



BUSSELTON WATER

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ANNUAL WATER QUALITY REPORT

2018-19

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MESSAGE FROM THE MANAGING DIRECTOR

I am pleased to present the 2018-19 Water Quality Report on behalf of Busselton Water.



Our commitment to compliance with health related and non-health related water quality criteria in the Australian Drinking Water Guidelines (ADWG) is firmly established. Our application of the ADWG is reinforced through our Memorandum of Understanding (MoU) with the Department of Health.

Busselton Water continued to achieve exceptional water quality results in 2018-19 as detailed in this report and summarised in the table below.

In addition to presenting water quality results and performance against the ADWG, this report describes the processes Busselton Water uses to collect, treat and distribute drinking water to our customers.

I wish to thank everyone who has contributed to these excellent results, particularly staff and representatives from Department of Health and the many contracted companies that support delivery of our services.

Chris Elliott
Managing Director

2018-19 WATER QUALITY RESULTS AT A GLANCE	
Incident management	
Incidents reportable to the Department of Health	Nil
Health related characteristics	
	Compliance
<i>Escherichia coli</i>	100%
<i>Naegleria</i>	100%
Chemical	100%
Pesticides	100%
Radiological	100%
Chlorine Disinfection	100%
Non-health characteristics	
	Compliance
Aesthetic characteristics (excluding chlorine) *	100%

* Busselton Water achieved full compliance with Australian Drinking Water Guidelines except for the 0.6 mg/L aesthetic guideline value for chlorine concentration. This aesthetic guideline value is exceeded to ensure the microbiological safety of our water supply.

OUR COMMITMENT

We are committed to achieving 100 per cent compliance, with health-related and non-health related water quality criteria in the ADWG.

To enable us to achieve this, we will:

- systematically monitor and report water quality performance;
- be prepared for incidents including regular testing of our response plans;
- fulfil all the requirements of our Operating Licence and MoU with the Department of Health; and
- review and implement the Drinking Water Quality Management Plan.

Drinking Water Quality Policy

Busselton Water is committed to providing our current and future customers with high quality, safe drinking water consistent with the ADWG.

In pursuit of our commitments, we will:

- endorse and embrace the ADWG including protection of catchments and sources;
- fulfil all the requirements of our Operating Licence and MoU with the Department of Health;
- maintain and implement a Drinking Water Quality Management System consistent with the 12 elements of the ADWG Framework;
- systematically monitor and report water quality performance;
- prepare for incidents and regularly test our response plans;
- ensure our own water extraction is sustainable; and

- champion protection of source catchments in collaboration with relevant government agencies and regulators.

Drinking Water Quality Management Framework

Busselton Water bases its Drinking Water Quality Management System on the ADWG Framework for Management of Drinking Water Quality, endorsed by the National Health and Medical Research Council. The Framework provides benchmark water quality guidelines and values for designing a structured system for drinking water quality management. It aims to ensure a safe and reliable water supply.

There are 12 elements within the ADWG Framework¹ which are considered best practice. These elements are divided into four sections:

1. Commitment to drinking water quality management;
2. System analysis and management;
3. Supporting requirements;
4. Review.

Busselton Water regularly assesses its performance against these elements.

In addition, our Operating Licence issued by the Economic Regulation Authority, incorporates our MoU² with the Department of Health. The MoU describes the Department of Health requirements for compliance with the microbiological, health, chemical and radiological criteria.

Busselton Water provides the Department of Health with a quarterly water quality report, outlining how our organisation has performed against agreed requirements specified in the MoU.

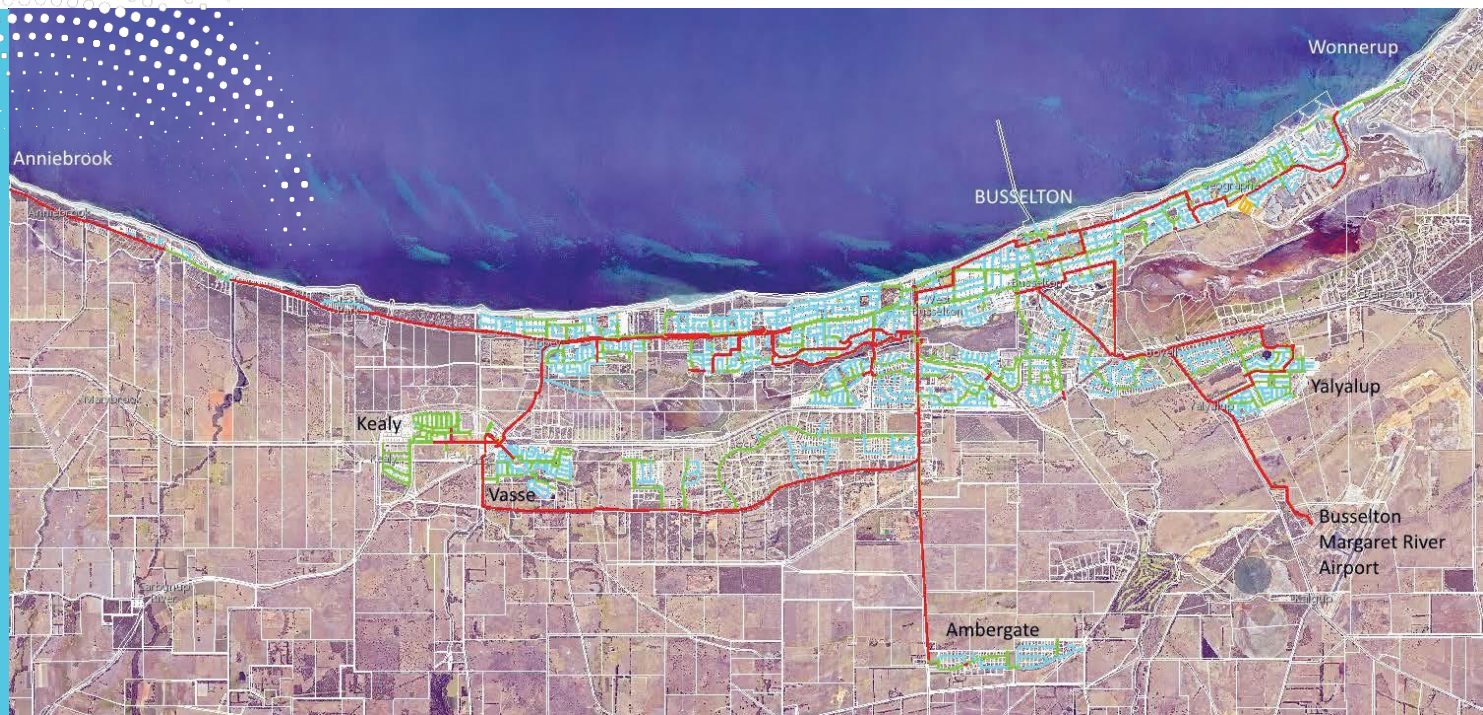
Busselton Water is a member of Western Australia's Advisory Committee for the Purity of Water³.

