



**ROTTNEST ISLAND
AUTHORITY**

Rottnest Island Authority

Annual Drinking Water Report

July 2022 – June 2023



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Foreword

The Rottnest Island Authority (RIA) is committed to providing high quality drinking water that meets the Australian Drinking Water Guidelines (ADWG), other regulatory requirements and consumer expectations in a sustainable way.

This Annual Report describes Rottnest Island's drinking water quality performance for the 2022 to 2023 reporting period. The RIA is committed to being transparent on its performance by providing the public with accurate and representative information in this report. The report aims to demonstrate to island customers and visitors, the ongoing commitment to the sustainable production and supply of high-quality drinking water on Rottnest Island.

Further details on RIA's commitment to Drinking Water Quality can be reviewed under [Rottnest Island Drinking Water Quality Policy](#) on the Rottnest Island website.

The [Rottnest Island Management Plan 2020-24](#), Drinking Water Source Protection Plan, and Groundwater Licence Operating Strategy reflect this commitment and contain the strategies, procedures and processes to meet this objective.

Programmed Facility Management (PFM) continues to operate the major facilities and delivers other services on behalf of the RIA. Management of the water network is a component of the utilities services performed by PFM, which includes the production, distribution, and monitoring of drinking water.

The 2022-2023 Annual Water Quality Report confirms that the RIA and PFM have remained consistent with previous years' performance in the management of the Drinking Water supply on Rottnest Island.

Acronyms

ADWG	Australian Drinking Water Guidelines	The Australian Drinking Water Guidelines provides a framework for management of drinking water supply.
Bq/L	Becquerels per litre	Becquerels per litre is the unit of activity of radioactivity per unit volume
DOH	Department of Health	The Department of Health oversee compliance of Western Australia's health system.
DWQMP	Drinking Water Quality Management Plan	The Drinking Water Quality Management Plan describes how the production, distribution and monitoring of drinking water is managed on Rottnest Island.
HU	Hazen Unit	A Hazen unit is a measurement of colour.
km	Kilometre	A kilometre is a unit of length in the metric system, equal to one thousand metres.
mg/L	Milligrams per litre	Milligrams per litre is the mass of a chemical per unit volume of water.
mg-NO ₂ /L	Milligrams of nitrite	Milligrams per litre is the mass of nitrite per unit volume.
mg-NO ₃ /L	Milligrams of nitrate	Milligrams per litre is the mass of nitrate per unit volume.
ML	Megalitre	A megalitre is a unit of volume in the metric system, equal to one million litres.
MoU	Memorandum of Understanding	The memorandum of understanding is an agreement between the RIA and DOH and demonstrates the agreed commitments to drinking water quality.
NTU	Nephelometric Turbidity Unit	A nephelometric turbidity unit is a measurement of turbidity.
PFAS	Per- and polyfluoroalkyl substances	A group of over 4,000 synthetic chemicals that are used for a variety of household and industrial purposes.
PFM	Programmed Facility Management	Programmed Facility Management (ABN 23001382010) is contracted to manage drinking water supply on Rottnest Island.
RIA	Rottnest Island Authority	Rottnest Island Authority is a statutory body who manage Rottnest Island.
TDS	Total Dissolved Solids	Total Dissolved Solids is a measurement of inorganic salts and organic matter dissolved in water.
µg/L	Micrograms per litre	Micrograms per litre is a unit of volume in the metric system. One microgram is equal to one millionth of a gram.

1. Introduction

Rottnest Island is located 19 km west of Fremantle, Western Australia, and is 11 km long and 4.5 km at its widest point. The total land area measures approximately 1,900 hectares and is managed by the RIA. The island is a Class A Reserve and a popular destination for local, interstate and international visitors.

Water production facilities include saline groundwater bores, desalination plant, drinking water storage tanks, and distribution system. The distribution and supply to customers is via a reticulated network. PFM is contracted by the RIA to manage the production, distribution and monitoring of the drinking water supply to customers, Rottnest Island residents, and visitors.

