate of 100% surpassed the regulated standard of 98%.

March saw the running of the 2006 Commonwealth Games in Melbourne. As the games village and many events were located in City West Water's area, we implemented an additional water quality monitoring program to assure stakeholders of the safety of our drinking water.

The past year has also been the ninth consecutive year in which Melbourne has experienced below average rainfall in its water supply catchments. Despite the resulting moderate storage levels, our drinking water quality has continued to be unaffected.

I hope readers will find this report informative and feel reassured of the high quality drinking water supplied by City West Water.

Anne Barker
Managing Director

1. INTRODUCTION

City West Water is a company incorporated under the Corporations Act 2001 and is wholly owned by the Victorian Government, which appoints a Board of Directors charged with overseeing the business.

We operate under a water and sewerage licence issued by the Victorian Government, and provide drinking water to approximately 316,000 residential and non-residential customers in Melbourne's central business district and inner and western suburbs.

Melbourne Water provides us with a bulk water supply and associated treatment services. It 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 (called a Bulk Supply Agreement) with Melbourne Water, as well as cross business contingency plans and arrangements.

Our management of the water supply system and drinking water quality is given the highest priority.

In line with public health considerations and community expectations, we have a tradition of providing quality drinking water, renowned as among the best in the world. In 2005/2006 we retained our HACCP certification, which recognises our commitment and practices in safeguarding drinking water quality.

1.1 Characterisation of the System

We distribute the treated, high quality bulk supply to over 700,000 residents at some 316,000 properties. The water travels through an extensive distribution network consisting of over 4000 kilometres of water mains, 10 pumping stations and 7 service reservoirs and tanks. This network encompasses central and western Melbourne, ranging from inner suburban areas 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.

Figure 1.1 shows the entire 580 square kilometre City West Water licence area to which we supply drinking water. It is divided into 11 water quality localities for the purposes of water quality monitoring and reporting.

1.1.1 Source of Water

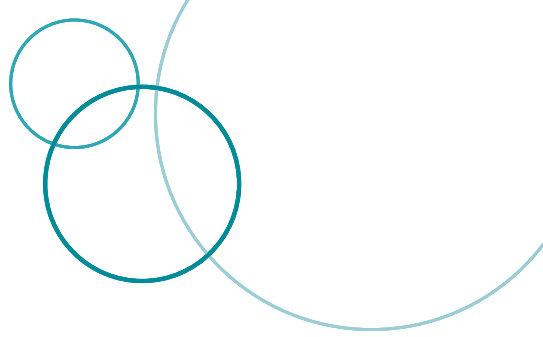
Our water originates from Melbourne's well-established water supply catchment and reservoir system, which has provided the city with a reliable, high quality water supply for many years. This extensive system, managed by Melbourne Water, is mainly to the east of Melbourne and extends as far as Thomson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

We receive 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 source 41% of our bulk supply from Silvan, 31% from Greenvale and 28% from Sugarloaf.

The supply from Silvan and Greenvale Reservoirs 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. Long storage periods (ranging between months and years) in these pristine reservoirs enhance water quality. The only active water treatment process needed for this water supply is gas chlorination and pH correction with lime.

The supply from Sugarloaf Reservoir originates from middle reaches of the Yarra River, which is an unprotected catchment surrounded by urban areas, light industries and agricultural activities. Water from the Yarra River is pumped into the reservoir, where it is stored for months before being comprehensively treated (via coagulation with alum, filtration, gas chlorination and pH correction) at Melbourne Water's nearby Winneke water treatment plant.

In addition to the bulk water gas chlorination, Melbourne Water also operates four secondary liquid chlorination plants within our area. These service the water quality localities of Werribee, St Albans, Sydenham, Altona and Werribee South.



Melbourne Water adds fluoride to all of City West Water's bulk water in line with requirements of the Victorian Health (Fluoridation) Act (1973).

The supply source(s) for each of City West Water's 11 water quality localities are listed in Table 1.1.

In contrast with historical practice and in response

to the current prolonged low rainfall period, the St Albans, East Keilor and Coburg localities have, over the past year, received significant supply from the Sugarloaf/Winneke system.

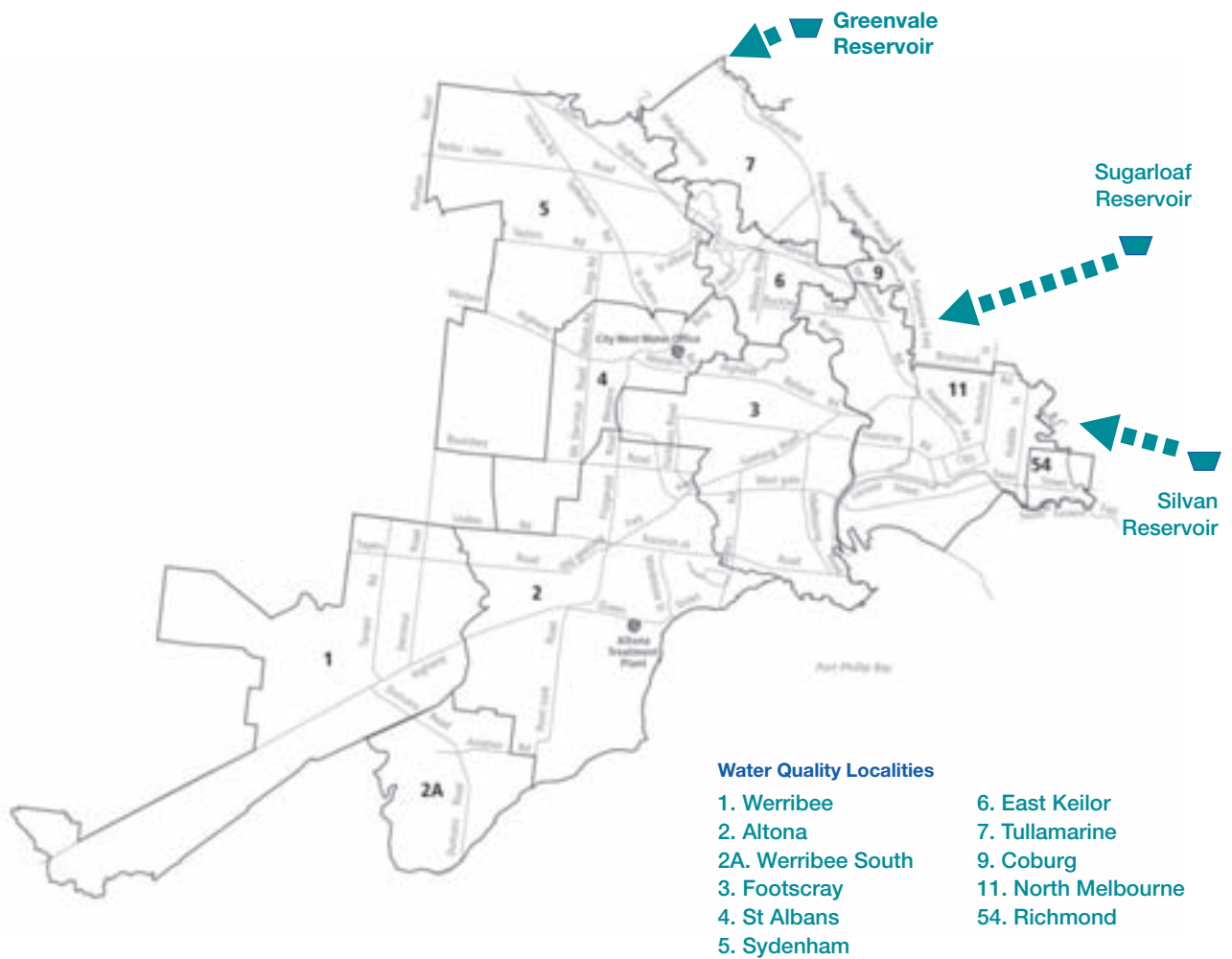


Figure 1.1

City West Water's licence area showing its 11 water quality localities and sources of bulk water supply (■■■▶)

Table 1.1 Supply sources for City West Water's water quality localities

Water quality locality	Source water reservoir	Treatment plant	Treatment process (added substances)	Population serviced (2001 census)
Werribee	Sugarloaf/Winneke Silvan Greenvale	Winneke Silvan Greenvale	Winneke treatment plant: Coagulation with alum, sand filtration, chlorination, pH correction, fluoridation (alum, chlorine gas, lime, fluoride).	79,630
Altona	Sugarloaf/Winneke Silvan Greenvale	Winneke Silvan Greenvale		43,270
Werribee South	Sugarloaf/Winneke Silvan Greenvale	Winneke Silvan Greenvale	Silvan & Greenvale treatment plants: Chlorination, pH correction, fluoridation (chlorine gas, lime, fluoride).	1,730
Footscray	Sugarloaf/Winneke Silvan	Winneke Silvan		131,360
St Albans	Sugarloaf/Winneke Silvan Greenvale	Winneke Silvan Greenvale		32,200
Sydenham	Greenvale	Greenvale		113,730
East Keilor	Sugarloaf/Winneke Silvan Greenvale	Winneke Silvan Greenvale		37,160
Tullamarine	Greenvale	Greenvale		9,920
Coburg	Sugarloaf/Winneke Silvan Greenvale	Winneke Silvan Greenvale		8,310
North Melbourne	Sugarloaf/Winneke Silvan	Winneke Silvan		148,740
Richmond	Silvan	Silvan		13,290

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

2. QUALITY MANAGEMENT SYSTEM

2.1 Water Treatment

The water quality treatment processes used for City West Water's supply are outlined in Section 1.1.1, including Table 1.1.

2.1.1 Issues

During 2005/2006 there were several instances when Melbourne Water's bulk water chlorinators temporarily ceased operation, thus allowing undisinfected water to enter the water supply system. The instances are listed in Table 2.1.

Table 2.1 Instances of bulk water chlorinator failures in 2005/2006

Chlorinator failure (date / duration)	Comments
Silvan (17 July 2005 / 1 hour)	No significant effect on City West Water due to mixing of the unchlorinated water with chlorinated supplies between Silvan and City West Water's area. No bacteriological contamination detected.
Silvan (3 October 2005 / 5 minutes)	As above.
Greenvale (14 October 2005 / <2 minutes)	No significant effect on City West Water due to short failure time and mixing of the unchlorinated water with chlorinated supplies. No bacteriological contamination detected.
Greenvale (20 October 2005 / 11 minutes)	As above.
Silvan (3 November 2005 / 25 minutes)	No significant effect on City West Water due to mixing of the unchlorinated water with chlorinated supplies between Silvan and City West Water's area. No bacteriological contamination detected.
Silvan (9 November 2005 / 2 hours)	No significant effect on City West Water due to targeted chlorine spot dosing by Melbourne Water upstream of City West Water's area. No bacteriological contamination detected.
Greenvale (25 November 2005 / 40 minutes)	No effect on City West Water as the undisinfected water was reversed back into Greenvale Reservoir.
Silvan (13 December 2005 / 1 hour 45 minutes)	No significant effect on City West Water due to mixing of the unchlorinated water with chlorinated supplies between Silvan and City West Water's area. No bacteriological contamination detected.



3. WATER QUALITY FOR 2005/2006

A significant part of our activities involves sampling and testing of the water supply. We undertake day-to-day sampling and testing of water from many locations throughout the distribution network, including from 340 purpose-built sampling fittings located at customers' properties (referred to as 'customers' taps'). Melbourne Water monitors the quality of bulk water supplies at points upstream of delivery points to City West Water. The results of these tests are scrutinised under a formal Bulk Water Supply Agreement between the two companies.

Between July 2005 and June 2006, City West Water collected and tested over 2000 microbiological and 300 physical/chemical water samples. This was undertaken on our behalf under contract by a government approved, specialised and quality certified laboratory. The extent of this monitoring was based on guidance provided in Australian Drinking Water Guidelines 2004 (ADWG 2004).

As well as guiding the design of monitoring programs, the Guidelines provide 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 (for example, the levels of chlorine, iron, fluoride, dissolved salts, aluminium, copper and other heavy metals).

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 specify water quality standards for a number of water quality parameters. The standards are as follows:

Water quality parameter	Standard
<i>Escherichia coli</i> (<i>E.coli</i>)	At least 98% of samples collected in any 12 month period to contain no <i>E.coli</i> 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	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 NTU



We monitor water quality for compliance against these standards, and also monitor for additional parameters. These additional parameters provide a more comprehensive characterisation of the water, as well as providing extra information to customers (e.g. industry, students, researchers). A detailed summary data for these parameters are provided in Appendices 1 and 2.

The Tables in this section report the 2005/2006 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 customers' taps tested between 1 July 2005 and 30 June 2006 (and 1 July 2004 to 30 June 2005)

Locality	Sampling frequency	No. of samples	<i>E.coli</i> (organisms/100mL)			% with no <i>E.coli</i>	Complying (Yes/No)
			Mean	Max.	Min.		
1. Werribee	>weekly	250 (248)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
2. Altona	>weekly	156 (155)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
2A. Werribee South	>weekly	65 (64)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
3. Footscray	>weekly	378 (379)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
4. St Albans	>weekly	130 (132)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
5. Sydenham	>weekly	353 (356)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
6. East Keilor	>weekly	146 (143)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
7. Tullamarine	>weekly	79 (79)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
9. Coburg	>weekly	80 (77)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
11. North Melbourne	>weekly	390 (394)	<1 (<1)	<1 (1)	<1 (<1)	100 (99.7)	Yes (Yes)
54. Richmond	>weekly	91 (91)	<1 (<1)	<1 (<1)	<1 (<1)	100 (100)	Yes (Yes)
Total	-	2118 (2118)	<1 (<1)	<1 (1)	<1 (<1)	100 (99.95)	Yes (Yes)

Comment: *E.coli* data demonstrate compliance with the standard (at least 98% samples with no *E.coli*) in each of City West Water's eleven water quality localities.

3.1.2 Actions in Relation to Non-Compliance

As *E. coli* was not detected in customer tap samples throughout 2005/2006, no actions were necessary.

3.2 Chlorine Based Disinfection Byproduct Chemicals

3.2.1 Results -

Chloroacetic acid

Table 3.2a Chloroacetic acid summary results in drinking water samples obtained from customers' taps tested between 1 July 2005 and 30 June 2006 (and 1 July 2004 to 30 June 2005)

Locality	Sampling frequency	No. of samples	Chloroacetic acid (mg/L)			Complying (Yes/No)
			Mean	Max.	Min.	
1. Werribee	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
2. Altona	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
2A. Werribee South	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
3. Footscray	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
4. St Albans	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
5. Sydenham	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
6. East Keilor	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
7. Tullamarine	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
9. Coburg	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
11. North Melbourne	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
54. Richmond	monthly	12 (12)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)
Total	-	132 (132)	<0.005 (<0.005)	<0.005 (<0.005)	<0.005 (<0.005)	Yes (Yes)

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

Dichloroacetic acid

Table 3.2b Dichloroacetic acid summary results in drinking water samples obtained from customers' taps tested between 1 July 2005 and 30 June 2006 (and 1 July 2004 to 30 June 2005)

Locality	Sampling frequency	No. of samples	Dichloroacetic acid (mg/L)			Complying (Yes/No)
			Mean	Max.	Min.	
1. Werribee	monthly	12 (12)	0.002 (0.003)	0.003 (0.004)	0.001 (0.001)	Yes (Yes)
2. Altona	monthly	12 (12)	0.001 (0.002)	0.002 (0.003)	<0.001 (0.001)	Yes (Yes)
2A. Werribee South	monthly	12 (12)	<0.001 0.002	0.002 (0.003)	<0.001 (<0.001)	Yes (Yes)
3. Footscray	monthly	12 (12)	0.001 (0.002)	0.002 (0.003)	0.001 (<0.001)	Yes (Yes)
4. St Albans	monthly	12 (12)	0.003 (0.004)	0.004 (0.008)	0.002 (0.001)	Yes (Yes)
5. Sydenham	monthly	12 (12)	0.004 (0.005)	0.008 (0.012)	0.001 (0.002)	Yes (Yes)
6. East Keilor	monthly	12 (12)	0.003 (0.004)	0.006 (0.006)	0.001 (0.002)	Yes (Yes)
7. Tullamarine	monthly	12 (12)	0.003 (0.004)	0.006 (0.007)	0.001 (0.002)	Yes (Yes)
9. Coburg	monthly	12 (12)	0.002 (0.002)	0.011 (0.003)	0.001 (<0.001)	Yes (Yes)
11. North Melbourne	monthly	12 (12)	0.001 (0.003)	0.002 (0.005)	<0.001 (0.001)	Yes (Yes)
54. Richmond	monthly	12 (12)	0.002 (0.002)	0.003 (0.003)	<0.001 (<0.001)	Yes (Yes)
Total	-	132 (132)	0.002 (0.003)	0.011 (0.012)	<0.001 (<0.001)	Yes (Yes)

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

Trichloroacetic acid**Table 3.2c Trichloroacetic acid summary results in drinking water samples obtained from customers' taps tested between 1 July 2005 and 30 June 2006 (and 1 July 2004 to 30 June 2005)**

Locality	Sampling frequency	No. of samples	Trichloroacetic acid (mg/L)			Complying (Yes/No)
			Mean	Max.	Min.	
1. Werribee	monthly	12 (12)	0.006 (0.010)	0.012 (0.021)	0.004 (0.006)	Yes (Yes)
2. Altona	monthly	12 (12)	0.003 (0.006)	0.006 (0.011)	<0.001 (0.002)	Yes (Yes)
2A. Werribee South	monthly	12 (12)	0.003 (0.004)	0.005 (0.009)	<0.001 (<0.001)	Yes (Yes)
3. Footscray	monthly	12 (12)	0.004 (0.006)	0.008 (0.012)	0.002 (0.002)	Yes (Yes)
4. St Albans	monthly	12 (12)	0.006 (0.011)	0.015 (0.028)	(0.003 0.005	Yes (Yes)
5. Sydenham	monthly	12 (12)	0.009 (0.011)	0.015 (0.016)	0.003 (0.005)	Yes (Yes)
6. East Keilor	monthly	12 (12)	0.004 (0.007)	0.009 (0.011)	0.002 (0.003)	Yes (Yes)
7. Tullamarine	monthly	12 (12)	0.004 (0.007)	0.008 (0.012)	0.002 (0.003)	Yes (Yes)
9. Coburg	monthly	12 (12)	0.006 (0.004)	0.028 (0.008)	0.003 (0.002)	Yes (Yes)
11. North Melbourne	monthly	12 (12)	0.003 (0.006)	0.004 (0.014)	0.001 (<0.005)	Yes (Yes)
54. Richmond	monthly	12 (12)	0.008 (0.007)	0.020 (0.014)	<0.001 (0.002)	Yes (Yes)
Total	-	132 (132)	0.005 (0.007)	0.028 (0.028)	<0.001 (<0.001)	Yes (Yes)

Comment: Trichloroacetic acid data demonstrate compliance with the standard (0.1 mg/L) in each of City West Water's eleven water quality localities.