¹ The "Australian Drinking Water Guidelines" published by the National Health and Medical Research Council, Australia's peak health research body, provides an authoritative reference on what defines safe, good quality drinking water; how it can be achieved; and how it can be assured. It is available for download from <https://nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines>.

² A copy of the Memorandum of Understanding with the Department of Health is available on the Busselton Water website.

³ More information on the Advisory Committee for the Purity of Water can be found at http://ww2.health.wa.gov.au/Articles/A_E/Advisory-Committee-for-the-Purity-of-Water

OUR GEOGRAPHIC COVERAGE



Current Extent of Operation

Established in 1906, Busselton Water is a local water corporation. We share a 113-year history and culture with the local community. We provide potable water services to more than 26,000 people within the city of Busselton (doubling to more than 50,000 in peak holiday periods), as well as bulk water supplies to the neighbouring town of Dunsborough.

We currently provide drinking water within a serviced area of 81,200ha, centred around Busselton as shown above. Red, green and blue lines depict water distribution pipes of various sizes, with red being the largest mains pipes and blue being the smallest.

⁴ <https://www.erawa.com.au/cproot/12840/2/Operating%20area%20map%20-%20WL3%20-%20Busselton%20Water.PDF>

Our Licence Area

Busselton Water's operating licence (WL 3, Version 7) authorises Busselton Water to provide potable water supply services to an area of approximately 688,700ha.

A map of our Operating Licence Area can be viewed on the Economic Regulation Authority website.⁴

SYSTEM ANALYSIS AND MANAGEMENT

Our Water Source

Busselton Water sources the bulk of its raw water from the deep, confined, Yarragadee aquifer. There is some draw from the base of the shallower Leederville aquifer which extends from about 10 to 275 metres in depth. Below this the Yarragadee aquifer extends to over 800 metres in depth.

Busselton Water extracts this raw water under licences (GWLs 110850 and 110851), issued by the Department of Water and Environmental Regulation (DWER). There are eight production bores pumping the raw water to treatment plants for filtration and disinfection before the treated water is stored in tanks and reticulated to customers.

Source protection

Busselton Water, in conjunction with DWER, developed the Busselton Water Reserves Drinking Water Source Protection Plan (Report WRP 139) released by the Department of Water, predecessor of DWER, in August 2013. The Plan defines the boundaries of Busselton Water's Water Reserve and assigns a Priority 1 to these reserves. This identifies that due to the confined nature of this drinking water source, there is no risk of contamination from overlying land uses. The purpose of proclaiming the water reserves was to ensure the bore locations are under legislative protection.



Busselton Water is also bound by DWER's Groundwater Licence Operating Strategy (GLOS), issued March 2014, stipulating annual extraction entitlement limits, licence conditions and compliance requirements. Busselton Water's consultant Hydrogeologists (Rockwater Pty Ltd) review this document along with the implementation of the borefield construction and maintenance plan, monitoring and reporting requirements, to ensure future operational strategies are sustainable in the long term.

Extraction of water in accordance with the operating strategy is shown as follows:

Financial Year	Extraction (gigalitres)
2008-2009	4.49
2009-2010	4.23
2010-2011	4.30
2011-2012	4.30
2012-2013	4.59
2013-2014	5.05
2014-2015	5.18
2015-2016	5.38
2016-2017	5.15
2017-2018	5.35
2018-2019	5.41

SYSTEM ANALYSIS AND MANAGEMENT

Understanding Water Quality

Turbidity	Turbidity is the cloudy appearance of water caused by the presence of suspended matter.	The Australian Drinking Water Guidelines specify an aesthetic guideline of 5 Nephelometric Turbidity Units (NTU). If disinfection is required, a turbidity of less than 1 NTU is desirable at the point of disinfection.
Colour	Colour in water originates mainly from natural drainage through soil and vegetation in a catchment.	The Australian Drinking Water Guidelines value for colour is based on the colour that is noticeable in a glass. This is generally accepted as 15 Hazen Units (HU).
Iron	Iron occurs naturally in water as a result of contact with soil or rock in the catchment. Iron in the water does not present a health hazard.	The Australian Drinking Water Guidelines recommend that based on aesthetic consideration, the concentration of Iron should not exceed 0.3 milligrams per Litre (mg/L).
Manganese	Manganese in water can come from contact with soil or rock in the catchment. Manganese is not considered a health concern unless the concentration exceeds 0.5 mg/L.	The Australian Drinking Water Guidelines recommend that based on aesthetic considerations, the levels of Manganese should not exceed 0.1 mg/L.
Total Dissolved Solids	Total dissolved solids (TDS) consist of inorganic (natural) salts and small amounts of organic matter dissolved in water. Total dissolved solids comprise sodium, potassium, calcium, magnesium, chloride, sulphate, bicarbonate, carbonate, silicon, organic matter, fluoride, iron, manganese, nitrate and phosphate.	Treated water quality containing TDS levels of below 500 mg/L is classified as good.
Microbial Pathogens	<p>The most common and widespread health risk associated with drinking water is contamination by microorganisms. Organisms associated with the gut of humans and mammals cause the usual waterborne diseases. Tests are undertaken for <i>Escherichia coli</i> (<i>E. coli</i>) as an indicator of microbial contamination.</p> <p>Thermophilic <i>Naegleria</i> refers to a group of amoebae which includes <i>Naegleria fowleri</i>, the organism that causes the waterborne disease primary amoebic meningoencephalitis. <i>Naegleria fowleri</i> is an environmental pathogen which naturally lives in fresh warm water.</p>	<p>The Australian Drinking Water Guidelines state that thermotolerant coliforms/<i>E.coli</i> should not be present in a minimum 100mL sample of drinking water.</p> <p>The Department of Health WA has notification protocols in place regarding <i>Naegleria</i>. Busselton Water is required to immediately notify the Department of Health if <i>Naegleria</i> is detected in any microbiological sample.</p>
Radiological	There are natural levels of radiation within the environment, and groundwater sources such as that sourced from the Yarragadee aquifer can have higher background levels than that of surface water systems.	Testing is undertaken for gross alpha and gross beta radioactivity, where screening levels can be determined. The Australian Drinking Water Guidelines recommend a screening level of 0.5 Becquerel per Litre (Bq/L).
pH	pH is a measure of how acidic/basic water is. The range goes from 0 - 14, with 7 being neutral. pH is the measure of free hydrogen ion concentrations in the water.	The suggested aesthetic pH target from the Australian Drinking Water Guidelines is 6.5 to 8.5.