The source of drinking water on Rottnest Island processed through the desalination plant is six saline production bores located within the Longreach Borefield. Historically Wadjemup Borefield has been used for the supply of drinking water, however, this ceased in 2017.

1.1 Drinking Water Quality Management

The DWQRMP is the principal framework document used by RIA and PFM to implement the effective management of the drinking water distribution system on Rottnest Island. The DWQRMP forms part of the Memorandum of Understanding (MoU) between the RIA and the Department of Health (DOH) and is supported by the drinking water binding protocols. The Drinking Water Quality Risk Management Plan Framework also includes the Drinking Water Incident Response Protocols and other statutory documentation required to ensure compliance with the ADWG.

The ADWG are published and updated by the National Health and Medical Research Council, Australia's peak health research body on Australian Drinking Water. The ADWG are the national standard for Australian Drinking Water; requiring a risk management framework to be established for the effective management of drinking water supplies in Australia.

The ADWG can be downloaded from: <https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines>

A key aspect of the ADWG is a risk management approach. This approach is aimed at ensuring the ADWG are achieved from the water source, to points of consumption. This ensures, and requires, that there is a monitoring program established with appropriate sampling points throughout the distribution system, whilst providing a robust tool for identifying preventative and corrective actions for the improvement of water quality.

The ADWG recognise the significance of a preventative, multi-barrier approach for the protection of public health in drinking water supplies and have incorporated a framework for management of drinking water quality. The framework presented in the ADWG includes twelve elements considered good practice in the systematic management of drinking water supplies.

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A DWQRMP has been developed for Rottnest Island, utilising the elements within the Australian Drinking Water Guidelines – Framework for the Management of Drinking Water Quality.

The DWQRMP is an important requirement of the MoU, and has included a detailed risk assessment for each element of the system including:

- Longreach (saline) Borefield;
- Desalination Plant;
- Storage Tanks;
- Treatment System (Chlorination);
- Pumping System;
- Distribution and Reticulation system;
- Water sampling and monitoring points.

To ensure that the production, monitoring, supply and management of Rottnest Island's drinking water supply continues to remain of high quality, the DWQRMP is reviewed at set frequencies. Where changes are made to the DWQRMP, these undergo a detailed review by relevant stakeholders and the changes will be presented within subsequent Quarterly and Annual Drinking Water Reports.

1.2 Memorandum of Understanding

In April 2012 the MoU between DOH and RIA commenced. This commitment to the MoU by both parties ensures a strong cooperative relationship for the management of drinking water and the protection of public health. The MoU was updated and re-signed by the RIA and DOH in December 2019 which extends for a period of five years. A copy of the 2019 Memorandum of Understanding is available to view on the RIA website.

Another important component of the MOU is the requirement for the Licensee (RIA) to notify DOH of the provision of other forms of water supply. That is, the supply of water not intended for drinking purposes. The specific items pertaining to management of this commitment as described within the MoU, and how these items are complied with on Rottnest Island, are detailed within the table below. Primarily, provision of non-drinking water on Rottnest Island occurs for the toilet facilities at the western end of Rottnest Island.

Memorandum of Understanding and the provision of non-drinking Water on Rottnest Island	
MOU	RIA Provision
Ensure advice is given to customers and their tenants or visitors that this water supply is not to be used for drinking or food preparation.	Where water provided is unsuitable for drinking/food preparation, public signage has been installed. Example provided below. 
Annual requirement by way of written reminders of water quality. Inspections to ensure affected taps are labelled with “non-drinking water”.	Water quality is reported annually and quarterly. Points have been labelled where the water provided is unsuitable for drinking.
If the Licensee provides non-drinking water to public open space areas, accessible to general public or via standpipes, then adequate signage advising “not suitable for drinking” is required.	Where non-drinking water is used in public open spaces, and areas accessible to the general public, appropriate signage has been installed clearly stating non-drinking water is in use.