Total trihalomethanes**Table 3.2d Trihalomethanes summary results in drinking water samples obtained from customers' taps tested between 1 July 2005 and 30 June 2006 (and 1 July 2004 to 30 June 2005)**

Locality	Sampling frequency	No. of samples	Total trihalomethanes (mg/L)			Complying (Yes/No)
			Mean	Max.	Min.	
1. Werribee	monthly	12 (12)	0.042 (0.048)	0.058 (0.072)	0.033 (0.031)	Yes (Yes)
2. Altona	monthly	12 (12)	0.032 (0.041)	0.045 (0.062)	0.027 (0.022)	Yes (Yes)
2A. Werribee South	monthly	12 (12)	0.032 (0.042)	0.046 (0.060)	0.014 (0.032)	Yes (Yes)
3. Footscray	monthly	12 (13)	0.032 (0.039)	0.043 (0.055)	0.028 (0.025)	Yes (Yes)
4. St Albans	monthly	12 (12)	0.034 (0.039)	0.045 (0.060)	0.022 (0.031)	Yes (Yes)
5. Sydenham	monthly	12 (12)	0.034 (0.037)	0.046 (0.057)	0.026 (0.026)	Yes (Yes)
6. East Keilor	monthly	12 (12)	0.028 (0.030)	0.039 (0.047)	0.020 (0.019)	Yes (Yes)
7. Tullamarine	monthly	12 (12)	0.027 (0.030)	0.036 (0.048)	0.016 (0.018)	Yes (Yes)
9. Coburg	monthly	12 (12)	0.035 (0.044)	0.057 (0.073)	0.018 (0.032)	Yes (Yes)
11. North Melbourne	monthly	12 (12)	0.032 (0.043)	0.041 (0.053)	0.027 (0.030)	Yes (Yes)
54. Richmond	monthly	12 (12)	0.052 (0.066)	0.075 (0.090)	0.035 (0.047)	Yes (Yes)
Total	-	132 (132)	0.035 (0.041)	0.075 (0.090)	0.014 (0.018)	Yes (Yes)

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

3.2.2 Actions in Relation to Non-Compliance

With 100% compliance, no actions were necessary.

3.3 Ozone Based Disinfection Byproduct Chemicals

3.3.1 Results

The Safe Drinking Water Regulations 2005 refer to two ozone based disinfection byproduct chemicals: bromate and formaldehyde. The two chemicals were not monitored on a regular basis for compliance purposes as City West Water's water supply is not treated with ozone (refer 2.1). Nevertheless, an annual customer tap water sample from each of the eleven water quality localities was tested during May 2006. All eleven results for both bromate and formaldehyde were <0.01 mg/L, thus being within the respective standards of 0.02 mg/L and 0.5 mg/L.

3.3.2 Actions in Relation to Non-Compliance

As neither bromate nor formaldehyde were detected, no actions were necessary.

3.4 Aluminium

3.4.1 Results

Table 3.3 Aluminium summary results in drinking water samples obtained from customers' taps tested between 1 July 2005 and 30 June 2006 (and 1 July 2004 to 30 June 2005)

Locality	Sampling frequency	No. of samples	Acid soluble aluminium (mg/L)			Complying (Yes/No)
			Mean	Max.	Min.	
1. Werribee	monthly	12 (12)	0.02 (<0.01)	0.06 (0.02)	<0.01 (<0.01)	Yes (Yes)
2. Altona	monthly	12 (12)	0.02 (0.01)	0.06 (0.03)	<0.01 (<0.01)	Yes (Yes)
2A. Werribee South	monthly	12 (12)	0.01 (0.02)	0.04 (0.05)	<0.01 (<0.01)	Yes (Yes)
3. Footscray	fortnightly	25 (26)	0.02 (0.01)	0.06 (0.04)	<0.01 (<0.01)	Yes (Yes)
4. St Albans	monthly	12 (12)	0.02 (0.01)	0.05 (0.04)	<0.01 (<0.01)	Yes (Yes)
5. Sydenham	monthly	12 (12)	0.02 (0.03)	0.05 (0.07)	<0.01 (<0.01)	Yes (Yes)
6. East Keilor	monthly	13 (12)	0.02 (0.02)	0.08 (0.15)	<0.01 (<0.01)	Yes (Yes)
7. Tullamarine	monthly	13 (12)	0.01 (0.02)	0.04 (0.05)	<0.01 (<0.01)	Yes (Yes)
9. Coburg	monthly	13 (12)	0.02 (0.02)	0.06 (0.04)	<0.01 (<0.01)	Yes (Yes)
11. North Melbourne	fortnightly	25 (26)	0.02 (0.01)	0.07 (0.04)	<0.01 (<0.01)	Yes (Yes)
54. Richmond	monthly	12 (12)	0.02 (0.03)	0.05 (0.08)	<0.01 (<0.01)	Yes (Yes)
Total	-	161 (160)	0.02 (0.02)	0.08 (0.15)	<0.01 (<0.01)	Yes (Yes)

Comment: Acid soluble aluminium data demonstrate compliance with the standard (0.2 mg/L) in each of City West Water's eleven water quality 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 2005 and 30 June 2006 (and 1 July 2004 to 30 June 2005)

Locality	Sampling frequency	No. of samples	Turbidity (NTU)			Complying (Yes/No)
			95% UCL of mean#	Max.	Min.	
1. Werribee	weekly	53 (52)	0.6 (0.5)	1.3 (1.1)	0.1 (0.1)	Yes (Yes)
2. Altona	weekly	52 (52)	0.4 (0.4)	0.8 (1.2)	0.1 (0.1)	Yes (Yes)
2A. Werribee South	weekly	53 (51)	0.5 (0.4)	1.1 (0.9)	0.1 (0.1)	Yes (Yes)
3. Footscray	weekly	52 (52)	0.5 (0.4)	1.1 (1.7)	0.1 (0.1)	Yes (Yes)
4. St Albans	weekly	52 (53)	0.8 (0.7)	3.3 (1.6)	0.1 (0.1)	Yes (Yes)
5. Sydenham	weekly	52 (52)	1.3 (1.2)	9.6 (5.4)	0.1 (0.1)	Yes (Yes)
6. East Keilor	weekly	53 (52)	0.8 (1.3)	3.8 (11)	0.1 (1.1)	Yes (Yes)
7. Tullamarine	weekly	53 (51)	0.8 (1.0)	2.4 (3.4)	0.1 (0.1)	Yes (Yes)
9. Coburg	weekly	54 (50)	0.5 (0.5)	1.1 (1.0)	0.1 (0.1)	Yes (Yes)
11. North Melbourne	weekly	147* (52)	0.4 (0.4)	1.7 (1.0)	0.1 (0.1)	Yes (Yes)
54. Richmond	weekly	52 (53)	0.7 (0.8)	1.5 (1.4)	0.1 (0.2)	Yes (Yes)
Total	-	673 (570)	0.6 (0.6)	9.6 (11)	0.1 (0.1)	Yes (Yes)

Comment: Turbidity data demonstrate compliance with the standard in each of City West Water's eleven water quality localities (#95% upper confidence limit of mean not to exceed 5.0 NTU). * additional monitoring during March 2006 (Commonwealth Games).

3.5.2 Actions in Relation to Non-Compliance

With 100% compliance, no actions were necessary.

3.6 Other Algae, Pathogen, Chemical or Substance Not Specified Above That May Pose a Risk to Human Health

3.6.1 Results

In addition to the water quality parameters designated as standards by the Safe Drinking Water Regulations 2005, City West Water also monitors a range of other microbiological and chemical parameters that provide further information on the overall quality of our drinking water supply. Among these other parameters monitored in 2005/2006, those that potentially represent a health risk (if present above ADWG 2004 health guideline levels), are listed in Table 3.5.

Table 3.5 Potential health risk water quality parameters monitored during 2005/2006

Parameter	Frequency of testing	Results
Microbiological		
<i>Vibrio spp.</i>	3 to 4 samples per month	Not detected
<i>Shigella spp.</i>		
<i>Yersinia spp.</i>		
<i>Salmonella spp.</i>		
<i>Campylobacter spp.</i>		
<i>Giardia spp.</i>		
<i>Cryptosporidium spp.</i>		
Norwalk virus		
Adeno virus		
Hepatitis A virus		
Rotavirus		
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	at least monthly 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)

Further details of monitoring results for manganese, lead, copper, arsenic and fluoride are contained in Table 3.6.

Table 3.6 Detailed monitoring results for manganese, lead, copper, arsenic and fluoride during 2005/2006

Water sampling locality	Parameter	Sampling frequency	No. of samples	Maximum (mg/L)	Minimum (mg/L)	Complying* (Yes/No)
Werribee	Manganese	fortnightly	26	0.02	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	<0.004	<0.004	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	fortnightly	26	1.00	0.78	Yes
Altona	Manganese	fortnightly	26	0.02	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	<0.004	<0.004	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	fortnightly	26	1.07	0.71	Yes
Werribee South	Manganese	monthly	13	<0.01	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	<0.004	<0.004	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	monthly	13	0.98	0.77	Yes
Footscray	Manganese	fortnightly	26	0.01	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	0.015	0.015	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	fortnightly	26	1.01	0.74	Yes
St Albans	Manganese	fortnightly	26	<0.01	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	0.024	0.024	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	fortnightly	26	1.00	0.75	Yes
Sydenham	Manganese	fortnightly	26	0.03	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	<0.004	<0.004	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	fortnightly	26	1.00	0.77	Yes
East Keilor	Manganese	fortnightly	26	0.03	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	0.032	0.032	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	fortnightly	26	1.08	0.70	Yes
Tullamarine	Manganese	fortnightly	26	<0.01	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	<0.004	<0.004	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	fortnightly	26	1.00	0.74	Yes
Coburg	Manganese	monthly	13	0.01	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	<0.004	<0.004	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	monthly	13	1.04	0.82	Yes
North Melbourne	Manganese	fortnightly	121#	0.03	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	<0.004	<0.004	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	fortnightly	26	0.99	0.73	Yes
Richmond	Manganese	fortnightly	26	0.01	<0.01	Yes
	Lead	annually	1	<0.001	<0.001	Yes
	Copper	annually	1	<0.004	<0.004	Yes
	Arsenic	annually	1	<0.001	<0.001	Yes
	Fluoride	fortnightly	26	1.00	0.79	Yes

* against health-related guideline values in ADWG 2004. # additional monitoring during March 2006 (Commonwealth Games).

3.6.2 Actions in Relation to Non-Compliance

No actions were necessary as no instances were recorded where levels of health-related water quality parameters tested did not satisfy ADWG 2004 guideline values.

3.7 Aesthetics

3.7.1 Results

A comprehensive range of monitoring data for individual localities, together with monitoring frequencies, Victorian standards and ADWG guidelines for both health-related and aesthetic water quality data, is contained in Appendix A.

Monitoring results for water pH, colour and hardness are also shown in Table 3.7. Note that City West Water's colour tests are undertaken as apparent colour whilst the ADWG 2004 guideline refers to true colour. Due to omission of a filtering stage 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 2004 guideline is assured in all cases where apparent colour levels are within the guideline.

Table 3.7 Detailed monitoring results for pH, apparent colour and hardness during 2005/2006

Water sampling locality	Parameter	Sampling frequency	No. of samples	Maximum*	Minimum*
Werribee	pH	>fortnightly	39	9.2	7.0
	apparent colour	monthly	13	3	<2
	hardness	annually	1	28	28
Altona	pH	fortnightly	26	9.2	7.1
	apparent colour	monthly	13	3	<2
	hardness	annually	1	27	27
Werribee South	pH	monthly	13	8.2	7.4
	apparent colour	monthly	13	3	<2
	hardness	annually	1	29	29
Footscray	pH	fortnightly	26	7.6	7.1
	apparent colour	fortnightly	26	5	<2
	hardness	annually	1	27	27
St Albans	pH	fortnightly	26	9.2	7.2
	apparent colour	monthly	13	4	2
	hardness	annually	1	25	25
Sydenham	pH	>fortnightly	40	9.5	7.0
	apparent colour	monthly	13	4	<2
	hardness	annually	1	26	26
East Keilor	pH	fortnightly	26	8.1	7.1
	apparent colour	monthly	13	4	<2
	hardness	annually	1	26	26
Tullamarine	pH	fortnightly	26	9.4	7.1
	apparent colour	monthly	13	5	<2
	hardness	annually	1	26	26
Coburg	pH	monthly	13	8.0	7.3
	apparent colour	monthly	13	6	<2
	hardness	annually	1	23	23
North Melbourne	pH	fortnightly	121#	7.6	7.2
	apparent colour	fortnightly	121#	7	<2
	hardness	annually	1	26	26
Richmond	pH	fortnightly	26	9.7	7.2
	apparent colour	monthly	13	6	<2
	hardness	annually	1	23	23

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

additional monitoring during March 2006 (Commonwealth Games).

All 2005/2006 water colour and hardness monitoring data showed full compliance with the respective ADWG 2004 guideline levels of 15 PCU and 200 mg/L. However, there were instances where pH readings exceeded the ADWG 2004 maximum guidelines of 8.5 and 9.2 (the latter being applicable in areas containing cement lined water mains). All of these elevated pH instances were associated with 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 remedial treatment would be quite complex and would involve adding chemicals to Melbourne's water supply, with uncertain benefits.

A 2000 joint water industry study by researchers at Melbourne's Alfred Hospital concluded 'there was no indication of the health effects on skin for weakly buffered water, such as 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 for such water:

- 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.

Despite these findings, City West Water has a policy of avoiding, where possible, the construction of new water mains with cement linings.

3.8 Analysis of Results

This section of the report examines (a) trends over time of water quality parameters tested which are designated as standards by the Safe Drinking Water Regulations 2005 and (b) trends over time and between localities of parameters listed in Appendix A tables that have a corresponding Victorian standard or ADWG 2004 guideline.

3.8.1 Historical Compliance of “Standard” Parameters

Table 3.8 summarises trends over time (and extent of compliance) of water quality parameters designated as standards by the Safe Drinking Water Regulations 2005.

Table 3.8 Compliance time trends of “standard” parameters

Parameter	Standard (2005 Regulations)	Localities compliant (% of customers supplied with compliant water)		
		2005/2006	2004/2005	2003/2004
<i>E. coli</i>	<1 in 98% samples	11 / 11 (100%)	11 / 11 (100%)	11 / 11 (100%)
Chloroacetic acid	0.15 mg/L	11 / 11 (100%)	11 / 11 (100%)	Not tested
Dichloroacetic acid	0.1 mg/L	11 / 11 (100%)	11 / 11 (100%)	Not tested
Trichloroacetic acid	0.1 mg/L	11 / 11 (100%)	11 / 11 (100%)	Not tested
Trihalomethanes	0.25 mg/L	11 / 11 (100%)	11 / 11 (100%)	11 / 11 (100%)
Bromate	0.02 mg/L	11 / 11 (100%)	Not tested	Not tested
Formaldehyde	0.5 mg/L	11 / 11 (100%)	Not tested	Not tested
Aluminium	0.2 mg/L	11 / 11 (100%)	11 / 11 (100%)	10 / 11 (99.7%)#
Turbidity	95% UCL of mean <= 5.0 NTU*	11 / 11 (100%)	11 / 11 (100%)	11 / 11 (100%)

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

Determined from population numbers in Appendix A tables. In this case one aluminium test result (0.36 mg/L) from the Werribee South locality exceeded the standard. This elevated reading was unique in that it was unprecedented and has not re-occurred.