SYSTEM ANALYSIS AND MANAGEMENT

Water Treatment

Busselton Water uses a three-step process to treat raw water from the deep groundwater aquifers to provide customers with safe drinking water.

Pre-oxidation and aeration

Raw water is dosed with a small amount of chlorine, which is a strong oxidizing agent. The water is then aerated through spray nozzles. These two processes oxidise naturally occurring iron and manganese, turning them from their soluble form into small solids.



Filtration

The pre-chlorinated and aerated water is then filtered through sand filters to remove the iron, manganese, turbidity and other impurities. The filtered water is then collected in a clear-water well.



Disinfection

A further dose of chlorine is added to water pumped from the clear-water well. This dose maintains the disinfection level required to preserve microbiological safety before the water is stored in tanks and pumped into the distribution system. Chlorine is approved for use in drinking water supplies and Busselton Water sources chlorine gas from an ISO 9001-accredited manufacturer.



The whole water supply process is shown schematically overleaf.

SYSTEM ANALYSIS AND MANAGEMENT

Our Water Treatment Plants

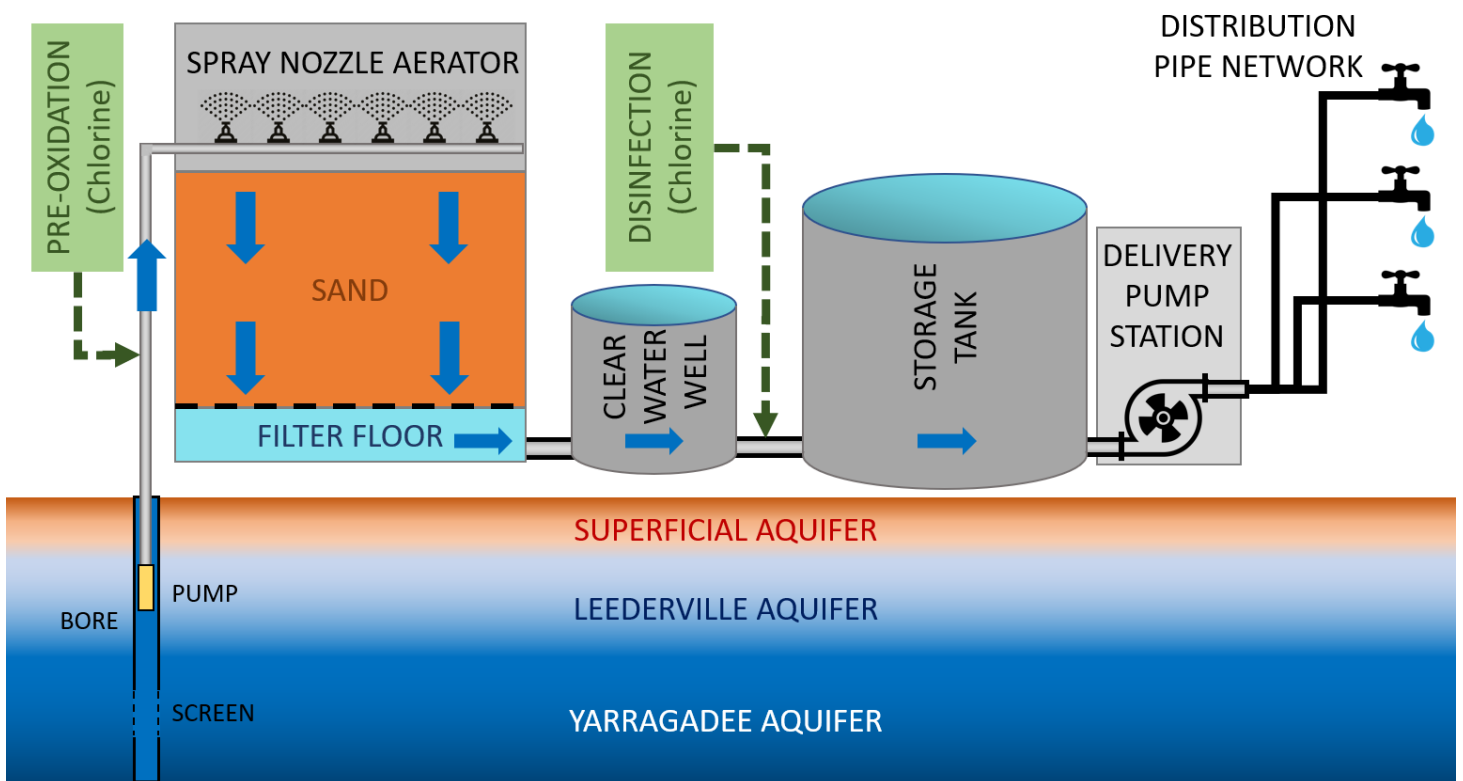
Busselton Water operates three water treatment plants (Plant 1, Plant 2 and Plant 3).

Chlorine disinfection occurs at each treatment plant to keep the concentration of chlorine in the distribution system at or above 0.4 mg/L to ensure adequate protection against Thermophilic *Naegleria* and other microbiological threats.

The ADWG set 5 mg/L of chlorine as the upper acceptable limit.

For further detail please refer to the non-health (aesthetic) results section on page 21.

WATER TREATMENT and SUPPLY PROCESS



Distribution Network

Busselton Water’s distribution network delivers drinking water to customers within the City of Busselton and transfers bulk water to neighbouring Dunsborough. The network operates as one large, interconnected system. Materials used in the reticulation network have been approved either under Australian Standard AS/NZS 4020: 2005. (Testing of Products for Use in Contact with Drinking Water) or as scheduled in the MoU with the Department of Health. Strict protocols established by Busselton Water in conjunction with the Department of Health and the Department of Mines, Industry Regulation and Safety assure the:

- safety and integrity of water distributed to customers;
- safe handling of chlorine at the water treatment plants; and
- safety of chemicals used and materials in contact with drinking water.