2. Water Provider Information

Contact Details			
Name of Company	Rottnest Island Authority		
Company Address	1 Mews Road, Fremantle WA 6160		
Company Phone	Ph (08) 9432 9300	Fax	(08) 9432 9301
Company Website	www.rottnestisland.com		
Company Email	enquiries@rottnestisland.com		
Executive Director	Jason Banks		
Director Environment Heritage and Parks	Arvid Hogstrom		
Manager Environment and Compliance	Rebecca Gabbitus		
Island Operations Manager (PFM)	Dan Hunt		

2.1 System Information

2.1.1 Consumers

Water demand is highly seasonal and directly related to tenancy and visitation to Rottnest Island. Typically, consumption is low in winter and high in summer.

The number of beds on the island for visitors totals 2,150, with the average length of stay being 3.5 nights. In addition, there are approximately 150 permanent residents on the island, however, this value fluctuates with seasonal staffing demands.

In a typical year Rottnest Island experiences an average low season minimum between June-August and an average high season maximum between December – February. During this reporting period approximately 806,000 visitors arrived at the Island, an increase from last year's number of 424,168.

2.1.2 Distribution System & Water Supply

The drinking water quality parameters are regularly monitored by the PFM Quality and Compliance Officer and hydraulic technicians to ensure that drinking water produced on Rottnest Island meets the requirements of the ADWG and DOH. A graphical representation of the drinking water distribution system is provided in **Figure 1**.

During the reporting period, 533,238 kilolitres of saline groundwater was abstracted from the Longreach Borefield (Ground Water Licence GWL177495(2) – Department of Water 2015-2025) for desalination purposes. No water abstracted from the Wadjemup Borefield was used to supplement the drinking water system.

The water demand on Rottnest Island is highly seasonal, with monthly consumption ranging from approximately 12,000 kilolitres in July (low season) to 22,000 kilolitres in December (peak season).

The combined storage capacity of the drinking water infrastructure is approximately 14.5 megalitres (ML), which provides around 22 days of drinking water storage at full capacity.

2.1.3 Sampling Schedule & Procedure

The DWQRMP details a comprehensive sampling schedule developed by a specialist consultant based on a risk management strategy and adopted by the RIA and PFM. The schedule includes eight nominated sampling points throughout the distribution system. The nominated sample points allow for fair representation of the water supply on Rottnest Island.

The sampling locations are shown in **Figure 1** and **Figure 2**.

Sampling and in-house monitoring procedures are carried out in accordance with best industry practice and executed by qualified hydraulics technicians. Nominated samples in the sampling schedule are analysed by a NATA accredited laboratory in accordance with the requirements of DOH.



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Figure 1 - Rottnest Island Water Distribution System