3.8.2 Parameter Trends Over Time and Between Localities

This section of the report provides a five year overview of drinking water quality in City West Water’s 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 2004 guideline and have been monitored for at least the last three years. Graphical representations of trends are contained in Appendix B and briefly discussed below.

E. coli (refer Figure A2.1 in Appendix B)

Detections of *E. coli* are infrequent, as shown by only three instances (out of 9,500 tests) in the last five years. As a result, *E. coli* performance in our drinking water has consistently complied with required standards in all water quality localities, including the current Victorian standard requiring “at least 98% of samples collected in any 12 months period to contain no *E. coli* per 100mL”.

Free Chlorine (refer Figure A2.2 in Appendix B)

Free chlorine levels have been well within the maximum guideline level of 5 mg/L in all water quality localities. Nevertheless, there are marked differences between the localities. These can be classified into two groups, namely a “moderate” group (Werribee, St Albans, Sydenham, East Keilor and Tullamarine localities) and a “low” group (Altona, Werribee South, Footscray, Coburg, North Melbourne and Richmond localities). The two groups correspond with distance from chlorine dosing. For example, in the “moderate” group, Sydenham, East Keilor and Tullamarine localities are close to chlorination at Greenvale Reservoir, whilst the Werribee and St Albans localities are served by secondary re-chlorination plants. The localities in the “low” group are relatively remote from respective chlorination plants at Silvan, Sugarloaf/Winneke and Greenvale Reservoirs, as well as the St Albans re-chlorination plant.

Aluminium (refer Figure A2.3 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 Sugarloaf/Winneke Reservoir/Treatment Plant, yet the water quality localities generally receiving water from this source (North Melbourne, Footscray, Altona, Werribee) do not exhibit higher aluminium levels as compared with the 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 levels.

Chloride (refer Figure A2.4 in Appendix B)

Chloride levels are quite low and relatively consistent within each water quality locality. Historically higher levels in the Werribee, Altona, Werribee South, Footscray, Coburg and North Melbourne water quality localities are consistent with their bulk water supply including the higher chloride Sugarloaf/Winneke source. Increased chloride levels in other localities in 2005/2006 resulted from increased supply to City West Water's area from Sugarloaf/Winneke in response to the current prolonged low rainfall period.

Colour (refer Figure A2.5 in Appendix B)

ADWG 2004 refers to True Colour of water, however City West Water has continued the historical practice of measuring the more conservative Apparent Colour, which gives higher readings. Nevertheless, our Apparent Colour levels have been within ADWG 2004's True Colour guideline of 15 PCU. Overall, slightly higher colour levels in the St Albans, Sydenham, East Keilor, Tullamarine and Richmond water quality localities are consistent with their source water including the relatively more highly coloured water from Silvan Reservoir. Instances of decreased colour levels since 2000/2001 are attributable to partial substitution of the Silvan supply with less coloured Sugarloaf/Winneke water, as a means to optimise use of reservoirs during the current prolonged low rainfall period.

Electrical Conductivity – EC – (refer Figure A2.6 in Appendix B)

City West Water measures EC as a surrogate for Total Dissolved Solids (TDS). ADWG 2004 advises that its TDS guideline level of 500 mg/L can be substituted by an EC level of approximately 1,000 us/cm. EC levels are quite low and relatively consistent within each water quality locality. Higher overall levels in the Werribee, Altona, Werribee South, Footscray, Coburg and North Melbourne water quality localities are consistent with their bulk water supply including the higher EC Sugarloaf/Winneke source.

Copper (refer Figure A2.7 in Appendix B)

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

Fluoride (refer Figure A2.8 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 A2.9 in Appendix B)

Water hardness levels are quite low and relatively consistent within each water quality locality. Higher overall levels in the Werribee, Altona, Werribee South, Footscray, Coburg and North Melbourne water quality localities are consistent with their bulk water supply including the higher hardness Sugarloaf/Winneke source. Increased chloride levels in other localities in 2005/2006 resulted from increased supply to City West Water's area from Sugarloaf/Winneke in response to the current prolonged low rainfall period.

Iron (refer Figure A2.10 in Appendix B)

Overall, slightly higher iron levels in the St Albans, Sydenham, East Keilor, Tullamarine and Richmond water quality localities are consistent with their source water including the relatively greater iron containing water from Silvan Reservoir. As with water colour, instances of decreased iron levels since 2000/2001 are attributable to partial substitution of the Silvan supply with lower iron Sugarloaf/Winneke water, as a means to optimise use of reservoirs during the current prolonged low rainfall period.

Manganese (refer Figure A2.11 in Appendix B)

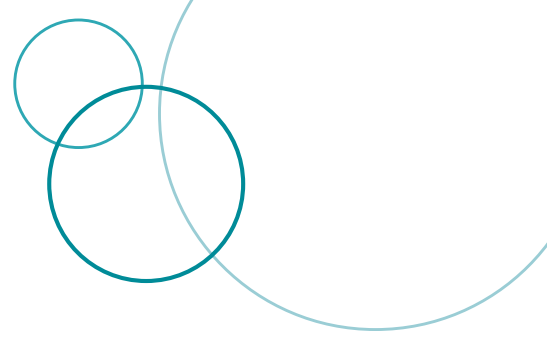
Manganese levels in the water supply are low and consistently well within the guidelines. Neither spatial nor chronological trends are apparent.

Nitrate (refer Figure A2.12 in Appendix B)

Nitrate levels are quite low and relatively consistent within each water quality locality. Higher overall levels in the Werribee, Altona, Werribee South, Footscray, Coburg and North Melbourne water quality localities are consistent with their bulk water supply including the higher nitrate Sugarloaf/Winneke source. Increased nitrate levels in other localities in 2005/2006 resulted from increased supply to City West Water's area from Sugarloaf/Winneke in response to the current prolonged low rainfall period.

pH (refer Figure A2.13 in Appendix B)

Average water pH levels have been approximately 7.5 in most water quality localities, apart from Werribee, Altona and Werribee South. Higher readings in these three localities are due to a combination of relative remoteness from primary treatment and consequential longer residence times in pipes with cement linings. City West Water's policy of avoiding, where possible, the use of cement-lined new water mains appears to have contributed to a fall in average pH readings in these three localities. Elevated water pH is discussed in Section 3.7.1.



Sodium (refer Figure A2.14 in Appendix B)

Sodium levels are quite low and relatively consistent within each water quality locality. Higher overall levels in the Werribee, Altona, Werribee South, Footscray, Coburg and North Melbourne water quality localities are consistent with their bulk water supply including the higher sodium Sugarloaf/Winneke source.

Turbidity (refer Figure A2.15 in Appendix B)

Overall higher turbidity levels in the St Albans, Sydenham, East Keilor, Tullamarine and Richmond water quality localities are consistent with their source water including the relatively higher turbidity water from Silvan and Greenvale Reservoirs.

Overall, increased turbidities between 2000/2001 and 2002/2003 followed by decrease, reflect a similar pattern in bulk supplies. Note that the 2004/2006 summary turbidity levels are not strictly comparable with those of previous years.

Sulphate (refer Figure A2.16 in Appendix B)

Sulphate levels are quite low and relatively consistent within each water quality locality. Higher overall levels in the Werribee, Altona, Werribee South, Footscray, Coburg and North Melbourne water quality localities are consistent with their bulk water supply including the higher sulphate Sugarloaf/Winneke source. Increased sulphate levels in other localities in 2005/2006 resulted from increased supply to City West Water's area from Sugarloaf/Winneke in response to the current prolonged low rainfall period.

Total Trihalomethanes – THMs –

(refer Figure A2.17 in Appendix B)

THM concentrations are relatively consistent amongst water quality localities, except for higher levels in Richmond. This may be related to Richmond being the only locality to receive 100% of its supply from Silvan Reservoir. Generally reduced THM levels in most localities in 2004-2006 could be due to corresponding less emphasis on maintaining chlorine residuals, in line with total coliforms having been removed as a regulated parameter.

Chloroacetic Acids

A discussion of trends at this stage would be premature in the context of these parameters only having been monitored in 2004-2006. The readings in the water supply are low and consistently well within the benchmark standards (refer Section 3.2.1).

4. Emergency/incident management

This section outlines events involving actual or potential adverse changes in water supply quality during 2005/2006, including those that were reported to Victoria's Department of Human Services.

4.1 Emergencies/Events

- Discoloured water: October 2005

Between 14 and 18 October 2005, a group of 37 related customer complaints were received of "dirty"/white water in the areas of Fitzroy, Carlton, North Melbourne, Footscray and Altona. The origin of this event was traced back to the bulk water supply, specifically at Melbourne Water's Preston Reservoir, where works were being undertaken to modify the Reservoir's outlets. Partial shut-down of local water mains led to entrapment of air in the water supply from the Reservoir. Associated variable flows caused re-suspension of natural sediments in the mains. We were assured by Melbourne Water that no external contamination had taken place and that public health had not been compromised. Melbourne Water has since modified its shut-down procedures to mitigate the possibility of a future similar event.

- Taste/odour: January-February 2006

Between 30 January and 4 February 2006, a group of 159 related customer complaints were received of unpleasant tasting and odorous water in the areas of Airport West, Avondale Heights, Keilor East, Essendon, Niddrie and St Albans. The origin of this event was traced to an adverse change in bulk supply water quality within the southern portion of Melbourne Water's Greenvale-St Albans water main. Comprehensive water quality testing at the time did not show a causal factor. The taste/odour issue has been successfully addressed by Melbourne Water increasing flow rates in the main. In addition, a new chlorine dosing station has been commissioned to assist in mitigating future possible related taste/odour instances.

This is a repeat of a similar event that took place in February 2005. In both cases Melbourne Water discounted the possibility of external contamination. Follow-up investigations have indicated that the unpleasant taste/ odour may be related to the main's internal lining during periods of low water flows. Melbourne Water is scheduled to inspect and test the main's internal lining in September 2006. In the meantime, high flow rates are being maintained to eliminate the taste/odour issue.



This event was reported to the Department of Human Services on 2 February 2006.

- *E. coli* was detected at two of City West Water's service reservoirs as follows:
 - Holden Reservoir, 30 January 2006 (5 *E. coli* /100mL),
 - Werribee South Reservoir, 18 April 2006 (2 *E. coli* /100mL).

Both reservoirs were not in service at the time of these detections and *E. coli* was not detected in customer

supplies. The reservoirs were kept isolated until thoroughly cleaned in June 2006.

The detections were reported to the Department of Human Services on 31 January and 19 April 2006, respectively.

- During 2005/2006 there were several instances when Melbourne Water's bulk water chlorinators temporarily ceased operation, thus allowing undisinfected water to enter the water supply system. The instances are as follows:

Chlorinator failure (date / duration)	Comments
Silvan (17 July 2005 / 1 hour)	No significant effect on City West Water due to mixing of the unchlorinated water with chlorinated supplies between Silvan and City West Water's area. No bacteriological contamination detected.
Silvan (3 October 2005 / 5 minutes)	As above.
Greenvale (14 October 2005/ <2 minutes)	No significant effect on City West Water due to short failure time and mixing of the unchlorinated water with chlorinated supplies. No bacteriological contamination detected.
Greenvale (20 October 2005 / 11 minutes)	As above.
Silvan (3 November 2005 / 25 minutes)	No significant effect on City West Water due to mixing of the unchlorinated water with chlorinated supplies between Silvan and City West Water's area. No bacteriological contamination detected.
Silvan (9 November 2005 / 2 hours)	No significant effect on City West Water due to targeted chlorine spot dosing by Melbourne Water upstream of City West Water's area. No bacteriological contamination detected.
Greenvale (25 November 2005 / 40 minutes)	No effect on City West Water as the undisinfected water was reversed back into Greenvale Reservoir.
Silvan (13 December 2005 / 1 hour 45 minutes)	No significant effect on City West Water due to targeted chlorine spot dosing by Melbourne Water upstream of City West Water's area. No bacteriological contamination detected.

5. 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. City West Water does not manage any water supplies that have been declared as Regulated Water.

City West Water, in certain cases however, does supply water from its 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, albeit that City West Water endeavours to maintain these.

6. Complaints

6.1 Water Quality Related Customer Complaints in 2005/2006

In 2005/2006, City West Water received 453 complaints related to water supply quality. The various categories of complaints were distributed as shown in Table 6.1.

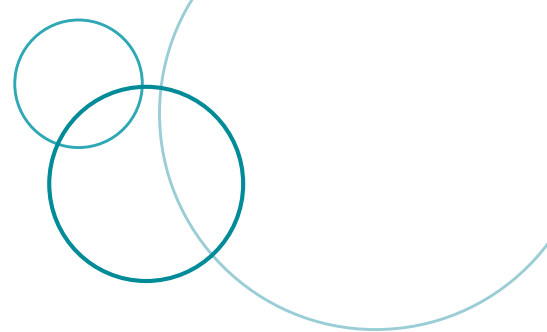


Table 6.1 Water quality related customer complaints received in 2005/2006

Complaint category	Number of complaints	No. of complaints per 100 customers supplied*
Discoloured water	168	0.053
Suspected illness	3	0.001
Air in water	38	0.012
Blue-green water	9	0.003
Taste/odour	232	0.073
Other	3	0.001

* number of customers (properties) at 30 June 2006 determined as 316,000.

The 2005/2006 numbers of water quality related complaints per 100 customers (properties) in each locality are shown in Table 6.2.

Table 6.2 Water quality related customer complaints per 100 customers (properties) in 2005/2006

Locality	Number of complaints	No. of complaints per 100 customers supplied*
Werribee	38	0.1
Altona	24	0.1
Werribee South	2	0.2
Footscray	32	<0.1
St Albans	87	0.5
Sydenham	67	0.1
East Keilor	96	0.5
Tullamarine	17	0.3
Coburg	3	<0.1
North Melbourne	77	0.1
Richmond	10	0.2

* Calculated as follows (e.g. Werribee locality):

Total no. of customers = 316,000 (refer Table 6.1)

From population data in Appendix A, no. of customers in Werribee locality estimated as

$(79,633 / 619,352) \times 316,000 = 40,630$. Thus, complaints / 100 customers = $(38 / 40,630) \times 100 = 0.1$

A historical comparison of water quality related complaints received over the last five years is contained in Table 6.3.

Table 6.3 Water quality related customer complaints received over the last five years

Complaint category	Number received in 2005–2006	Number received in 2004–2005	Number received in 2003–2004	Number received in 2002–2003	Number received in 2001–2002
Discoloured water	168	149	127	173	273
Suspected illness	3	2	1	2	7
Air in water	38	17	19	23	51
Blue-green water	9	10	13	32	72
Taste/odour	232 (17 chlorine)*	226 (11 chlorine)*	71 (15 chlorine)*	83 (22 chlorine)*	103 (42 chlorine)*
Other	3 (blocked filters)	-	-	-	-
Total	453	404	231	313	506
No. of properties	316,000	307,000	295,000	290,000	279,000
Complaints per 100 properties	0.14	0.13	0.078	0.11	0.18

* Number of complaints received about chlorine taste or odour.

Note: City West Water's brochure 'Providing safe, clean drinking water' contains background information on various complaint types. For a copy of the brochure, please call 13 16 91.

The increased number/rate of complaints since 2003/2004 has been due to water quality events associated with Melbourne Water's bulk supply. For example, additional complaints received due to issues with the bulk water supply were 174 in 2004/2005 and 196 in 2005/2006 (refer Section 4.1).

6.2 Complaints and Responses

City West Water provides individual responses to water quality related complaints. These can range between verbal clarification to on-site investigations and remedial action. In terms of the major complaint categories, our responses in 2005/2006 were 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. It can also result from older, rusting internal galvanised-iron pipes. Calls to City West Water are assessed by trained staff and quite often lead to targeted mains flushing.

Suspected Illness

There were three reports of suspected illness. One of these was of temporary nausea associated with taste/odour. The other two did not appear to be water quality related. Customers were advised to seek medical attention if required.

White Water

White water (water with a cloudy appearance that clarifies within a few minutes) indicates the presence of tiny air bubbles. It tends to be associated with maintenance and repair works, when air can enter water pipes. In the past we often responded to customers' concerns with targeted mains flushing, however since the introduction of water restrictions, greater emphasis is placed on better explaining the phenomenon and obtaining customers' agreement 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.

At this stage, neither the cause of, nor solution to, this international and Australia-wide copper corrosion phenomenon are known.

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 you are experiencing blue-green water or have other water quality concerns, please call City West Water on 13 2642 for further information and advice.

The decline in reports of blue-green water since 2001-2002 may be a consequence of increased installation of non-copper pipes in newly constructed properties.

Taste/Odour

Taste/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/odour) occur from time to time, largely due to changed water demands and flow rates. Our responses to customers reporting chlorine taste/odour involve providing an explanation, as well as consideration of changes to chlorine dosing.

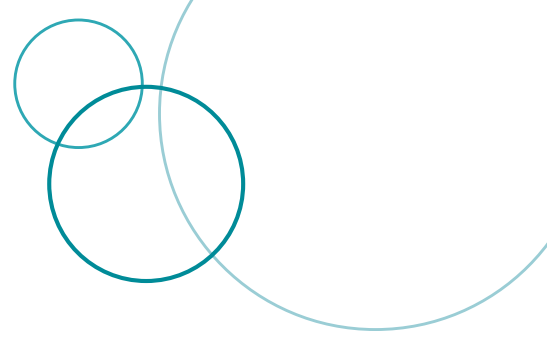
Other tastes/odours can result when water flows are slower and during flow reversals in large pipes. As outlined in Section 4.1, we received relatively high numbers of taste/odour complaints in late January / early February 2006. In such cases the cause is identified and, where appropriate, a combination of targeted flushing and/or changes to flow regimes are implemented.