DISTRIBUTION NETWORK COMPONENTS	
Estimated population	Approx. 26,000
Total number of connections	13,710
Total length of pipes	325 km
Number of storage tanks	5
Chlorine residual target	0.4 to 0.6 mg/L
Number of distribution water quality zones	1

SYSTEM ANALYSIS AND MANAGEMENT

Multi-barrier Approach

Preventing contamination and minimising potential hazards is an essential part of providing our customers with safe drinking water. The ADWG require the implementation of a multi-barrier approach as the most effective way of ensuring the safety of drinking water.

Busselton Water's barriers include:

- protection of groundwater;
- treatment;
- chlorine disinfection; and
- backflow prevention.

Busselton Water maintains and operates these multiple barriers, ensuring they are robust and that high-quality drinking water is delivered to our customers.



Incident Responses

While every effort is made to prevent water quality incidents from occurring, there will inevitably be times when our systems fail due to equipment malfunction, human error, extreme weather conditions or unforeseen events. Busselton Water has incident response plans to manage such events with the minimum possible impact on water quality.

In the event of a water quality incident, Busselton Water activates its Water Quality Incident Response Plan. This comprehensive plan is applied to manage water quality incidents and is consistent

with the MoU between Busselton Water and the Department of Health.

To maintain our preparedness to deal with any water quality incidents, as part of our compliance with the MoU with the Department of Health, a mock event simulating a major chlorine gas event was held in November 2019 in conjunction with the Department of Fire and Emergency Services (DFES). It tested the effectiveness of staff and BW's Business Continuity and Emergency Response Plans.

There were no water quality incidents reportable to the Department of Health in 2018-19.

SYSTEM ANALYSIS AND MANAGEMENT

Water Quality Monitoring and Testing

Busselton Water has a comprehensive water quality monitoring program which has been reviewed and endorsed by the Department of Health.

Key parameters monitored by Busselton Water are:

- **microbiological** – including Thermophilic *Naegleria* and *Escherichia coli*;
- **chemical health** – including:
 - a large range of parameters with health-related guideline values defined by the ADWG; and
 - pesticides which are monitored and tested on an annual basis to monitor the risk of groundwater contamination by pesticides and agricultural chemicals used in proximity to our bores or in the aquifer recharge area;
- **chemical non-health (aesthetic)** – including a large range of parameters with non-health guideline values defined by the ADWG; and
- **radiological health** – monitored and tested on an annual basis.



Development, Training and Innovation

Busselton Water utilises training in accordance with the National Water Industry Training package. Water quality operational staff progress towards Certificate III in Water Industry Operations.

Busselton Water adopts a best practice 70/20/10 development approach. This approach allocates more time to experiential learning and delivers better employee development and business outcomes. It consists of 70 per cent experiential learning, 20 per cent mentorship of employee learning (including development planning), and 10 per cent approved class-based training.

Personnel regularly attend relevant training courses and/or conferences.

Busselton Water continued to derive benefit from innovative detection of backflow from residential customers' properties using radio frequency water meters.

Our Customers

We strive to deliver excellence in customer service and continue to improve our existing levels of customer satisfaction. Busselton Water holds Customer Advisory Group meetings twice per year.

Water quality complaints remain at a very low level. Busselton Water received 15 water quality complaints during 2018-19, with three relating to taste and odour, eleven relating to discoloured water, and one relating to customers' water use for non-drinking purposes.

All customer complaints were investigated through personal contact with the customer. All complaints were resolved through either flushing the pipe network in the immediate vicinity of the customer's property or improving the customer's understanding of how drinking water quality is managed.

REVIEW

Busselton Water monitors water quality by taking weekly water samples.

Microbiological Health and Disinfection Results

Busselton Water collected 350 samples from the reticulation system during the reporting period and 100 per cent of these samples were compliant with no detections of either *Escherichia coli* or Thermophilic *Naegleria*. A further 1,222 samples were taken to assess chlorine levels.

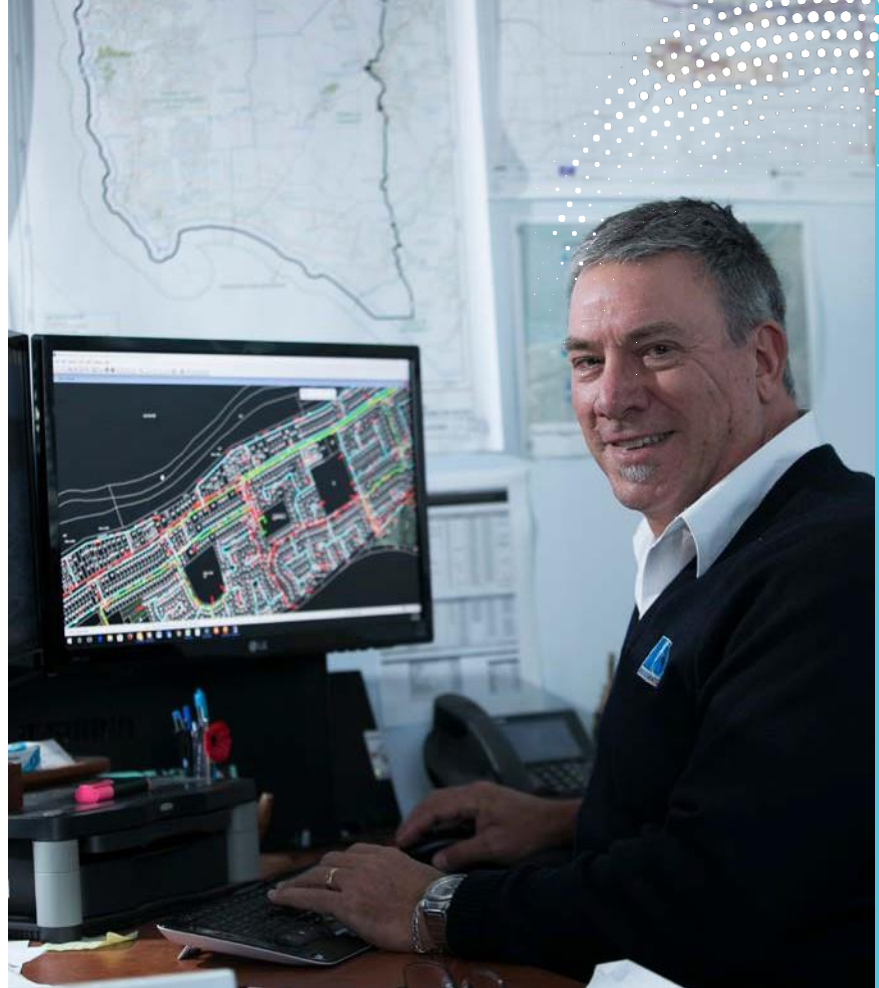
Chemical Health Results

There are many chemical parameters that have health-related guideline values in the ADWG. Busselton Water achieved 100 per cent compliance with all these requirements. The report in the next section gives more detail on the individual parameters.