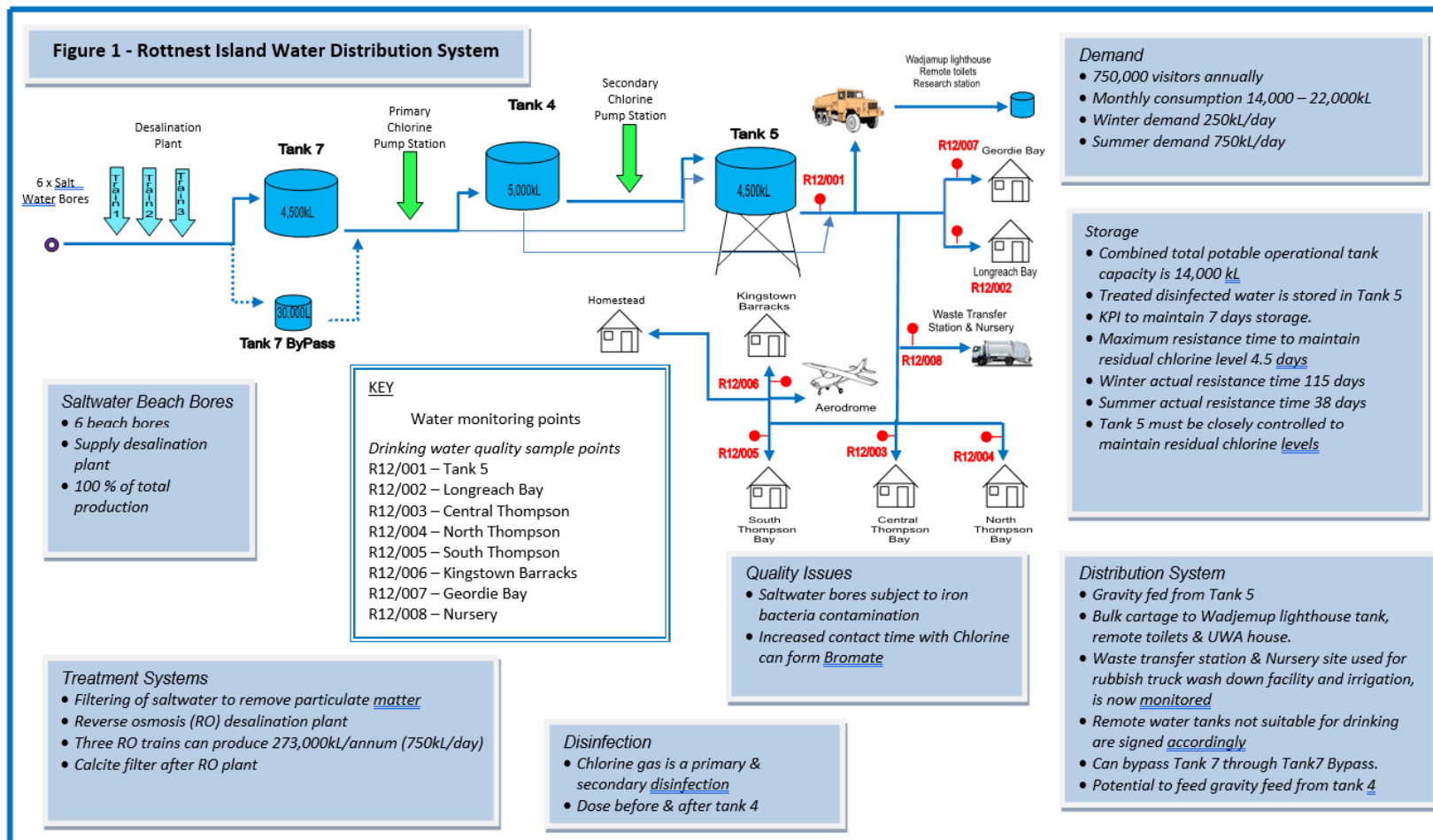


Figure 1: Rottnest Island Water Distribution System

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Figure 2: Map of Sampling Locations

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3. Microbial Performance

The results in Section 3.1 summarise the outcome of microbial characteristics monitored during the 2022-2023 period. 100% compliance was reported at the eight nominated sampling points in 2022-2023 maintaining the compliance rate set in 2021-2022.

3.1 Microbial Compliance Summary

Rottnest Island Distribution System 2022-23				
Microbial Characteristic	Memorandum of Understanding Compliance Criteria	No. of Analyses	No. of Analyses Complying with Memorandum of Understanding	% Compliance
Bacterial				
<i>E.coli</i>	Non Detect	238	238	100%
Amoeba				
Thermophilic <i>Naegleria</i>	Non Detect	107	107	100%

3.2 Microbial Incident Specific Information

There were no recorded microbial non-conformances for *E.coli*, thermotolerant coliforms or thermophilic *Naegleria* at the eight nominated sample points during the 2022-2023 reporting period.

4. Chemical: Health Related Performance

The results in Section 4.1 summarise the outcome of health characteristics monitored during the 2022-2023 reporting period.

The health characteristics monitored within the eight nominated sampling points recorded 99% overall compliance with the ADWG. The reported exceedances were related to the presence of bromate in the drinking water system. Specific details are described in the below section 4.2 Health Related Incident Specific Information.