7. HACCP and Research Activities

7.1 HACCP Certification

In 2005/2006 we retained our Hazard Analysis and Critical Control Points (HACCP) certification, which recognises our commitment to, and high standard of practice in, safeguarding drinking water quality. 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.

Our HACCP certification ensures we attend to those parts of our network and operations that have an impact on water



quality. The maintenance of HACCP certification requires constant vigilance and improvements to our water quality management operations. We aim to continue meeting the HACCP requirements.

During the year we also maintained a water quality risk management plan as per requirements of Victoria's Safe Drinking Water Act 2003. The plan's format closely follows that suggested in ADWG 2004 and strongly complements our pre-existing HACCP plan.

7.2 Research Activities

As well as focusing on delivering a safe and reliable water supply to our customers, we maintain an awareness of and responsiveness to emerging issues in water quality management, water treatment, public health, water quality standards and community expectations. In 2005/2006, we continued to be involved in activities (outlined below) aimed at better understanding and improving drinking water quality.

Membership of CRCWQT

Since July 2003, City West Water has been a member of Australia's Cooperative Research Centre for Water Quality and Treatment (CRCWQT). This organisation comprises some 30 partners from the water industry, research organisations, universities and government agencies, and provides a national strategic research capacity for the Australian water industry. Benefits to City West Water and our customers from this membership include:

- access to expert, national and international knowledge on water quality issues;
- involvement in the planning and operation of national research on water quality and related public health links;
- involvement in the formulation of drinking water policies and regulations;
- contribution to the development of water industry professionals;
- involvement in both national and local community consultation.

pH variability

City West Water measures the pH (the acidic, alkaline or neutral condition of water) of the water it delivers to customers. Some properties experience water of elevated pH, this is a result of water's exposure to the internal cement lining in the water mains. Localised instances of elevated pH tend to be associated with 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 remedial treatment would be quite complex and would involve adding chemicals to Melbourne's water supply, with uncertain benefits.

A 2000 joint water industry study by researchers at Melbourne's Alfred Hospital concluded 'there was no indication of the health effects on skin for weakly buffered water, such as 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 for such water:

- 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.

Despite these findings, City West Water has a policy of avoiding, where possible, the construction of new water mains with cement linings.



Copper corrosion research

City West Water has been at the forefront of the copper pipe corrosion issue since 1997, through its research with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and its close work with the Water Services Association of Australia (WSAA). Given the complexities of copper pipe corrosion, the Australian and worldwide research has yet to provide a practical solution.

While testing has shown no evidence that the quality of the water has caused the problem, we are working with the Australian water industry to further research the cause and means for preventing copper pipe problems being experienced Australia-wide. By early 2005 this research, conducted by the CSIRO (and funded jointly by the Water Services Association of Australia and the Copper Development Association), has led to the development of a promising pipe treatment that appears to be effective in stopping established copper corrosion for at least several months. Further work is being undertaken to confirm the practical applicability of the process. We anticipate that these efforts will lead to benefits for our customers who are experiencing blue-green water.

If you are experiencing blue-green water or have other water quality concerns, please call City West Water on 13 2642 for information and advice.

Disinfection review

In 2005 City West Water commissioned an independent review of chlorine levels in the water supply throughout our service area. As a result, we are installing two new, permanent chlorination dosing plants to service the water quality localities of Little River and Richmond. The plants will be operational by late 2006.

Maintaining an awareness of water quality issues

In addition to our direct involvement in research activities, we monitor developments in the management of water supply quality and hydraulic systems through our active membership of bodies such as the WSAA, the Victorian Water Industry Association, the Australian Water Association and the American Water Works Association.

8. Glossary of Terms

ADWG 2004	Australian Drinking Water Guidelines 2004. Published by the National Health & Medical Research Council of Australia.
<i>E. coli</i>	<i>Escherichia coli</i> , 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.
<	"less than" symbol.
mg/L	milligrams per litre.

9. Further Information

For further information on the details of this report or on general water quality matters, please contact City West Water's office on St Albans Road, Sunshine (telephone 03 13 1691). Alternatively, contact our water quality scientist, Georges Ruta, directly (telephone 03 9313 8388; email gruta@citywestwater.com.au). Written enquiries can be addressed to Mr Ruta at City West Water, Locked Bag 350, Sunshine, Victoria 3020.

APPENDIX A WATER QUALITY DATA BY LOCALITY

ALL QUALITY WATER LOCALITIES								
For Period		1 July 2005 to 30 June				2006 POPULATION 619,352		
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			No. of Samples		Performance against standard / guideline
			Min	Mean ^G	Max	Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	1	1,600	2118	2117	99.95%
Total Coliforms	orgs/100mL	N	<1	<1	200	2118	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	2118	2118	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.10	0.85	2118	2118	100%
Total Chlorine	mg/L	5	0	0.17	0.95	2118	2118	100%
Alkalinity	mg/L	N	10	12	13	11	-	-
Aluminium	mg/L	0.2	<0.01	0.02	0.08	161	161	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	11	11	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	11	11	100%
Calcium	mg/L	N	7.1	7.4	8.9	11	-	-
Chloride	mg/L	250	13.0	15.4	16.0	11	11	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	11	11	100%
Colour	Pt/Co	25**	<2	2	7	264	264	100%
Conductivity	µS/cm	~1,000	55	107	140	264	264	100%
Copper	mg/L	1	<0.004	0.008	0.032	11	11	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	11	11	100%
Dissolved Oxygen	mg/L	N	6.8	9.4	10.6	24	-	-
Fluoride	mg/L	1.5	0.70	0.90	1.08	260	260	100%
Hardness (as CaCO ₃)	mg/L	200	23	26	29	11	11	100%
Iron	mg/L	0.3	<0.02	0.02	0.24	355	355	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	11	11	100%
Magnesium	mg/L	N	1.6	1.8	2.0	11	-	-
Manganese	mg/L	0.1	<0.01	<0.01	0.03	355	355	100%
Mercury	mg/L	0.001	<0.0001	<0.0001	<0.0001	11	11	100%
Nitrate (NO ₃)	mg/L	50	0.84	1.18	1.37	11	11	100%
pH	units	6.5-8.5	7.0	7.5	9.7	382	357	93.5%
pH	units	6.5-9.2	7.0	7.5	9.7	382	378	99.0%
Potassium	mg/L	N	1.0	1.1	1.2	11	-	-
Silica (SiO ₂)	mg/L	N	5.2	5.6	6.0	11	-	-
Sodium	mg/L	180	6.7	8.2	9.3	11	11	100%
Sulphate	mg/L	250	7.0	10.5	12.0	11	11	100%
Temperature	°C	N	12	17	27	24	-	-
Total Organic Carbon	mg/L	N	1.3	1.5	1.9	11	-	-
Total Phosphorus	mg/L	N	<0.003	<0.003	0.003	11	-	-
Total Dissolved Solids	mg/L	500	57	67	70	11	11	100%
Turbidity	NTU	5 ¹	0.1	0.6 ¹	9.6	673	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	11	11	100%
Dibromochloromethane	mg/L	N	<0.001	0.005	0.012	132	-	-
Dichlorobromomethane	mg/L	N	<0.005	0.010	0.020	132	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	132	-	-
Chloroform	mg/L	N	0.007	0.019	0.066	132	-	-
Total Trihalomethanes	mg/L	0.25	0.014	0.035	0.075	132	132	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	132	132	100%
Dichloroacetic acid	mg/L	0.1	<0.001	0.002	0.011	132	132	100%
Trichloroacetic acid	mg/L	0.1	<0.001	0.005	0.028	132	132	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	11	11	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	11	11	100%

- Notes:
- * Internal City West guideline.
 - ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 - N No guideline 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 continued

WATER QUALITY LOCALITY FOR PERIOD		Werribee1 July 2005 to 30 June 2006				LOCALITY No. 1 POPULATION 79,633 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean ^e	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	1	180	>weekly	250	250	100%
Total Coliforms	orgs/100mL	N	<1	<1	1	>weekly	250	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	250	250	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.13	0.35	>weekly	250	250	100%
Total Chlorine	mg/L	5	0	0.21	0.45	>weekly	250	250	100%
Alkalinity	mg/L	N	13	13	13	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.020	0.06	monthly	12	12	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	8.4	8.4	8.4	annually	1	-	-
Chloride	mg/L	250	16	16	16	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	2	3	monthly	13	13	100%
Conductivity	µS/cm	~1,000	86	112	140	monthly	13	13	100%
Copper	mg/L	1	<0.004	<0.004	<0.004	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.78	0.91	1.00	fortnightly	26	26	100%
Hardness (as CaCO ₃)	mg/L	200	28	28	28	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.02	0.07	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	1.7	1.7	1.7	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	0.02	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	1.15	1.15	1.15	annually	1	1	100%
pH	units	6.5-8.5	7.0	7.9	9.2	>fortnightly	39	29	74%
pH	units	6.5-9.2	7.0	7.9	9.2	>fortnightly	39	39	100%
Potassium	mg/L	N	1.1	1.1	1.1	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.3	5.3	5.3	annually	1	-	-
Sodium	mg/L	180	8.5	8.5	8.5	annually	1	1	100%
Sulphate	mg/L	250	10.0	10.0	10.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.5	1.5	1.5	annually	1	-	-
Total Phosphorus	mg/L	N	<0.003	<0.003	<0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	69	69	69	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.6 ¹	1.3	weekly	53	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.005	0.007	0.012	monthly	12	-	-
Dichlorobromomethane	mg/L	N	0.008	0.013	0.020	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	12	-	-
Chloroform	mg/L	N	0.015	0.022	0.028	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.033	0.042	0.058	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	0.001	0.002	0.003	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	0.004	0.006	0.012	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

Notes: * Internal City West guideline.
 ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 N No guideline value set for this parameter.
 # Victorian standard: 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.

WATER QUALITY LOCALITY FOR PERIOD		Altona 1 July 2005 to 30 June 2006				LOCALITY No. 2 POPULATION 43,270 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			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	1600	>weekly	156	155	99.4%
Total Coliforms	orgs/100mL	N	<1	<1	6	>weekly	156	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	156	156	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.05	0.20	>weekly	156	156	100%
Total Chlorine	mg/L	5	0	0.12	0.35	>weekly	156	156	100%
Alkalinity	mg/L	N	11	11	11	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.02	0.06	monthly	12	12	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	7.6	7.6	7.6	annually	1	-	-
Chloride	mg/L	250	16	16	16	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	2	3	monthly	13	13	100%
Conductivity	µS/cm	~1,000	100	114	130	monthly	13	13	100%
Copper	mg/L	1	<0.004	<0.004	<0.004	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.71	0.90	1.07	fortnightly	26	26	100%
Hardness (as CaCO ₃)	mg/L	200	27	27	27	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.02	0.07	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	1.9	1.9	1.9	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	0.02	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	1.20	1.20	1.20	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.6	9.2	fortnightly	26	22	84.6%
pH	units	6.5-9.2	7.1	7.6	9.2	fortnightly	26	26	100%
Potassium	mg/L	N	1.1	1.1	1.1	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.7	5.7	5.7	annually	1	-	-
Sodium	mg/L	180	8.9	8.9	8.9	annually	1	1	100%
Sulphate	mg/L	250	11.0	11.0	11.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.5	1.5	1.5	annually	1	-	-
Total Phosphorus	mg/L	N	<0.003	<0.003	<0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	69	69	69	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.4 ¹	0.8	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.005	0.006	0.009	monthly	12	-	-
Dichlorobromomethane	mg/L	N	0.008	0.011	0.015	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	12	-	-
Chloroform	mg/L	N	0.009	0.015	0.026	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.027	0.032	0.045	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	<0.001	0.001	0.002	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	<0.001	0.003	0.006	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

- Notes:
- * Internal City West guideline.
 - ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 - N No guideline value set for this parameter.
 - # Victorian standard: 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 continued

WATER QUALITY LOCALITY FOR PERIOD		Werribee South 1 July 2005 to 30 June 2006				LOCALITY No. 2A POPULATION 1,732 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			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	45	>weekly	65	65	100%
Total Coliforms	orgs/100mL	N	<1	<1	14	>weekly	65	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	65	65	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.02	0.15	>weekly	65	65	100%
Total Chlorine	mg/L	5	0	0.08	0.25	>weekly	65	65	100%
Alkalinity	mg/L	N	13	13	13	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.01	0.04	monthly	12	12	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	8.9	8.9	8.9	annually	1	-	-
Chloride	mg/L	250	16	16	16	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	2	3	monthly	13	13	100%
Conductivity	µS/cm	~1,000	96	114	140	monthly	13	13	100%
Copper	mg/L	1	<0.004	<0.004	<0.004	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.77	0.90	0.98	monthly	13	13	100%
Hardness (as CaCO ₃)	mg/L	200	29	29	29	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.02	0.06	monthly	13	13	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	1.6	1.6	1.6	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	<0.01	monthly	13	13	100%
Mercury	mg/L	0.001	<0.0001	<0.0001	<0.0001	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	7.4	7.7	8.2	monthly	13	13	100%
pH	units	6.5-9.2	7.4	7.7	8.2	monthly	13	13	100%
Potassium	mg/L	N	1.1	1.1	1.1	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.2	5.2	5.2	annually	1	-	-
Sodium	mg/L	180	8.0	8.0	8.0	annually	1	1	100%
Sulphate	mg/L	250	11.0	11.0	11.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.9	1.9	1.9	annually	1	-	-
Total Phosphorus	mg/L	N	0.003	0.003	0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	69	69	69	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.5 ¹	1.1	weekly	53	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.005	0.006	0.009	monthly	12	-	-
Dichlorobromomethane	mg/L	N	<0.005	0.011	0.015	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	0.001	monthly	12	-	-
Chloroform	mg/L	N	0.007	0.015	0.023	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.014	0.032	0.046	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	<0.001	<0.001	0.002	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	<0.001	0.003	0.005	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

- Notes:
- * Internal City West guideline.
 - ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 - N No guideline value set for this parameter.
 - # Victorian standard: 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.

WATER QUALITY LOCALITY FOR PERIOD		Footscray 1 July 2005 to 30 June 2006				LOCALITY No. 3 POPULATION 131,356 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			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	560	>weekly	378	378	100%
Total Coliforms	orgs/100mL	N	<1	<1	10	>weekly	378	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	378	378	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.06	0.30	>weekly	378	378	100%
Total Chlorine	mg/L	5	0	0.12	0.40	>weekly	378	378	100%
Alkalinity	mg/L	N	11	11	11	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.02	0.06	fortnightly	25	25	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	7.6	7.6	7.6	annually	1	-	-
Chloride	mg/L	250	16	16	16	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	2	5	fortnightly	26	26	100%
Conductivity	µS/cm	~1,000	64	113	130	fortnightly	26	26	100%
Copper	mg/L	1	0.015	0.015	0.015	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.74	0.90	1.01	fortnightly	26	26	100%
Hardness (as CaCO ₃)	mg/L	200	27	27	27	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.02	0.07	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	1.9	1.9	1.9	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	0.01	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	1.24	1.24	1.24	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.4	7.6	fortnightly	26	26	100%
pH	units	6.5-9.2	7.1	7.4	7.6	fortnightly	26	26	100%
Potassium	mg/L	N	1.1	1.1	1.1	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.6	5.6	5.6	annually	1	-	-
Sodium	mg/L	180	8.3	8.3	8.3	annually	1	1	100%
Sulphate	mg/L	250	12.0	12.0	12.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.4	1.4	1.4	annually	1	-	-
Total Phosphorus	mg/L	N	<0.003	<0.003	<0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	68	68	68	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.5 ¹	1.1	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.005	0.006	0.009	monthly	12	-	-
Dichlorobromomethane	mg/L	N	0.009	0.011	0.015	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	12	-	-
Chloroform	mg/L	N	0.011	0.014	0.018	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.028	0.032	0.043	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	<0.001	0.001	0.002	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	0.002	0.004	0.008	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	monthly	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	monthly	1	1	100%

- Notes:
- * Internal City West guideline.
 - ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 - N No guideline value set for this parameter.
 - # Victorian standard: 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 continued

WATER QUALITY LOCALITY FOR PERIOD		St. Albans 1 July 2005 to 30 June 2006				LOCALITY No. 4 POPULATION 32,196 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			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	160	>weekly	130	130	100%
Total Coliforms	orgs/100mL	N	<1	<1	<1	>weekly	130	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	130	130	within standard (actual 100%)
Free Chlorine	mg/L	5	0.05	0.17	0.45	>weekly	130	130	100%
Total Chlorine	mg/L	5	0.10	0.26	0.60	>weekly	130	130	100%
Alkalinity	mg/L	N	12	12	12	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.02	0.05	monthly	12	12	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	7.0	7.0	7.0	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	2	4	monthly	13	13	100%
Conductivity	µS/cm	~1,000	70	102	130	monthly	13	13	100%
Copper	mg/L	1	0.024	0.024	0.024	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.75	0.89	1.00	fortnightly	26	26	100%
Hardness (as CaCO ₃)	mg/L	200	25	25	25	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.03	0.08	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	1.9	1.9	1.9	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	<0.01	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	1.06	1.06	1.06	annually	1	1	100%
pH	units	6.5-8.5	7.2	7.6	9.2	fortnightly	26	23	88.5%
pH	units	6.5-9.2	7.2	7.6	9.2	fortnightly	26	26	100%
Potassium	mg/L	N	1.0	1.0	1.0	annually	1	-	-
Silica (SiO ₂)	mg/L	N	6.0	6.0	6.0	annually	1	-	-
Sodium	mg/L	180	7.9	7.9	7.9	annually	1	1	100%
Sulphate	mg/L	250	10.0	10.0	10.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.4	1.4	1.4	annually	1	-	-
Total Phosphorus	mg/L	N	<0.003	<0.003	<0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	65	65	65	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.8 ¹	3.3	weekly	53	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.005	0.005	0.010	monthly	12	-	-
Dichlorobromomethane	mg/L	N	0.006	0.011	0.015	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	12	-	-
Chloroform	mg/L	N	0.010	0.018	0.034	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.022	0.034	0.045	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	0.002	0.003	0.004	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	0.003	0.006	0.015	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

- Notes:
- * Internal City West guideline.
 - ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 - N No guideline value set for this parameter.
 - # Victorian standard: 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.