Radiological Health Results

Groundwater radiological testing is carried out in accordance with parameters and frequencies based on the ADWG and in consultation with the Department of Health.

Groundwater radiological testing is only required periodically. Gross alpha and gross beta are tested annually in April and results from these samples were 100 per cent compliant.



Non-health (Aesthetic) Results

Except for chlorine as described below, Busselton Water achieved 100 per cent compliance.

Busselton Water uses chlorine to provide a disinfectant residual in the water distribution system. Disinfection is designed to kill pathogenic microorganisms, thereby preventing waterborne diseases.

Chlorination is the most commonly used process for disinfection and was endorsed by the National Health and Medical Research Council for use as a drinking water treatment chemical in 1983. The ADWG aesthetic upper guiding value for chlorine is 0.6 mg/L.

The ADWG state that “*In some supplies it may be necessary to exceed the aesthetic guideline in order to maintain an effective disinfectant residual throughout the system.*” Busselton Water closely manages chlorine dosing levels to maintain a minimum residual chlorine level of 0.4 mg/L throughout the distribution system. During the year, Busselton Water collected 1,222 chlorine samples in the distribution network. The minimum total chlorine level was 0.08 mg/L (in a new street slowly establishing consistent flows), and the maximum was 0.80 mg/L.

There are many parameters with aesthetic guideline values in the ADWG. Results of individual parameters are outlined in the next section of this report.

WATER QUALITY RESULTS

In the period 1 July 2018 to 30 June 2019, there were no water quality incidents reportable to the Department of Health.

CHLORINE SAMPLES – 1 JULY 2018 TO 30 JUNE 2019

Busselton Water collected 217 total chlorine samples during 2018-19 for formal assessment of our water's chemical health characteristics. An additional 1,222 total chlorine samples were taken in the distribution network during 2018-19 to manage the disinfection performance achieved within the pipe network. The minimum average and maximum levels of these additional operational samples were:

TYPE	Minimum mg/L	Average mg/L	Maximum mg/L
Distributed Chlorine (Total)	0.08	0.52	0.80

MICROBIOLOGICAL SAMPLES – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG limit	Number of samples		Total no. of samples (treated + distribution)	Maximum value		Number of non-compliance with ADWG limit		Distribution water Compliance %
			Treated water (non-assessable)	Distribution water (assessable)		Treated water (non-assessable)	Distribution water (assessable)	Treated water (non-assessable)	Distribution water (assessable)	
<i>Escherichia coli</i>	CFU/ 100mL	0	228	357	585	0	0	0	0	100%
Thermophilic <i>Naegleria</i>	org/ 250mL	ND	223	350	573	ND	ND	0	0	100%
<i>Naegleria fowleri</i>	org/ 250mL	ND	0	0	0	-	-	0	0	100%

Note: Five Treated Water and seven Distribution Water microbiological samples were not scheduled or carried out on 2 January 2019, because Busselton Water staff believed that the PathWest Laboratory, subcontracted to carry out TA and TN sampling for SGS Australia, would be closed over the Christmas / New Year period. These samples were not rescheduled.

RADIOLOGICAL SAMPLES – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG (Health) limit	Raw Water (Bores)				Treated Water (Storage Tanks)			
			Non-Compliance (Health)	No. of Samples	% Compliance (Health)	Maximum Detected Bq/L	Non-Compliance (Health)	No. of Samples	% Compliance (Health)	Maximum Detected Bq/L
Gross Alpha	Bq/L	0.5	0	7	100%	0.254	0	5	100%	0.312
Gross Beta	Bq/L	0.5	0	7	100%	0.218	0	5	100%	0.157

WATER QUALITY RESULTS

Memorandum of Understanding – Drinking Water Quality Report

CHEMICAL HEALTH – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG LIMIT (Health)	Lab Limit of Reporting (LOR)	Number of Samples		Total No. of Samples (Raw + Distribution)	Maximum Value		Number of Non-compliance with ADWG limit		Compliance % Distribution Water	
				Raw Water	Distribution Water		Raw Water	Distribution Water	Raw Water	Distribution Water		
Antimony	mg/L	0.003	0.001	NR	16	16	NR	ND	NR	0	100%	
Arsenic	mg/L	0.007	0.001	NR	16	16	NR	ND	NR	0	100%	
Barium	mg/L	0.7	0.001	NR	16	16	NR	0.31	NR	0	100%	
Beryllium	mg/L	-	0.001	NR	16	16	NR	ND	NR	0	100%	
Boron	mg/L	4	0.005	NR	16	16	NR	0.21	NR	0	100%	
Bromate	mg/L	0.02	0.005	NR	7	7	NR	ND	NR	0	100%	
Bromide	mg/L	-	0.05	NR	7	7	NR	0.12	NR	0	100%	
Bromodichloromethane	mg/L	0.25*	0.0005	NR	12	12	NR	ND	NR	0	100%	
Bromoform	mg/L	0.25*	0.0005	NR	12	12	NR	0.003	NR	0	100%	
Cadmium	mg/L	0.002	0.0001	NR	16	16	NR	ND	NR	0	100%	
Chlorine (Total)	mg/L	5		NR	217	217	NR	0.8	NR	0	100%	
Chloroform	mg/L	0.25*	0.0005	NR	12	12	NR	ND	NR	0	100%	
Copper	mg/L	2	0.001	NR	16	16	NR	0.13	NR	0	100%	
Dibromochloromethane	mg/L	0.25*	0.0005	NR	12	12	NR	0.0052	NR	0	100%	
Fluoride	mg/L	1.5	0.1	NR	84	84	NR	0.6	NR	0	100%	
Lanthanum	mg/L	0.002	0.001	NR	7	7	NR	ND	NR	0	100%	
Lead	mg/L	0.01	0.001	NR	16	16	NR	ND	NR	0	100%	
Manganese (Soluble)	mg/L	0.5	0.005	77	84	161	0.12	ND	0	0	100%	
Manganese (Total)	mg/L	0.5	0.005	77	84	161	0.18	ND	0	0	100%	
Mercury	mg/L	0.001	0.00005	NR	16	16	NR	ND	NR	0	100%	
Molybdenum	mg/L	0.05	0.001	NR	16	16	NR	ND	NR	0	100%	
Nickel	mg/L	0.02	0.001	NR	16	16	NR	ND	NR	0	100%	
Nitrate	mg/L	50	0.05	26	NR	26	0.12	NR	0	NR	100%	
Nitrite	mg/L	3	0.005	26	NR	26	0.55	NR	0	NR	100%	
Selenium	mg/L	0.01	0.001	NR	16	16	NR	ND	NR	0	100%	
Silver	mg/L	0.1	0.001	NR	16	16	NR	ND	NR	0	100%	
Total Trihalomethanes	mg/L	0.25*	0.0005	NR	12	12	NR	0.008	NR	0	100%	
Uranium	mg/L	0.017	0.001	NR	16	16	NR	ND	NR	0	100%	
			TOTAL		206	276	482	-	-	0	0	100%

mg/L = milligrams per litre

NTU = Nephelometric turbidity units

Note 1: ND = Not Detected

Note 2: NR = Not required to be sampled

Note 3: Chlorine Total is a Busselton Water in-house test. All others are accredited test results.