4.1 Chemical: Health Related Compliance Summary

Rottnest Island Distribution System 2022-23					
Health Characteristic	ADWG Compliance Criteria (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)
Antimony (Sb)	0.003	105	105	100%	< 0.001
Bromate (BrO ₃ ⁻)	0.020	421	420	99%	0.021
Cadmium (Cd)	0.002	19	19	100%	< 0.002
Chlorine Total (Cl)	5	365	365	100%	1.58
Copper (Cu)	2	14	14	100%	0.066
Fluoride (F)	1.50	102	102	100%	0.6
Lead (Pb)	0.010	14	14	100%	0.001
Manganese (Mn)	0.50	11	11	100%	< 0.005
Nickel (Ni)	0.020	12	14	100%	< 0.001
Nitrate (NO ₃)	50 mg-NO ₃ /L	13	13	100%	< 0.01
Nitrite (NO ₂)	3 mg-NO ₂ /L	44	44	100%	0.04
¹ Trihalomethanes (THM)	0.25	44	44	100%	0.097

¹ Trihalomethanes can be present in drinking water as a by-product of chlorination or chloramination. Chlorine is the only source of disinfection currently used on Rottnest.

4.2 Chemical: Health Related Incident Specific Information

The health characteristics sampled during the 2022-2023 reporting period returned results in line with those taken during the 2021-2022 period in that bromate was the only detected exceedance. There was one exceedance of bromate in the current reporting period compared with two exceedances in the previous reporting period. The exceedance event reported a bromate concentration of 0.025 mg/L on 30 August 2022 from sample location R12-005 (South Thompson).

A remedial flushing plan was initiated in accordance with the Island's Bromate Remediation Plan (PFM, 2018). The flush point at South Thompson was flushed for 24 hours on 31 August and flushing then occurred weekly until bromate results were below the ADWG limit of 0.020 mg/L for two consecutive samples. Samples taken at R12-005 on 6 August reported a bromate concentration of 0.005 mg/L.

All critical control points were then checked and confirmed to be working (pH, chlorine, and turbidity sensors).

4.2.1 Bromate Management

Bromate testing was added to the agreed sampling schedule in the 2017-2018 reporting period. This followed a request from DOH to participate in a voluntary monitoring program for bromate. RIA and PFM continue to manage bromate formation through proactive and reactive management:

Proactive

Close monitoring of tank levels, water retention times and their relationship with bromate formation. The holding time in pipes is believed to be a contributing factor in the production of bromate in the drinking water system. Avoidance of excessive chlorination and oxidation of bromide to bromate by optimising chlorine levels in the storage tanks before distribution in the water network. Regular maintenance and replacement of membranes, which improves the quality of the permeate, in turn lowering bromide levels.

Reactive

Flushing regime – Flushing of the distribution system when the bromate levels are reported approximately 25% below the limit set out in the AWDG.

Rottnest Island Homestead

In addition to the above-mentioned monitoring program PFM commenced monthly sampling of a potable water storage tank installed at the Rottnest Island Homestead shortly after its installation in November 2022. The sampling was done on a voluntary basis. During the 2022-2023 reporting period there were four bromate exceedance events reported at the Homestead.

In accordance with the Rottnest Island Flushing Plan, the following actions took place after every exceedance event was reported:

- The original sample result was verified with laboratory.
- Investigation and corrective actions were commenced.
- The tank was flushed until empty upon receiving the laboratory report.
- Continued monitoring of monthly samples.
- CCPs were checked. The reverse osmosis and chlorination stations were all performing within desired limits.

For these Bromate exceedances, the Drinking Water Emergency Response Protocols were not followed because at the time the Homestead was not considered as part of the main drinking water network. This is further discussed in Section 8.3. Previous investigation in bromate exceedances concluded that prolonged retention of chlorinated water increases bromate concentration. The Homestead is at the furthest limit of the distribution network so the water that arrives has had a relatively long retention time in the pipework which can't be avoided. As a preventative measure the tank is periodically flushed to reduce the retention time of the water within it.

The sampling results are presented in the table below.