WATER QUALITY LOCALITY FOR PERIOD		Sydenham 1 July 2005 to 30 June 2006				LOCALITY No. 5 POPULATION 113,733 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean ^G	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	2	870	>weekly	353	353	100%
Total Coliforms	orgs/100mL	N	<1	<1	200	>weekly	353	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	353	353	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.16	0.85	>weekly	353	353	100%
Total Chlorine	mg/L	5	0.05	0.25	0.95	>weekly	353	353	100%
Alkalinity	mg/L	N	12	12	12	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.02	0.05	monthly	12	12	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	7.4	7.4	7.4	annually	1	-	-
Chloride	mg/L	250	16	16	16	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	2	4	monthly	13	13	100%
Conductivity	µS/cm	~1,000	65	85	120	monthly	13	13	100%
Copper	mg/L	1	<0.004	<0.004	<0.004	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.77	0.90	1.00	fortnightly	26	26	100%
Hardness (as CaCO ₃)	mg/L	200	26	26	26	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.04	0.24	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	1.9	1.9	1.9	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	0.03	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	1.37	1.37	1.37	annually	1	1	100%
pH	units	6.5-8.5	7.0	7.6	9.5	>fortnightly	40	35	87.5%
pH	units	6.5-9.2	7.0	7.6	9.5	>fortnightly	40	38	95.0%
Potassium	mg/L	N	1.1	1.1	1.1	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.3	5.3	5.3	annually	1	-	-
Sodium	mg/L	180	8.1	8.1	8.1	annually	1	1	100%
Sulphate	mg/L	250	11.0	11.0	11.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.4	1.4	1.4	annually	1	-	-
Total Phosphorus	mg/L	N	<0.003	<0.003	<0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	68	68	68	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	1.3 ¹	9.6	weekly	52	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.005	<0.005	0.008	monthly	12	-	-
Dichlorobromomethane	mg/L	N	0.006	0.008	0.013	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	12	-	-
Chloroform	mg/L	N	0.011	0.023	0.031	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.026	0.034	0.046	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	0.001	0.004	0.008	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	0.003	0.009	0.015	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

- Notes:
- * Internal City West guideline.
 - ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 - N No guideline value set for this parameter.
 - # Victorian standard: 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 continued

WATER QUALITY LOCALITY FOR PERIOD		East Keilor 1 July 2005 to 30 June 2006				LOCALITY No. 6 POPULATION 37,163 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	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	38	>weekly	146	146	100%
Total Coliforms	orgs/100mL	N	<1	<1	<1	>weekly	146	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	146	146	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.16	0.40	>weekly	146	146	100%
Total Chlorine	mg/L	5	0.05	0.25	0.55	>weekly	146	146	100%
Alkalinity	mg/L	N	10	10	10	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.02	0.08	monthly	13	13	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	7.1	7.1	7.1	annually	1	-	-
Chloride	mg/L	250	16.0	16.0	16.0	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	2	4	monthly	13	13	100%
Conductivity	µS/cm	~1,000	68	101	130	monthly	13	13	100%
Copper	mg/L	1	0.032	0.032	0.032	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	0.93	1.08	fortnightly	26	26	100%
Hardness (as CaCO ₃)	mg/L	200	26	26	26	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.03	0.16	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	0.03	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	1.28	1.28	1.28	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.4	8.1	fortnightly	26	26	100%
pH	units	6.5-9.2	7.1	7.4	8.1	fortnightly	26	26	100%
Potassium	mg/L	N	1.2	1.2	1.2	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.7	5.7	5.7	annually	1	-	-
Sodium	mg/L	180	9.3	9.3	9.3	annually	1	1	100%
Sulphate	mg/L	250	12.0	12.0	12.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.3	1.3	1.3	annually	1	-	-
Total Phosphorus	mg/L	N	<0.003	<0.003	<0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	70	70	70	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.8 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	<0.005	<0.005	0.009	monthly	12	-	-
Dichlorobromomethane	mg/L	N	<0.005	0.009	0.015	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	12	-	-
Chloroform	mg/L	N	0.009	0.014	0.024	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.020	0.028	0.039	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	0.001	0.002	0.006	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	0.002	0.004	0.009	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

Notes: * Internal City West guideline.
 ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 N No guideline value set for this parameter.
 # Victorian standard: 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.

WATER QUALITY LOCALITY FOR PERIOD		Tullamarine 1 July 2005 to 30 June 2006				LOCALITY No. 7 POPULATION 9,923 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean ^g	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	2	120	>weekly	79	79	100%
Total Coliforms	orgs/100mL	N	<1	<1	200	>weekly	79	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	79	79	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.16	0.50	>weekly	79	79	100%
Total Chlorine	mg/L	5	0.05	0.26	0.60	>weekly	79	79	100%
Alkalinity	mg/L	N	11	11	11	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.01	0.04	monthly	13	13	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	7.3	7.3	7.3	annually	1	-	-
Chloride	mg/L	250	16.0	16.0	16.0	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	5	monthly	13	13	100%
Conductivity	µS/cm	~1,000	66	95	130	monthly	13	13	100%
Copper	mg/L	1	<0.004	<0.004	<0.004	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.74	0.90	1.00	fortnightly	26	26	100%
Hardness (as CaCO ₃)	mg/L	200	26	26	26	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.03	0.11	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	<0.01	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	1.37	1.37	1.37	annually	1	1	100%
pH	units	6.5-8.5	7.1	7.5	9.4	fortnightly	26	24	92.3%
pH	units	6.5-9.2	7.1	7.5	9.4	fortnightly	26	25	96.2%
Potassium	mg/L	N	1.2	1.2	1.2	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.7	5.7	5.7	annually	1	-	-
Sodium	mg/L	180	9.2	9.2	9.2	annually	1	1	100%
Sulphate	mg/L	250	12.0	12.0	12.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.3	1.3	1.3	annually	1	-	-
Total Phosphorus	mg/L	N	<0.003	<0.003	<0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	70	70	70	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.8 ¹	2.4	weekly	51	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.005	<0.005	0.008	monthly	12	-	-
Dichlorobromomethane	mg/L	N	<0.005	0.008	0.014	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	12	-	-
Chloroform	mg/L	N	0.009	0.015	0.025	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.016	0.027	0.036	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	0.001	0.003	0.006	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	0.002	0.004	0.008	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

- Notes:
- * Internal City West guideline.
 - ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 - N No guideline value set for this parameter.
 - # Victorian standard: 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 continued

WATER QUALITY LOCALITY FOR PERIOD		Coburg 1 July 2005 to 30 June 2006				LOCALITY No. 9 POPULATION 8,308 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	MeanG	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	2	240	>weekly	80	80	100%
Total Coliforms	orgs/100mL	N	<1	<1	120	>weekly	80	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	80	80	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.05	0.20	>weekly	80	80	100%
Total Chlorine	mg/L	5	0.05	0.12	0.30	>weekly	80	80	100%
Alkalinity	mg/L	N	13	13	13	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.02	0.06	monthly	13	13	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	6.5	6.5	6.5	annually	1	-	-
Chloride	mg/L	250	13.0	13.0	13.0	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	2	6	monthly	13	13	100%
Conductivity	µS/cm	~1,000	68	107	130	monthly	13	13	100%
Copper	mg/L	1	<0.004	<0.004	<0.004	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	0.90	1.04	monthly	13	13	100%
Hardness (as CaCO ₃)	mg/L	200	23	23	23	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.02	0.07	monthly	13	13	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	1.6	1.6	1.6	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	0.01	monthly	13	13	100%
Mercury	mg/L	0.001	<0.0001	<0.0001	<0.0001	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	7.3	7.5	8.0	monthly	13	13	100%
pH	units	6.5-9.2	7.3	7.5	8.0	monthly	13	13	100%
Potassium	mg/L	N	1.0	1.0	1.0	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.9	5.9	5.9	annually	1	-	-
Sodium	mg/L	180	7.4	7.4	7.4	annually	1	1	100%
Sulphate	mg/L	250	7.0	7.0	7.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.5	1.5	1.5	annually	1	-	-
Total Phosphorus	mg/L	N	0.003	0.003	0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	57	57	57	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.5 ¹	1.1	weekly	54	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	<0.005	<0.005	0.008	monthly	12	-	-
Dichlorobromomethane	mg/L	N	0.005	0.010	0.014	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	12	-	-
Chloroform	mg/L	N	0.008	0.020	0.051	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.018	0.035	0.057	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	0.001	0.002	0.011	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	0.003	0.006	0.028	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

Notes: * Internal City West guideline.
 ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 N No guideline 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.

WATER QUALITY LOCALITY FOR PERIOD		North Melbourne 1 July 2005 to 30 June 2006				LOCALITY No. 11 POPULATION 148,743 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	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	44	>weekly	390	390	100%
Total Coliforms	orgs/100mL	N	<1	<1	9	>weekly	390	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	390	390	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.05	0.30	>weekly	390	390	100%
Total Chlorine	mg/L	5	0	0.11	0.35	>weekly	390	390	100%
Alkalinity	mg/L	N	11	11	11	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.02	0.07	fortnightly	25	25	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	7.3	7.3	7.3	annually	1	-	-
Chloride	mg/L	250	16.0	16.0	16.0	annually	1	1	100%
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	annually	1	1	100%
Colour	Pt/Co	25**	<2	2	7	fortnightly ^	121	121	100%
Conductivity	µS/cm	~1,000	59	111	130	fortnightly ^	121	121	100%
Copper	mg/L	1	<0.004	<0.004	<0.004	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.73	0.89	0.99	fortnightly	26	26	100%
Hardness (as CaCO ₃)	mg/L	200	26	26	26	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.02	0.13	fortnightly ^	121	121	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	2.0	2.0	2.0	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	0.03	fortnightly ^	121	121	100%
Mercury	mg/L	0.001	<0.0001	<0.0001	<0.0001	annually	1	1	100%
Nitrate (NO ₃)	mg/L	50	1.15	1.15	1.15	annually	1	1	100%
pH	units	6.5-8.5	7.2	7.4	7.6	fortnightly ^	121	121	100%
pH	units	6.5-9.2	7.2	7.4	7.6	fortnightly ^	121	121	100%
Potassium	mg/L	N	1.1	1.1	1.1	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.7	5.7	5.7	annually	1	-	-
Sodium	mg/L	180	7.6	7.6	7.6	annually	1	1	100%
Sulphate	mg/L	250	11.0	11.0	11.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.4	1.4	1.4	annually	1	-	-
Total Phosphorus	mg/L	N	<0.003	<0.003	<0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	67	67	67	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.4 ¹	1.7	weekly ^	147	-	within standard
Zinc	mg/L	3	<0.01	<0.01	<0.01	annually	1	1	100%
Dibromochloromethane	mg/L	N	0.005	0.006	0.009	monthly	12	-	-
Dichlorobromomethane	mg/L	N	0.009	0.011	0.015	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	12	-	-
Chloroform	mg/L	N	0.010	0.014	0.021	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.027	0.032	0.041	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	<0.001	0.001	0.002	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	0.001	0.003	0.004	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

- Notes:
- * Internal City West guideline.
 - ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 - N No guideline 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.
 - ^ More intense monitoring during March 2006 Commonwealth Games

APPENDIX A continued

WATER QUALITY LOCALITY FOR PERIOD		Richmond 1 July 2005 to 30 June 2006				LOCALITY No. 54 POPULATION 13,294 (2001 Census)			
Parameter	Unit	Guideline Value (ADWG 2004)	Concentration or value			Sampling frequency	No. of Samples		Performance against standard / guideline
			Min	Mean ^g	Max		Total	Passing	
Total Plate Count (37°C)	orgs/mL	1000*	<1	2	91	>weekly	91	91	100%
Total Coliforms	orgs/100mL	N	<1	<1	14	>weekly	91	-	-
<i>E.coli</i> #	orgs/100mL	98%<1	<1	<1	<1	>weekly	91	91	within standard (actual 100%)
Free Chlorine	mg/L	5	0	0.02	0.10	>weekly	91	91	100%
Total Chlorine	mg/L	5	0	0.07	0.20	>weekly	91	91	100%
Alkalinity	mg/L	N	11	11	11	annually	1	-	-
Aluminium	mg/L	0.2	<0.01	0.02	0.05	monthly	12	12	100%
Arsenic	mg/L	0.007	<0.001	<0.001	<0.001	annually	1	1	100%
Cadmium	mg/L	0.002	<0.001	<0.001	<0.001	annually	1	1	100%
Calcium	mg/L	N	6.3	6.3	6.3	annually	1	-	-
Chloride	mg/L	250	13.0	13.0	13.0	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	6	monthly	13	13	100%
Conductivity	µS/cm	~1,000	55	86	120	monthly	13	13	100%
Copper	mg/L	1	<0.004	<0.004	<0.004	annually	1	1	100%
Cyanide	mg/L	0.08	<0.005	<0.005	<0.005	annually	1	1	100%
Fluoride	mg/L	1.5	0.79	0.89	1.00	fortnightly	26	26	100%
Hardness (as CaCO ₃)	mg/L	200	23	23	23	annually	1	1	100%
Iron	mg/L	0.3	<0.02	0.04	0.11	fortnightly	26	26	100%
Lead	mg/L	0.01	<0.001	<0.001	<0.001	annually	1	1	100%
Magnesium	mg/L	N	1.7	1.7	1.7	annually	1	-	-
Manganese	mg/L	0.1	<0.01	<0.01	0.01	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	1.02	1.02	1.02	annually	1	1	100%
pH	units	6.5-8.5	7.2	7.5	9.7	fortnightly	26	25	96.2%
pH	units	6.5-9.2	7.2	7.5	9.7	fortnightly	26	25	96.2%
Potassium	mg/L	N	1.0	1.0	1.0	annually	1	-	-
Silica (SiO ₂)	mg/L	N	5.7	5.7	5.7	annually	1	-	-
Sodium	mg/L	180	6.7	6.7	6.7	annually	1	1	100%
Sulphate	mg/L	250	8.0	8.0	8.0	annually	1	1	100%
Total Organic Carbon	mg/L	N	1.6	1.6	1.6	annually	1	-	-
Total Phosphorus	mg/L	N	0.003	0.003	0.003	annually	1	-	-
Total Dissolved Solids	mg/L	500	59	59	59	annually	1	1	100%
Turbidity	NTU	5 ¹	0.1	0.7 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	<0.001	0.003	0.005	monthly	12	-	-
Dichlorobromomethane	mg/L	N	0.007	0.009	0.011	monthly	12	-	-
Bromoform	mg/L	N	<0.001	<0.001	<0.001	monthly	12	-	-
Chloroform	mg/L	N	0.019	0.040	0.066	monthly	12	-	-
Total Trihalomethanes	mg/L	0.25	0.035	0.052	0.075	monthly	12	12	100%
Chloroacetic acid	mg/L	0.15	<0.005	<0.005	<0.005	monthly	12	12	100%
Dichloroacetic acid	mg/L	0.1	<0.001	0.002	0.003	monthly	12	12	100%
Trichloroacetic acid	mg/L	0.1	<0.001	0.008	0.020	monthly	12	12	100%
Bromate	mg/L	0.02	<0.01	<0.01	<0.01	annually	1	1	100%
Formaldehyde	mg/L	0.5	<0.01	<0.01	<0.01	annually	1	1	100%

Notes: * Internal City West guideline.
 ** Guideline set for "True Colour" (15 NTU) however "Apparent Colour" is measured (with a benchmark guideline of 25 NTU).
 N No guideline 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 A2.1 *E.coli* performance in water qualities
(between 2001/2002 and 2005/2006, from left to right within each locality)