Note 4: *The concentration of trihalomethanes, either individually or in total, in drinking water should not exceed 0.25 mg/L

WATER QUALITY RESULTS

CHEMICAL HEALTH – PESTICIDES – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG LIMIT (Health)	Lab Limit of Reporting (LOR)	Number of Samples	Maximum Value	Number of Non-compliance with ADWG limit	Compliance %
Organochlorine Pesticides							
Aldrin	µg/L	0.3	0.01	5	ND	0	100%
Methoxychlor	µg/L	0.3	0.1	5	ND	0	100%
Organochlorine Pesticides							
Alpha Endosulfan	µg/L	20	0.005	5	ND	0	100%
Beta Endosulfan	µg/L	20	0.005	5	ND	0	100%
Endosulfan Sulphate	µg/L	20	0.005	5	ND	0	100%
Heptachlor	µg/L	0.3	0.002	5	ND	0	100%
Heptachlor Epoxide	µg/L	0.3	0.002	5	ND	0	100%
Dieldrin	µg/L	0.3	0.002	5	ND	0	100%
p,p'-DDT	µg/L	9	0.001	5	ND	0	100%
Alpha Chlordane	µg/L	2	0.002	5	ND	0	100%
Gamma Chlordane	µg/L	2	0.002	5	ND	0	100%
Organophosphate Pesticides							
Diazinon (Dimpylate)	µg/L	4	0.01	5	ND	0	100%
Dichlorvos	µg/L	5	0.5	5	ND	0	100%
Methidathion	µg/L	6	0.05	5	ND	0	100%
Azinphos-methyl (Guthion)	µg/L	30	0.05	5	ND	0	100%
Fenthion	µg/L	7	1	5	ND	0	100%
Dimethoate	µg/L	7	0.15	5	ND	0	100%
Ethion	µg/L	4	0.05	5	ND	0	100%
Organophosphate Pesticides							
Chlorpyrifos (Chlorpyrifos Ethyl)	µg/L	10	0.009	5	ND	0	100%
Parathion-ethyl (Parathion)	µg/L	20	0.004	5	ND	0	100%
Fenitrothion	µg/L	7	0.1	5	ND	0	100%
Acid Herbicides							
Picloram	µg/L	300	0.01	5	ND	0	100%
Triclopyr	µg/L	20	0.01	5	ND	0	100%
2,4-D	µg/L	30	0.01	5	ND	0	100%
Clopyralid	µg/L	2000	0.01	5	ND	0	100%
2,4,5-T	µg/L	100	0.01	5	ND	0	100%
MCPA	µg/L	40	0.01	5	ND	0	100%
Bromoxynil	µg/L	10	0.01	5	ND	0	100%
Dicamba	µg/L	100	0.01	5	ND	0	100%

mg/L = milligrams per litre µg/L = micrograms per litre ND = Not Detected

WATER QUALITY RESULTS

CHEMICAL HEALTH – VOLATILE ORGANIC COMPOUNDS (part 1) – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG LIMIT (Health)	Lab Limit of Reporting (LOR)	Number of Samples	Maximum Value	Number of Non-compliance with ADWG limit		Compliance %
						Distribution Water		
Fumigants								
cis-1,3-dichloropropene	µg/L	100	0.5	5	ND	0		100%
trans-1,3-dichloropropene	µg/L	100	0.5	5	ND	0		100%
Halogenated Aliphatics								
Tetrachloroethene (Perchloroethylene,PCE)	µg/L	50	0.5	5	ND	0		100%
Trichloroethene (Trichloroethylene,TCE)	µg/L	no data	0.5	5	ND	0		100%
Vinyl chloride (Chloroethene)	µg/L	0.3	0.3	5	ND	0		100%
1,1,1-trichloroethane	µg/L	no data	0.5	5	ND	0		100%
Carbon tetrachloride	µg/L	3	0.5	5	ND	0		100%
1,1-dichloroethane	µg/L	no data	0.5	5	ND	0		100%
1,2-dichloroethane	µg/L	1500	0.5	5	ND	0		100%
1,1-dichloroethene	µg/L	no data	0.5	5	ND	0		100%
cis-1,2-dichloroethene	µg/L	60	0.5	5	ND	0		100%
trans-1,2-dichloroethene	µg/L	60	0.5	5	ND	0		100%
Dichloromethane (Methylene chloride)	µg/L	4	5	5	ND	0		100%
Halogenated Aromatics								
1,2,3-trichlorobenzene	µg/L	30	0.5	5	ND	0		100%
1,2,4-trichlorobenzene	µg/L	30	0.5	5	ND	0		100%
1,3,5-trichlorobenzene	µg/L	no data	0.5	5	ND	0		100%
Total Trichlorobenzene	µg/L	no data	1	5	ND	0		100%
Chlorobenzene	µg/L	0.3	0.5	5	ND	0		100%
1,2-dichlorobenzene	µg/L	1500	0.5	5	ND	0		100%
1,3-dichlorobenzene	µg/L	no data	0.5	5	ND	0		100%
1,4-dichlorobenzene	µg/L	40	0.3	5	ND	0		100%
Monocyclic Aromatic Hydrocarbons								
Ethylbenzene	µg/L	300	0.5	5	ND	0		100%
Toluene	µg/L	800	0.5	5	ND	0		100%
m/p-xylene	µg/L	600	1	5	ND	0		100%
o-xylene	µg/L	600	0.5	5	ND	0		100%
Benzene	µg/L	1	0.5	5	ND	0		100%
Styrene (Vinyl benzene)	µg/L	30	0.5	5	ND	0		100%

mg/L = milligrams per litre
µg/L = micrograms per litre
ND = Not Detected

WATER QUALITY RESULTS

CHEMICAL HEALTH – VOLATILE ORGANIC COMPOUNDS (part 2) – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG LIMIT (Health)	Lab Limit of Reporting (LOR)	Number of Samples	Maximum Value	Number of Non-compliance with ADWG limit	Compliance %
Semi-Volatile Organic Compounds							
Fenarimol	µg/L		1	5	ND	0	100%
Malathion	µg/L		1	5	ND	0	100%
Metolachlor	µg/L		1	5	ND	0	100%
Napropamide	µg/L		1	5	ND	0	100%
Propachlor	µg/L		1	5	ND	0	100%
Triadimefon	µg/L		1	5	ND	0	100%
Vernolate	µg/L		1	5	ND	0	100%
Additional Semi-Volatile Organic Compounds							
Chlorothalonil*	µg/L		1	5	ND	0	100%
Dichlorbenil*	µg/L		1	5	ND	0	100%
Diclofop-methyl*	µg/L		1	5	ND	0	100%
Etridiazole*	µg/L		1	5	ND	0	100%
Flamprop-methyl*	µg/L		1	5	ND	0	100%
Fluometuron*	µg/L		1	5	ND	0	100%
pendimethalin*	µg/L		1	5	ND	0	100%
Primiphos methyl*	µg/L		1	5	ND	0	100%
Propargite*	µg/L		1	5	ND	0	100%
Propyzamide	µg/L		1	5	ND	0	100%
Pesticides / Herbicides							
Aldicarb	µg/L		1	5	ND	0	100%
Amitraz	µg/L		1	5	ND	0	100%
Amitrole	µg/L	9	10	5	ND	0	100%
Carbendazim	µg/L		1	5	ND	0	100%
Diuron	µg/L	20	1	5	ND	0	100%
2,2-DPA	µg/L		1	5	ND	0	100%
Fipronil	µg/L		1	5	ND	0	100%
Fluazifop	µg/L		1	5	ND	0	100%
Methiocarb	µg/L		1	5	ND	0	100%
Methomyl	µg/L		1	5	ND	0	100%
Metsulfuron methyl	µg/L		1	5	ND	0	100%
Oxamyl	µg/L		1	5	ND	0	100%

mg/L = milligrams per litre
 µg/L = micrograms per litre
 ND = Not Detected

WATER QUALITY RESULTS

CHEMICAL HEALTH – VOLATILE ORGANIC COMPOUNDS (part 3) – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG LIMIT (Health)	Lab Limit of Reporting (LOR)	Number of Samples	Maximum Value	Number of Non-compliance with ADWG limit	Compliance %
Glyphosate							
Glyphosate	µg/L	1000	0.01	5	ND	0	100%
Paraquat and Diquat							
Paraquat and Diquat in Water by GC MS	µg/L	20	0.005	5	ND	0	100%
Diquat	µg/L	7	0.005	5	ND	0	100%
Acrylamide in Water							
Acrylamide	µg/L	0.2	0.00005	5	ND	0	100%
Chelating Agents							
Ethylenediamine tetraacetic acid	µg/L	20	20	5	ND	0	100%
Nitrilotriacetic acid	µg/L	20	20	5	ND	0	100%
Organotins							
Dibutyltin	µg/L	no data	0.000005	5	ND	0	100%
Tributyltin	µg/L	1	0.000002	5	ND	0	100%

CHEMICAL HEALTH – PFAS AND PFOS – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG LIMIT (Health)	Lab Limit of Reporting (LOR)	Number of Samples	Maximum Value	Number of Non-compliance with ADWG limit	Compliance %
PFAS and PFOS							
Perfluorobutanoic acid (PFBA)	µg/L	-	0.002	1	ND	0	100%
Perfluoropentanoic acid (PFPeA)	µg/L	-	0.002	1	ND	0	100%
Perfluorohexanoic acid (PFHxA)	µg/L	-	0.002	1	ND	0	100%
Perfluoroheptanoic acid (PFHpA)	µg/L	-	0.002	1	ND	0	100%
Perfluorooctanoic Acid (PFOA)	µg/L	0.56	0.001	1	ND	0	100%
Perfluorononanoic acid (PFNA)	µg/L	-	0.004	1	ND	0	100%
Perfluorodecanoic acid (PFDA)	µg/L	-	0.004	1	ND	0	100%
Perfluoroundecanoic acid (PFUnA)	µg/L	-	0.004	1	ND	0	100%
Perfluorododecanoic acid (PFDoA)	µg/L	-	0.004	1	ND	0	100%
Perfluorotridecanoic acid (PFTrDA)	µg/L	-	0.004	1	ND	0	100%
Perfluorotetradecanoic acid (PFTeDA)	µg/L	-	0.004	1	ND	0	100%
Perfluorohexadecanoic acid (PFHxDA)	µg/L	-	0.008	1	ND	0	100%
Perfluorobutane sulfonate (PFBS)	µg/L	-	0.01	1	ND	0	100%
Perfluoropentane sulfonate (PFPeS)	µg/L	-	0.01	1	ND	0	100%
Perfluorohexane sulfonate (PFHxS)	µg/L	-	0.01	1	ND	0	100%
Perfluoroheptane sulfonate (PFHpS)	µg/L	-	0.01	1	ND	0	100%
Perfluorooctane sulfonate (PFOS)	µg/L	-	0.01	1	ND	0	100%
Perfluorooctane sulfonate (PFOS) + Perfluorohexane sulfonate (PFHxS)	µg/L	0.07	0.01	1	ND	0	100%
Perfluorononane sulfonate (PFNS)	µg/L	-	0.01	1	ND	0	100%
Perfluorodecane sulfonate (PFDS)	µg/L	-	0.01	1	ND	0	100%
Perfluorododecane sulfonate (PFDoS)	µg/L	-	0.01	1	ND	0	100%
1H,1H,2H,2H-Perfluorohexane sulfonate (4:2) (4:2 FTS)	µg/L	-	0.01	1	ND	0	100%
1H,1H,2H,2H-Perfluorooctane sulfonate (6:2) (6:2 FTS)	µg/L	-	0.01	1	ND	0	100%
1H,1H,2H,2H-Perfluorodecane sulfonate (8:2) (8:2 FTS)	µg/L	-	0.01	1	ND	0	100%
Perfluorooctane sulfonamide (PFOSA)	µg/L	-	0.008	1	ND	0	100%
N-Methylperfluorooctane sulphonamide (N-MeFOSA)	µg/L	-	0.01	1	ND	0	100%
N-Ethylperfluorooctane sulfonamide (N-EtFOSA)	µg/L	-	0.01	1	ND	0	100%
2-(N-Methylperfluorooctane sulfonamido)-ethanol (N-MeFOSE)	µg/L	-	0.02	1	ND	0	100%
2-(N-Ethylperfluorooctane sulfonamido)-ethanol (N-EtFOSE)	µg/L	-	0.02	1	ND	0	100%
N-Methylperfluorooctanesulfonamidoacetic acid (N_MeFOSAA)	µg/L	-	0.01	1	ND	0	100%
N-Ethylperfluorooctanesulfonamidoacetic Acid (N-EtFOSAA)	µg/L	-	0.01	1	ND	0	100%