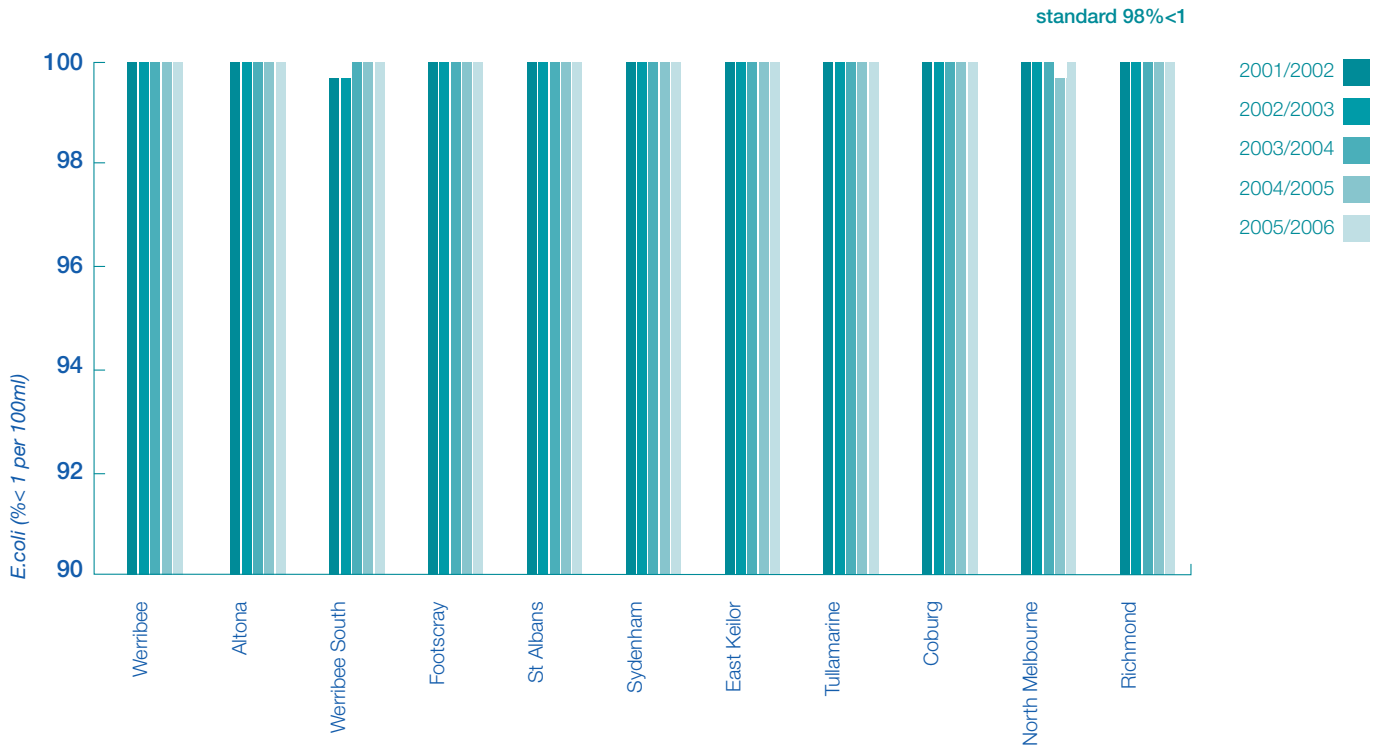


Figure A2.2 Annual average free chlorine concentrations in water quality localities
(between 2001/2002 and 2005/2006, from left to right within each locality)

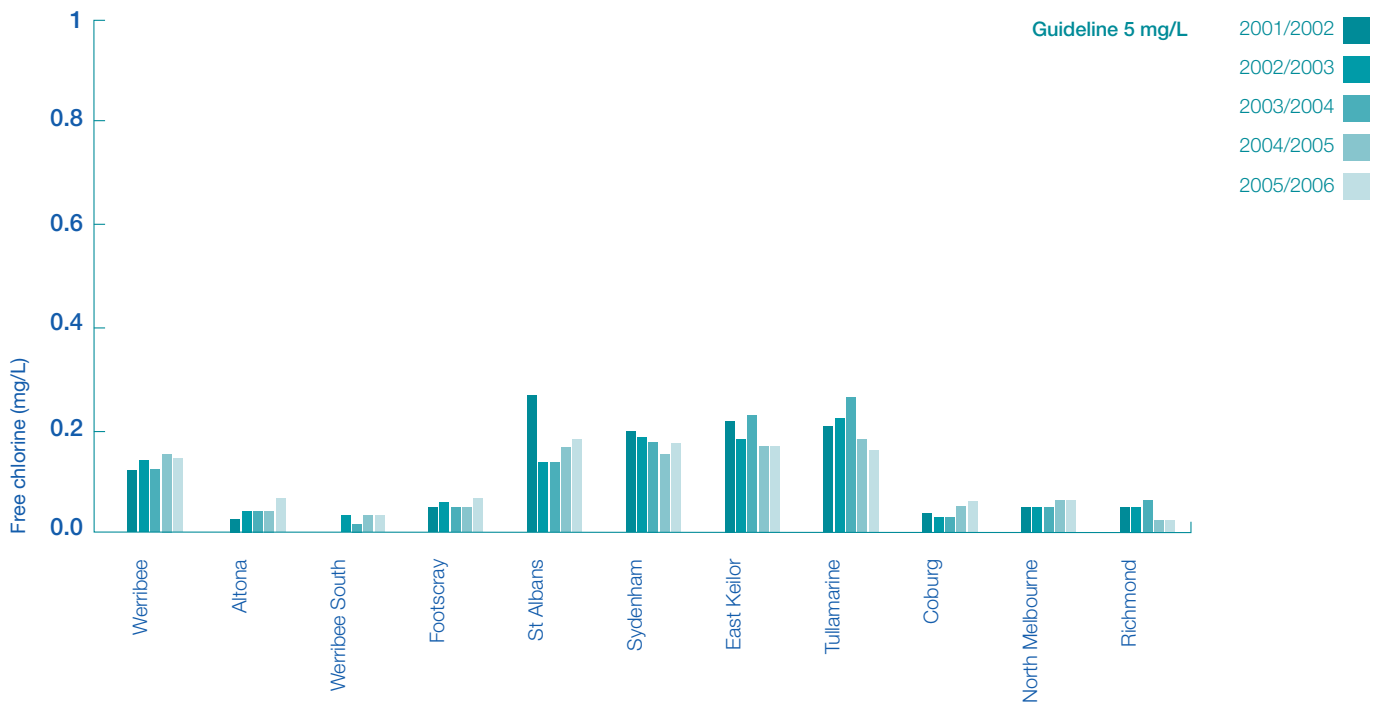


Figure A2.3 Annual average aluminium concentrations in water quality localities (between 2001/2002 and 2005/2006, from left to right within each locality)

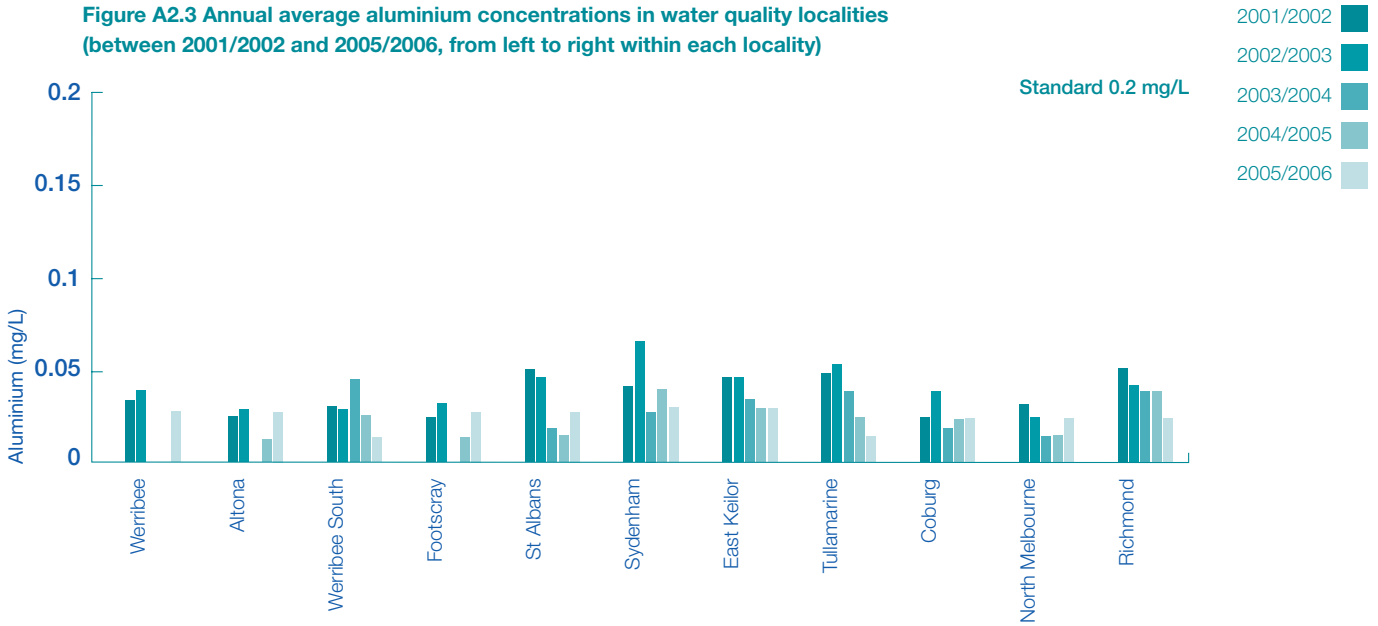


Figure A2.4 Chloride concentrations in water quality localities (between 2001/2002 and 2005/2006, from left to right within each locality)

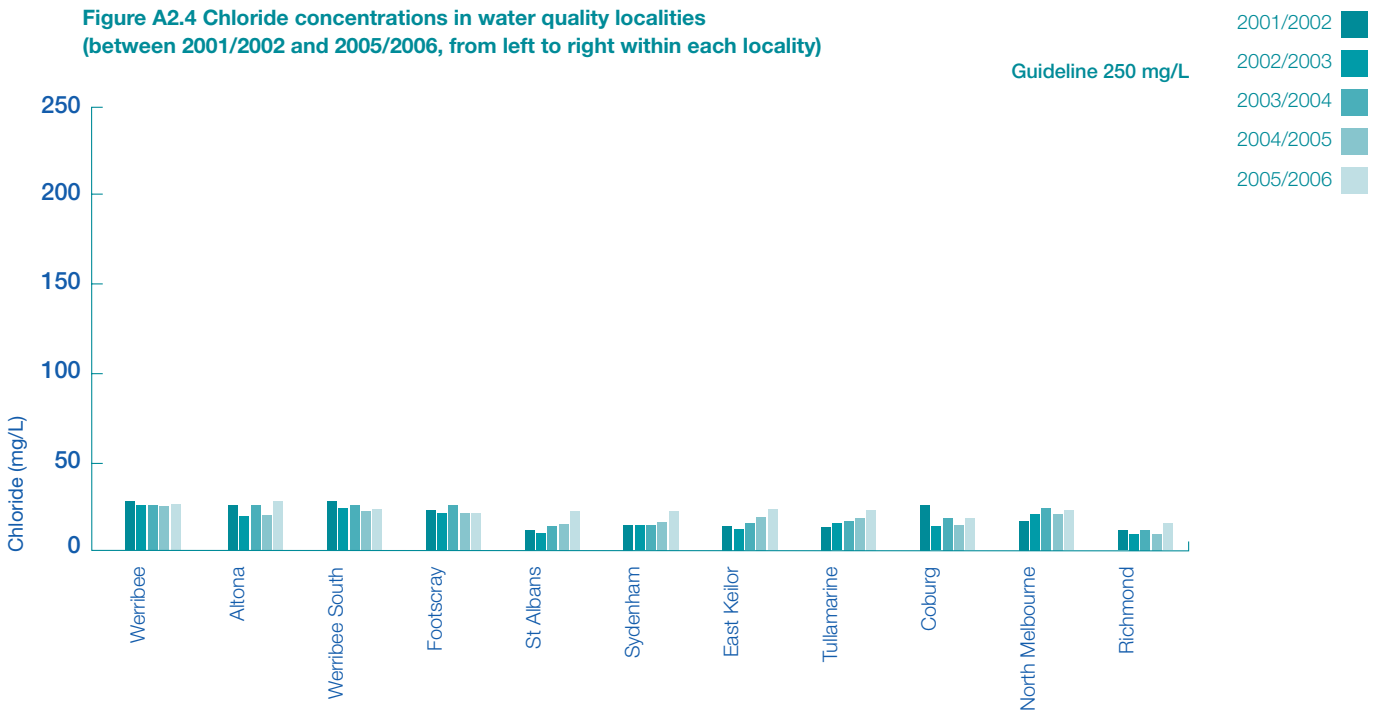


Figure A2.5 Average apparent colour levels in water quality localities (between 2001/2002 and 2005/2006, from left to right within each locality)

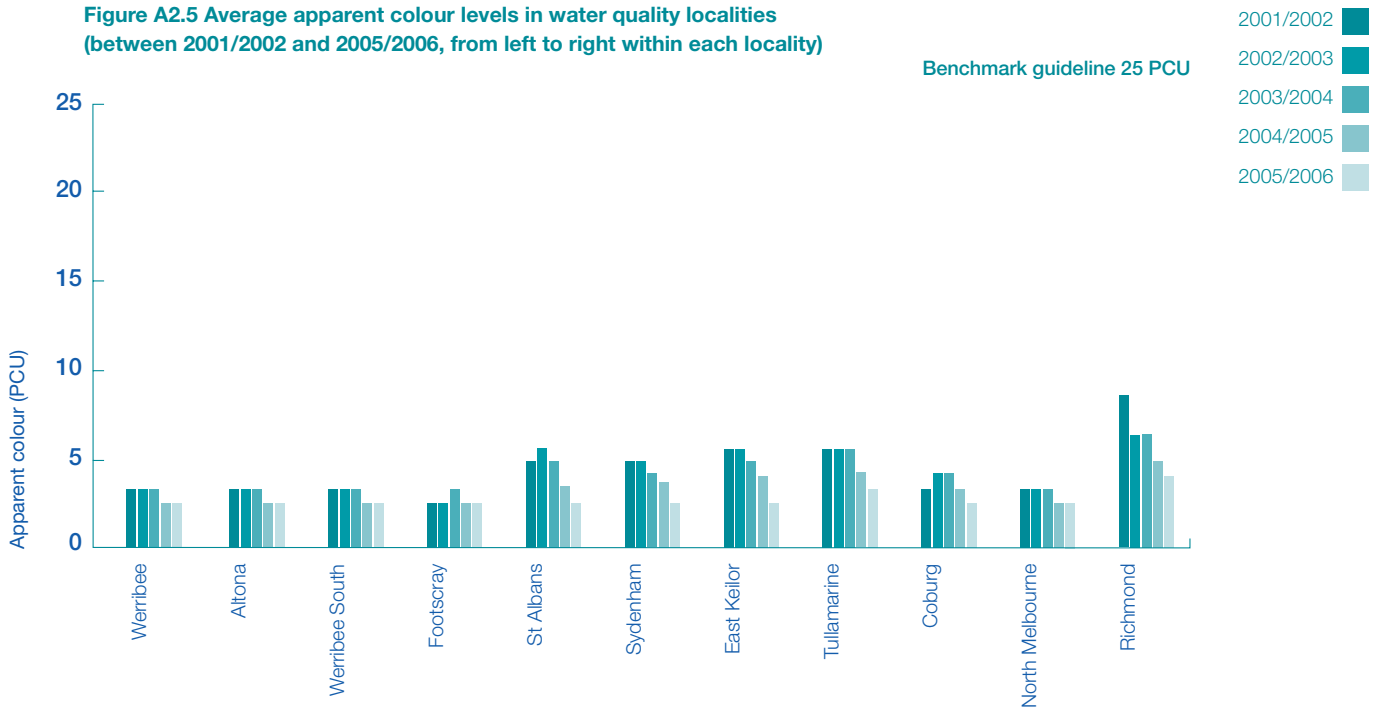


Figure A2.6 Average electrical conductivity levels in water quality localities (between 2001/2002 and 2005/2006, from left to right within each locality)