mg/L = milligrams per litre µg/L = micrograms per litre ND = Not Detected

WATER QUALITY RESULTS

CHEMICAL HEALTH – OTHER ORGANIC COMPOUNDS – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG LIMIT (Health)	Lab Limit of Reporting (LOR)	Number of Samples	Maximum Value	Number of Non-compliance with ADWG limit	Compliance %
Other Semi-Volatile Organic Compound Analytes							
Temephos	µg/L	0.4	1	5	ND	0	100%
Propiconazole Isomer 1	µg/L	0.1	1	5	ND	0	100%
Propiconazole Isomer 2	µg/L	0.1	1	5	ND	0	100%
Bromacil	µg/L	0.4	1	5	ND	0	100%
Triazines							
Simazine	µg/L	0.02	0.01	5	ND	0	100%
Hexazinone	µg/L	0.4	0.01	5	ND	0	100%
Atrazine	µg/L	0.02	0.01	5	ND	0	100%
Ametryn	µg/L	0.07	0.01	5	ND	0	100%
Terbutryn	µg/L	0.4	0.01	5	ND	0	100%
Metribuzin	µg/L	0.07	0.01	5	ND	0	100%
Terbutylazine	µg/L	0.01	0.01	5	ND	0	100%
Semi-Volatile Organic Compounds							
Hexachlorobutadiene	µg/L	0.0007	0.01	5	ND	0	100%
Chlorfenvinphos-cis	µg/L	0.002	0.05	5	ND	0	100%
Chlorfenvinphos-trans	µg/L	0.002	0.01	5	ND	0	100%
Carbaryl	µg/L	0.03	0.01	5	ND	0	100%
Carbofuran	µg/L	0.01	0.01	5	ND	0	100%
Trifluralin	µg/L	0.09	0.01	5	ND	0	100%
Mevinphos-cis/trans	µg/L	0.005	0.1	5	ND	0	100%
Parathion methyl	µg/L	0.02	0.01	5	ND	0	100%
Synthetic Phthalates							
Bis(2-ethylhexyl)phthalate	µg/L	10	10	5	ND	0	100%
Synthetic Pyrethroids							
cis-Permethrin	µg/L	200	0.5	5	ND	0	100%
trans-Permethrin	µg/L	200	0.5	5	ND	0	100%
Cyfluthrin	µg/L	50	2	5	ND	0	100%
Cypermethrin	µg/L	200	2	5	ND	0	100%
Deltamethrin	µg/L	40	0.5	5	ND	0	100%
Esfenvalerate	µg/L	30	0.5	5	ND	0	100%

mg/L = milligrams per litre
 µg/L = micrograms per litre
 ND = Not Detected

WATER QUALITY RESULTS

CHEMICAL NON-HEALTH (AESTHETIC) SAMPLES – 1 JULY 2018 TO 30 JUNE 2019

CHARACTERISTIC	UNIT	ADWG LIMIT (non-health)	Lab Limit of Reporting (LOR)	Number of Samples		Total No. of Samples (Raw + Distribution)	Maximum Value		Number of Non-compliance with ADWG Limit		Distribution Water Compliance %
				Raw Water	Distribution Water		Raw Water	Distribution Water	Raw Water	Distribution Water	
Alkalinity (Bicarbonate)	mg/L	-	5	26	16	42	210	190	0	0	100%
Alkalinity (Carbonate)	mg/L	-	5	26	16	42	ND	ND	0	0	100%
Alkalinity (Hydroxide)	mg/L	-	5	26	16	42	ND	ND	0	0	100%
Alkalinity (Total)	mg/L	-	5	26	16	42	170	160	0	0	100%
Aluminium (Soluble)	mg/L	0.2	0.02	26	16	42	ND	ND	0	0	100%
Aluminium (Total)	mg/L	0.2	0.02	26	16	42	ND	ND	0	0	100%
Ammonia	mg/L	0.5	0.005	NR	16	16	NR	ND	NR	0	100%
Calcium	mg/L	-	0.2	NR	16	16	NR	27	NR	0	100%
Chloride	mg/L	250	1	26	NR	26	130	NR	0	NR	
Colour True	HU	15	1	62	84	146	25	ND	1	0	100%
Electrical Conductivity	uS/cm	-	2	76	84	160	750	630	0	0	100%
Filterable Reactive Phosphorus	mg/L	-	0.005	26	NR	26	0.019	NR	0	NR	
Filterable Reactive Phosphorus as PO4	mg/L	-	0.01	26	NR	26	0.04	NR	0	NR	
Hardness	mg/L	200	5	26	16	42	130	120	0	0	100%
Iron (Soluble)	mg/L	0.3	0.005	76	84	160	8.5	0.032	57	0	100%
Iron (Total)	mg/L	0.3	0.005	76	84	160	8.6	0.041	58	0	100%
Magnesium	mg/L	-	0.1	NR	16	16	NR	14	NR	0	100%
pH	pH	6.5-8.5	NR	77	217	294	8	8.3	0	0	100%
Salinity (as Total Dissolved Solids)	mg/L	500	10	76	NR	76	400	NR	0	NR	
Silica	mg/L	-	0.05	26	NR	26	19	NR	0	NR	
Sodium	mg/L	180	0.5	26	NR	26	100	NR	0	NR	
Sulphate	mg/L	250	1	26	NR	26	19	NR	0	NR	
Total Hardness by Calculation	mg/L	200	1	26	16	42	130	120	0	0	100%
Turbidity	NTU	5	NR	77	216	293	3.62	0.45	0	0	100%
Zinc	mg/L	-	0.005	NR	16	16	NR	0.014	NR	0	100%
TOTAL				884	961	1845					100%

Note 1: HU = Hazen Units
 NTU = Nephelometric Turbidity Units
 mg/L = milligrams per litre
 ND = Not Detected
 NR = Not required to be sampled

Note 2: pH and Turbidity are Busselton Water in-house tests. All others are accredited test results.




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