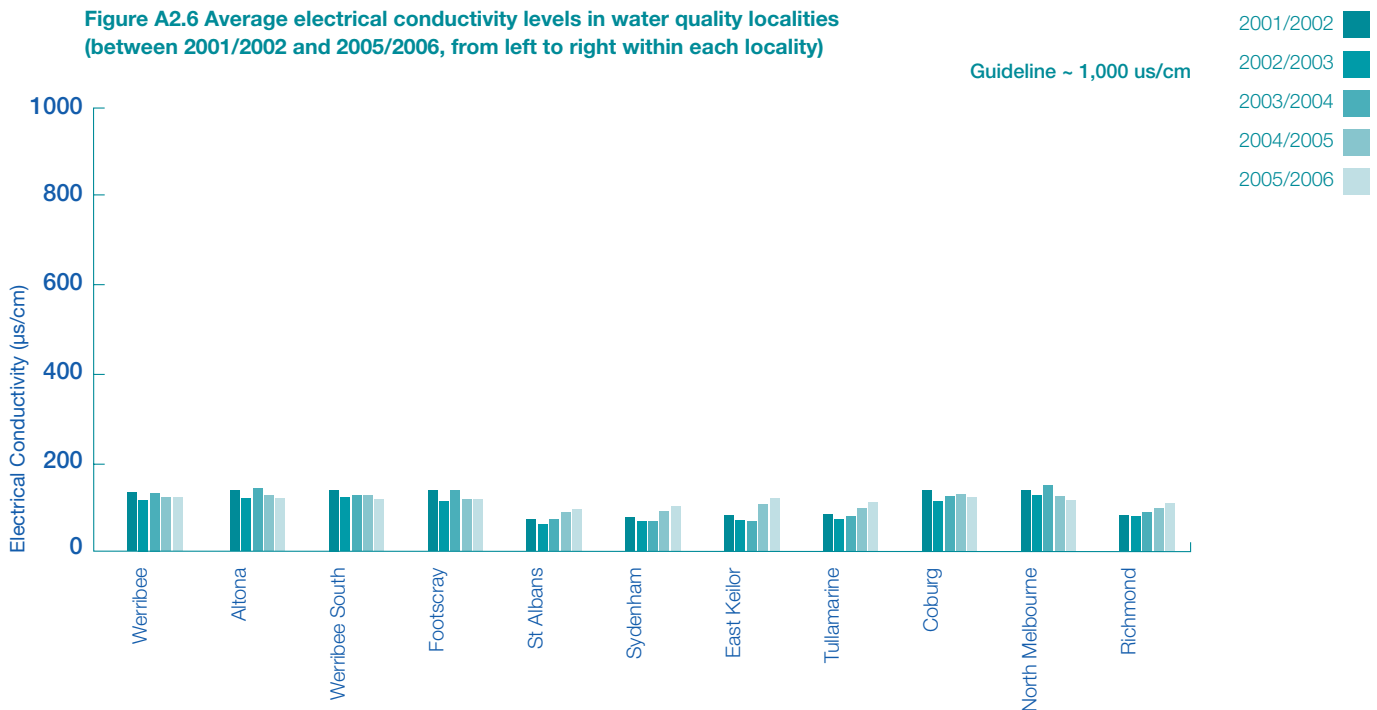


Figure A2.7 Copper concentrations in water quality localities
 (between 2001/2002 and 2005/2006, from left to right within each locality)

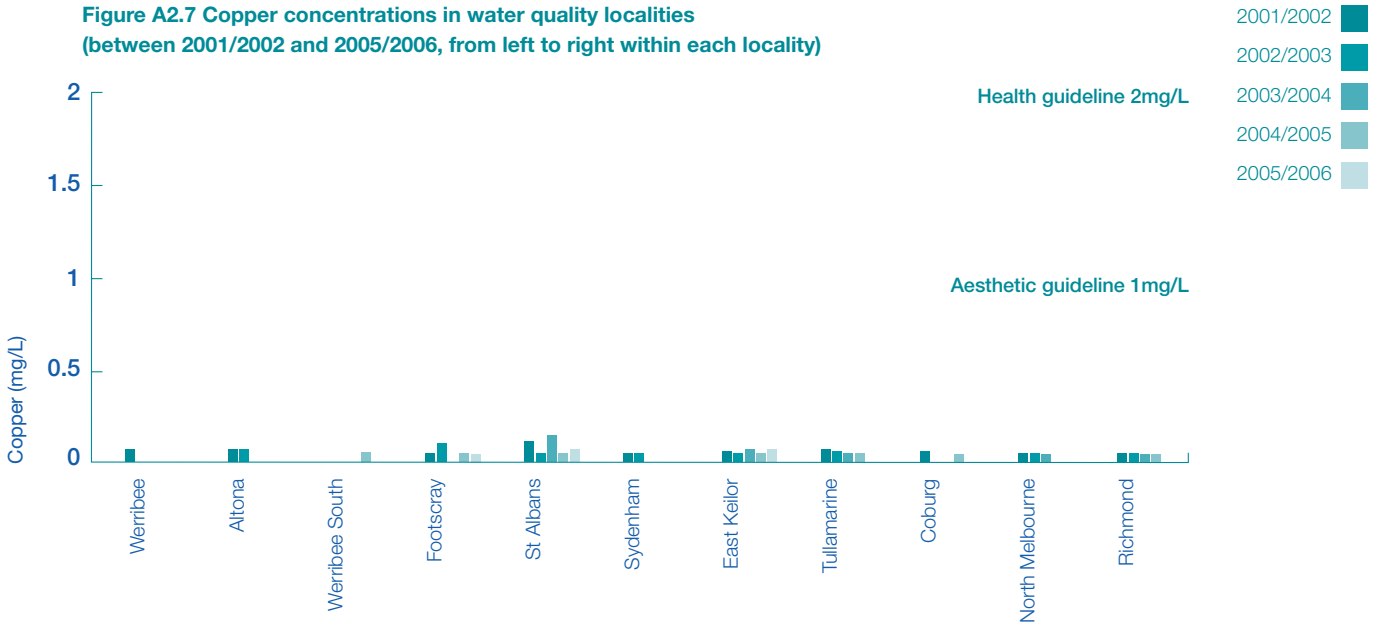


Figure A2.8 Average fluoride concentrations in water quality localities
 (between 2001/2002 and 2005/2006, from left to right within each locality)

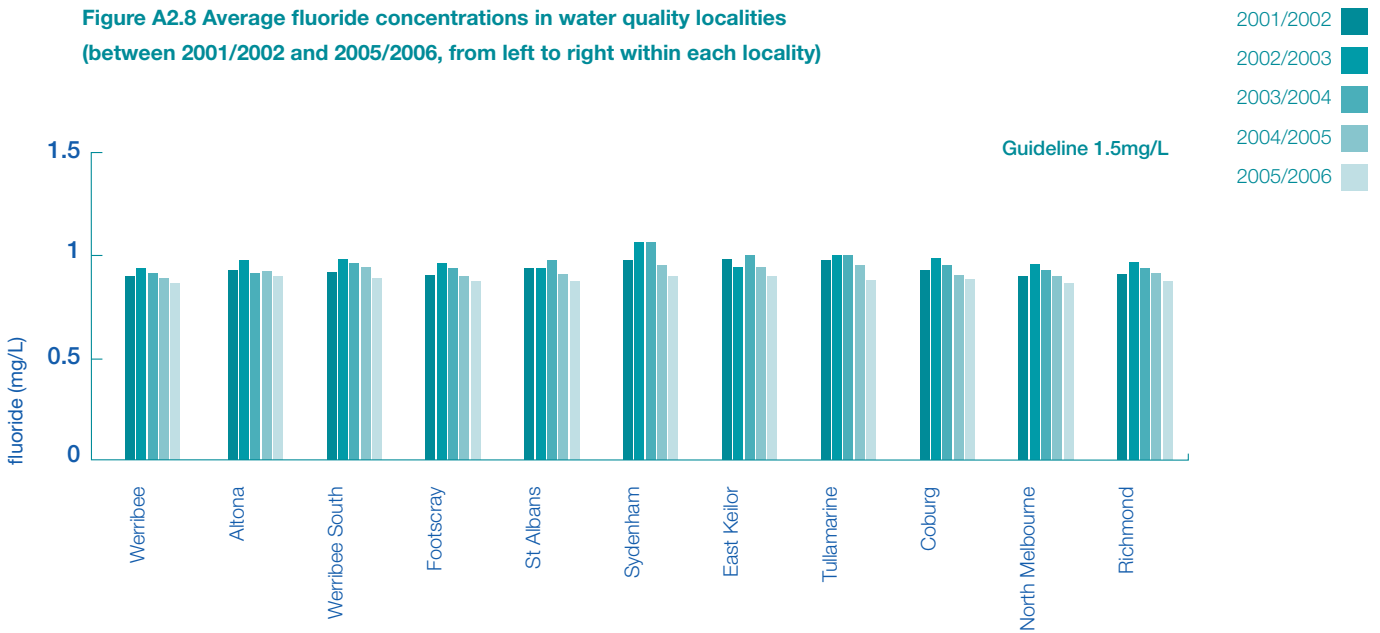


Figure A2.9 Hardness concentrations in water quality localities
 (between 2001/2002 and 2005/2006, from left to right within each locality)

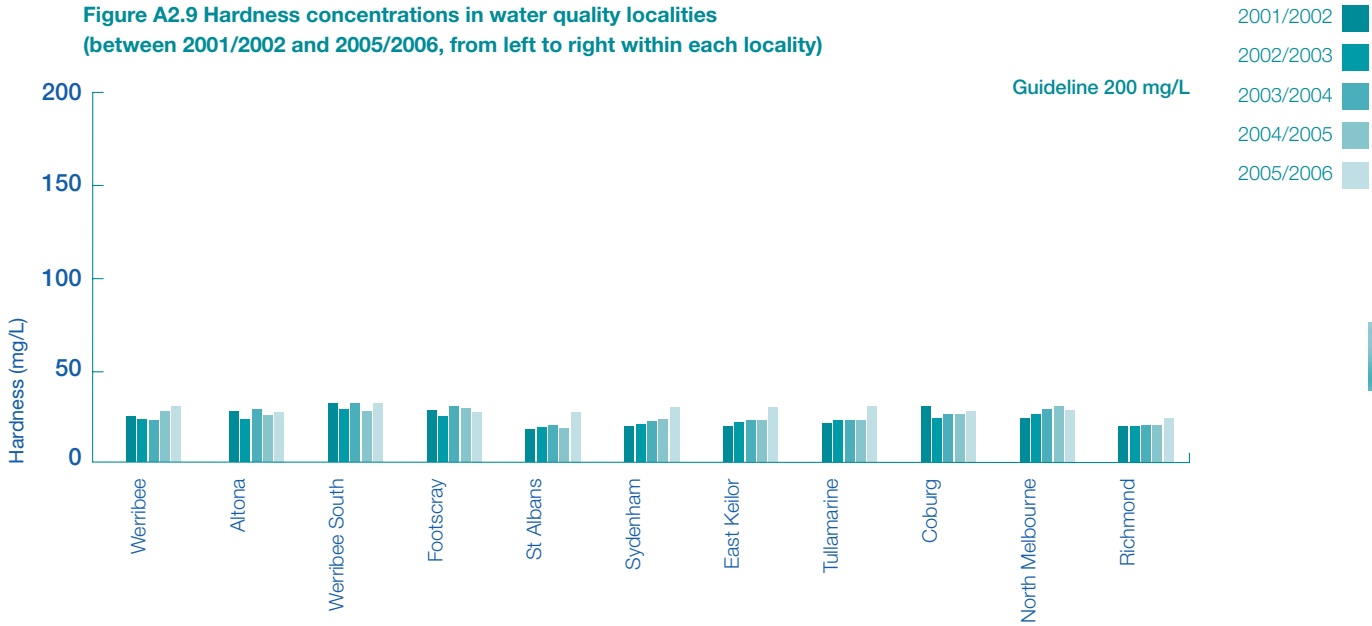


Figure A2.10 Average iron concentrations in water quality localities
 (between 2001/2002 and 2005/2006, from left to right within each locality)

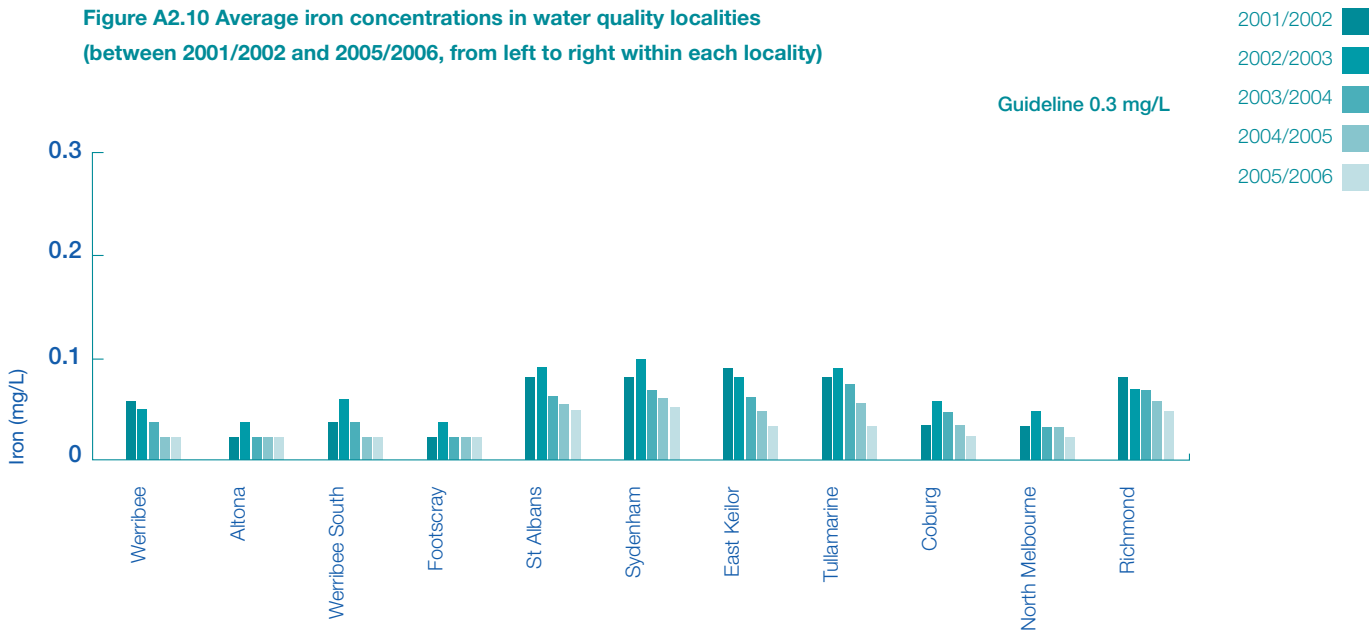


Figure A2.11 Average manganese concentrations in water quality localities (between 2001/2002 and 2005/2006, from left to right within each locality)

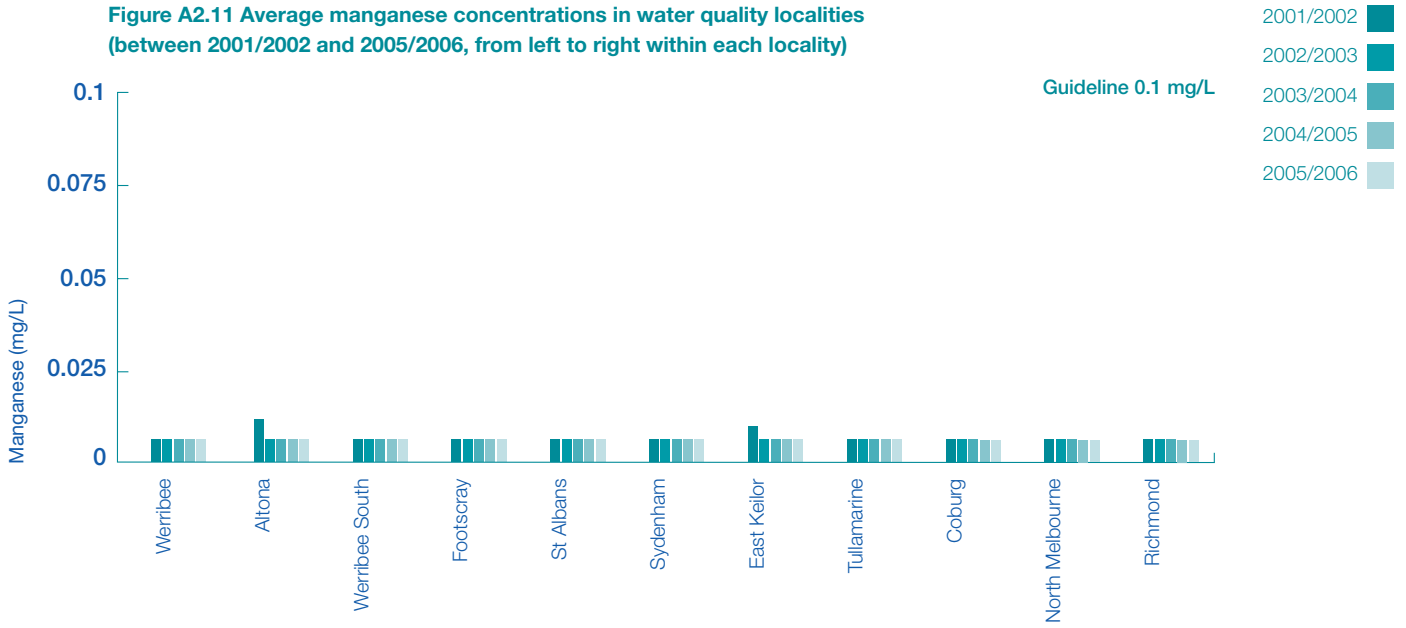


Figure A2.12 Nitrate concentrations in water quality localities (between 2001/2002 and 2005/2006, from left to right within each locality)

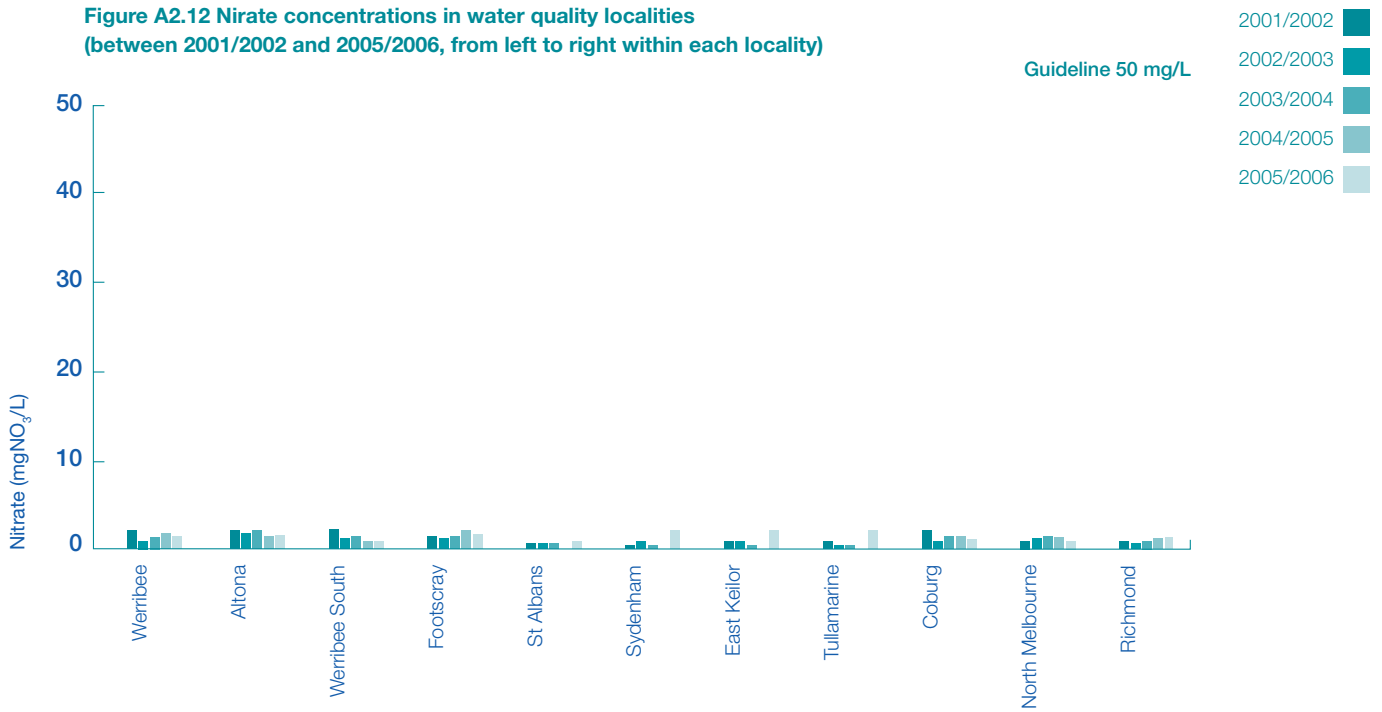


Figure A2.13 Average pH values in water quality localities
(between 2001/2002 and 2005/2006, from left to right within each locality)

Guideline 6.5 to 9.2

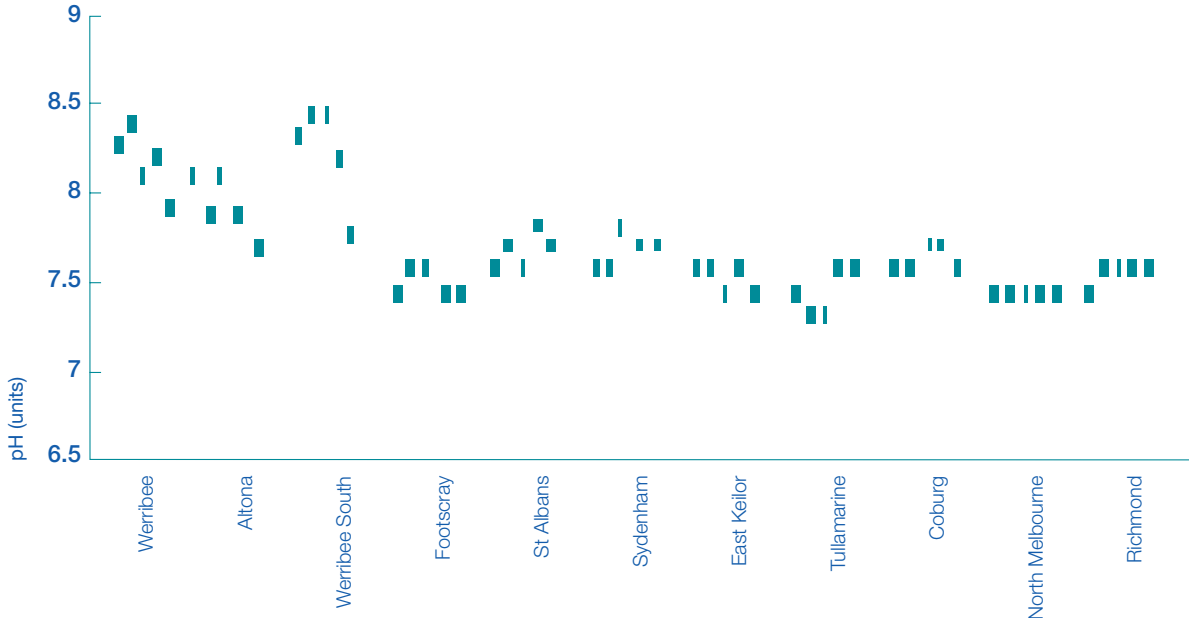


Figure A2.14 Sodium concentrations in water quality localities
(between 2001/2002 and 2005/2006, from left to right within each locality)

Guideline 180 mg/L

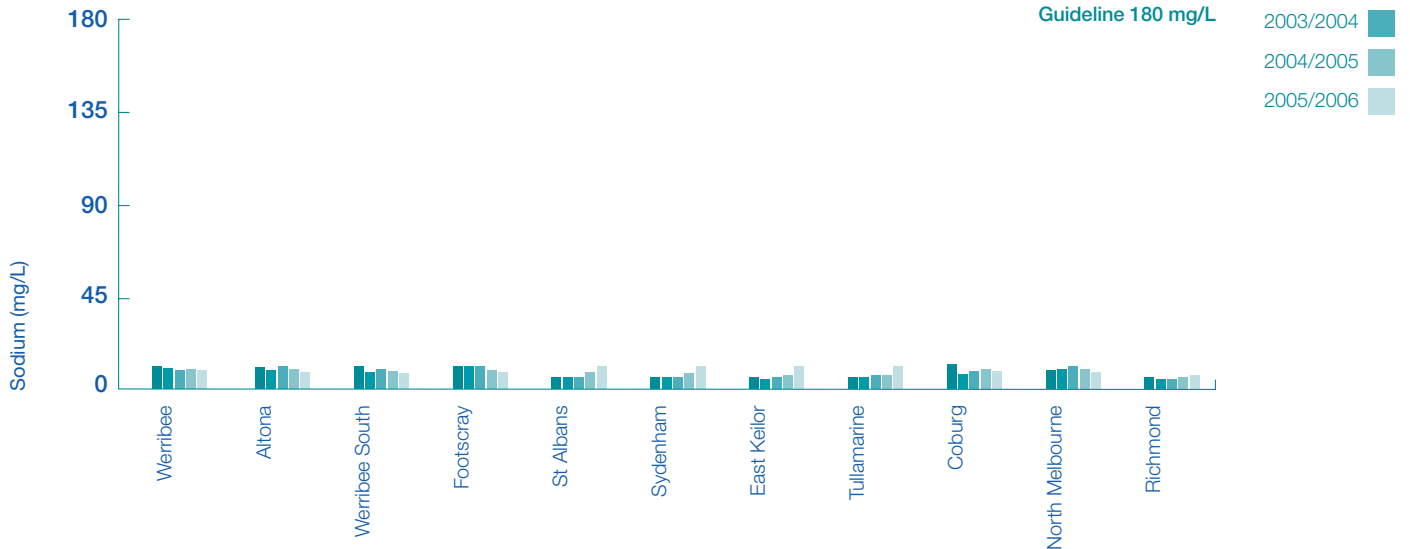


Figure A2.15 Summary turbidity levels in water quality localities
(between 2001/2002 and 2005/2006, from left to right within each locality)

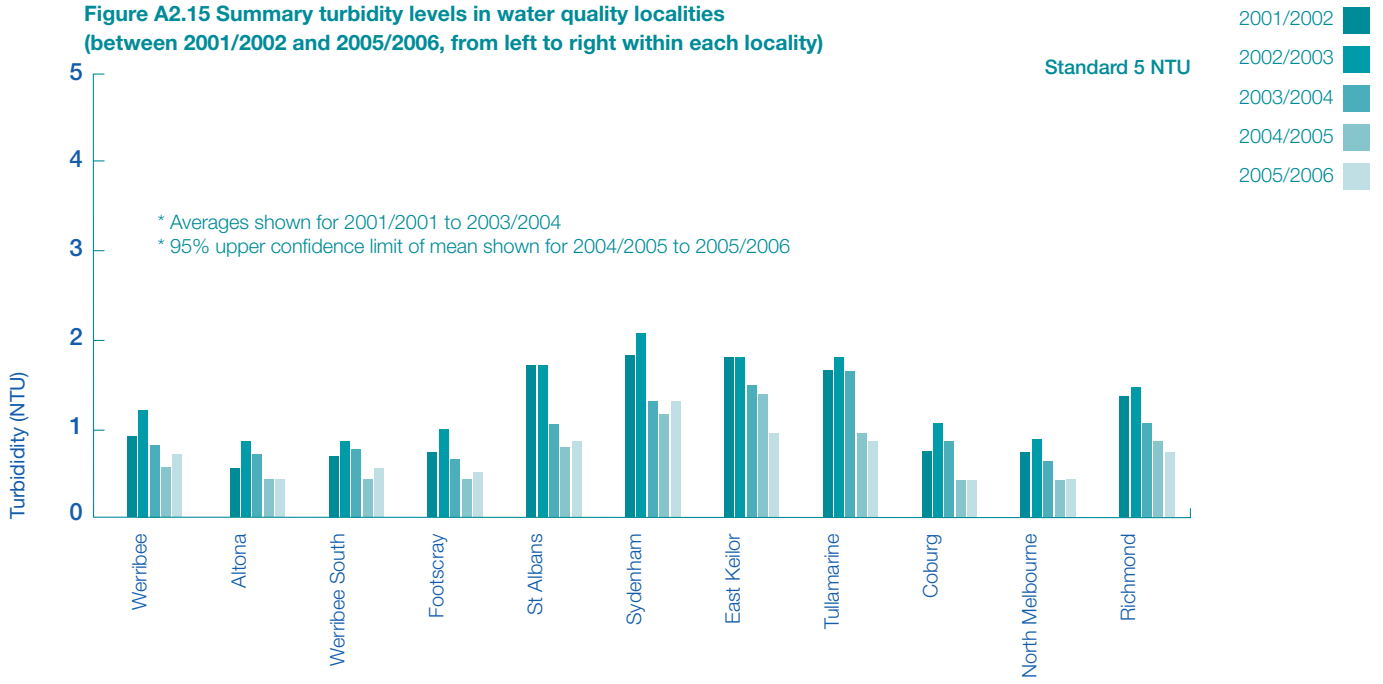


Figure A2.16 Sulphate concentrations in water quality localities
(between 2001/2002 and 2005/2006, from left to right within each locality)

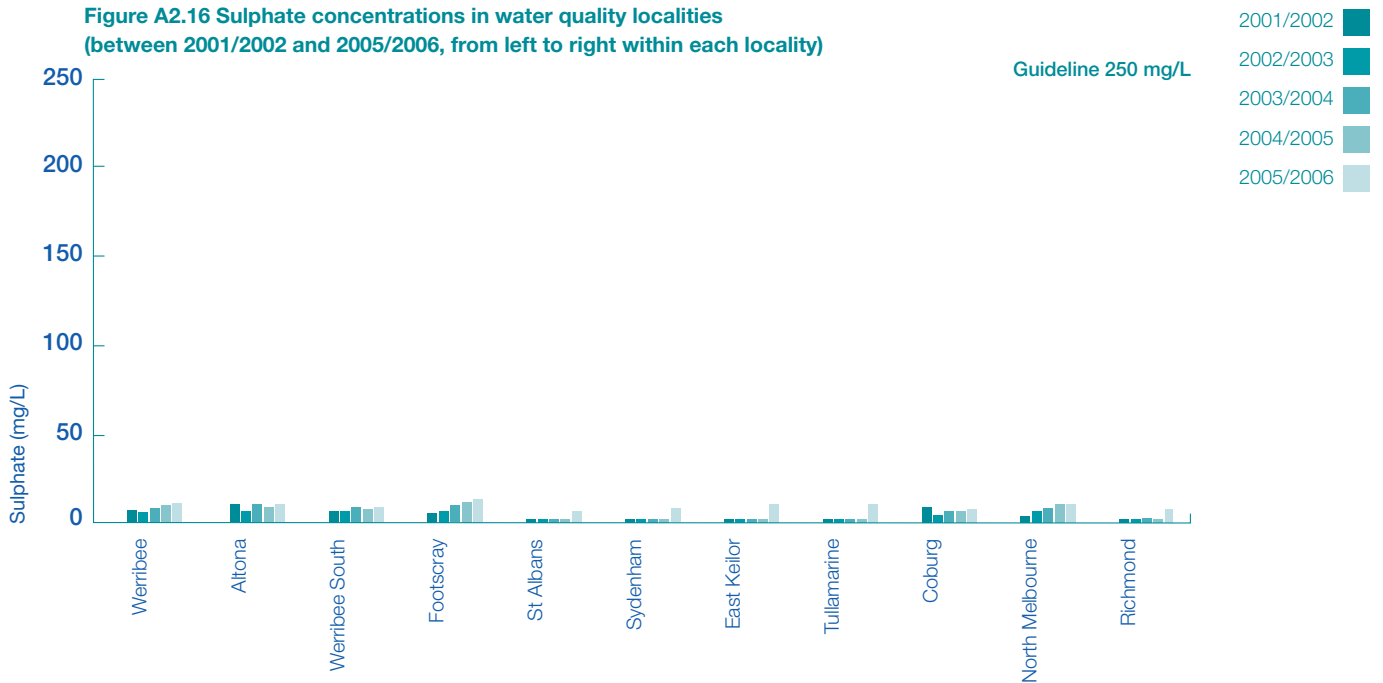
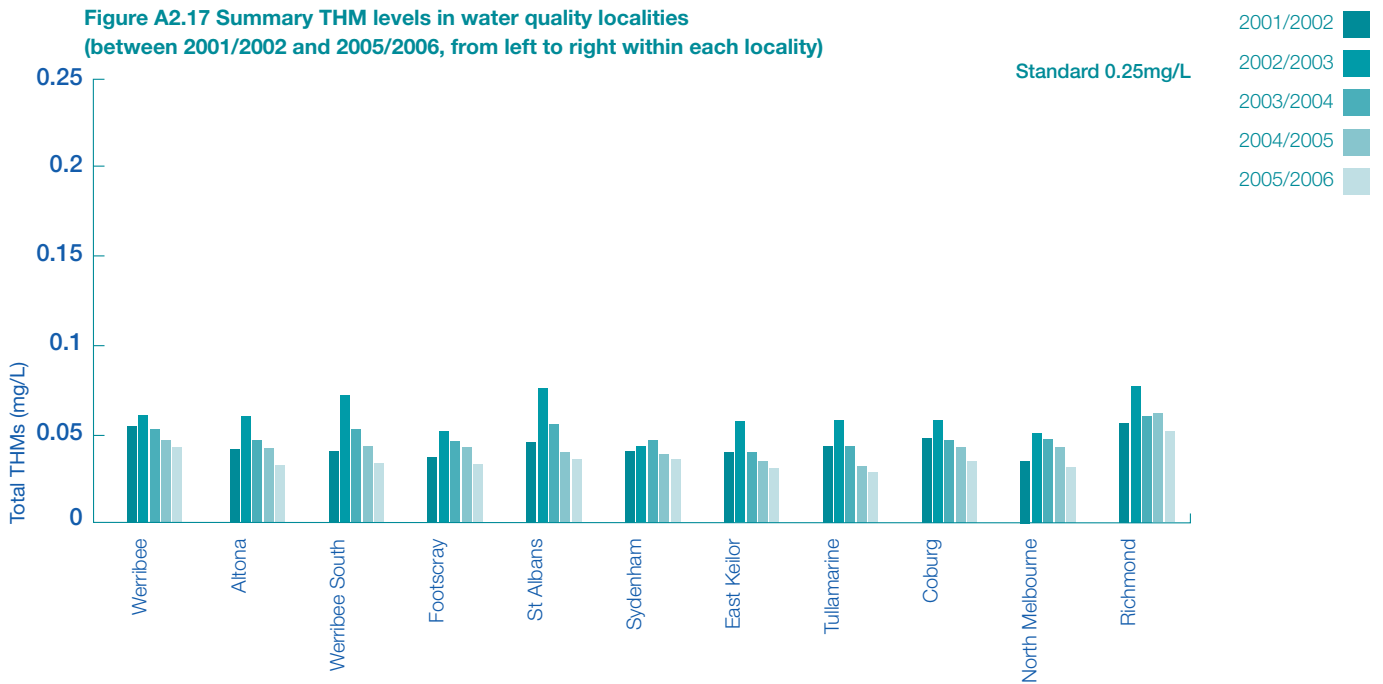


Figure A2.17 Summary THM levels in water quality localities
(between 2001/2002 and 2005/2006, from left to right within each locality)





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