Bromate Exceedances - Homestead 2022-23					
Date	Location	Parameter	Australian Drinking Water Guideline limit	Result	Response
24 January 2023	Homestead	Bromate	0.020 mg/L	0.024 mg/L	Flushing
28 February (monthly sampling)				0.016 mg/L	NA
21 March 2023				0.023 mg/L	Flushing
26 April 2023				0.022 mg/L	Flushing
30 May 2023				0.021 mg/L	Flushing
13 June 2023 (monthly sampling)				0.015 mg/L	NA

4.3 Pesticides

As part of RIA's commitment to providing a sustainable environment, pesticide usage is minimised and applied in a controlled manner on Rottnest Island. Pesticide testing was undertaken in February 2021 at R12/001 in line with DOH 'Pesticides Monitoring Exclusion Policy' (2018) and from the MOU between RIA and DOH. All pesticide test results in February 2021 complied with the health-related guideline values set out in the ADWG. These results are shown in the 2020-21 annual report. According to the *Pesticides Monitoring Exclusion Policy* (2018) if the presence of pesticides is unlikely, very infrequent monitoring or no monitoring at all is required. Therefore, there was no pesticide analysis completed during this reporting period.

4.4 PFAS

Following the Drinking Water Quarterly Meeting held on 5 June 2019, DOH recommended a one-off sampling for per- and poly-fluoroalkyl substances (PFAS) to take place at two locations along the drinking water distribution line. From this point onwards, PFAS has been tested on an annual basis.

Samples for this reporting period were taken 23 May 2023. PFAS are manufactured chemicals that do not occur naturally in the environment. PFAS chemicals include perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS) amongst a large group of other compounds. PFAS are persistent in the environment, show the potential for bioaccumulation and biomagnification, and are toxic in animal studies (potential developmental, reproductive and systemic toxicity). They have been used in a wide range of consumer products including surface treatments such as non-stick cookware, and notably in aqueous film forming foam historically used to extinguish fires.

The results are presented in the below table.

Rottnest Island Distribution System 2022-23					
Health Characteristic	ADWG compliance criteria (ug/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (ug/L)
Sum of Perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS)	0.07	2	2	100%	0.03
Perfluorooctanoic acid PFOA	0.56	2	2	100%	0.01

5. Chemical: Aesthetic Related Performance

5.1 Chemical: Aesthetic Compliance Summary

The following table summarises the outcomes for specific aesthetic related characteristics during the 2022-2023 reporting period.

Rottnest Island Distribution System 2022-23					
Aesthetic Characteristic	ADWG compliance criteria (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)
Aluminium (Al)	0.2	13	13	100%	0.09
Ammonia (NH ₃)	0.5	48	48	100%	0.05
Chloride (Cl ⁻)	250	6	6	100%	190
Chlorine (Cl ₂) Free Residual	0.6	295	8	0.03%	1.36
Colour (True Colour)	15 (HU)	24	24	100%	< 5 (HU)
Hardness (CaCO ₃)	200	4	4	100%	13
Iron (Fe)	0.3	103	92	89%	1.40
pH	6.5 - 8.5	411	409	99%	6.5 - 9.1 ²
Sodium (Na)	180	411	411	100%	150
Sulfate (SO ₄ ²⁻)	250	4	4	100%	2.5
Hydrogen Sulphide (H ₂ S)	0.05	13	13	100%	< 0.05
TDS	600	4	4	100%	330
Turbidity	5 (NTU)	22	25	100%	1.2 (NTU)
Zinc (Zn)	3	14	14	100%	0.042

² The two numbers represent the lowest and the highest pH values measured respectively.

5.2 Chemical: Aesthetic Incident Specific Information

Whilst exceedances of aesthetic guidelines can affect consumer experience, it is important to note that exceedances to aesthetic guidelines refer only to palatability to consumers, including appearance, taste and odour. There were several instances where analytical results exceeded the aesthetic guidelines for chemical and physical properties as follows:

- **Free Chlorine:** 287 out of 295 samples reported chlorine concentrations above the ADWG aesthetic value of 0.6 mg/L, with the highest concentration reported at 1.36 mg/L in December 2022. The ADWG states that chlorine has an aesthetic odour threshold of 0.6 mg/L, however, the reported concentrations exceeding this threshold do not pose any health risks, as values are below the specific health guideline value of 5 mg/L. Whilst impacts to aesthetic quality of drinking water may occur due to greater concentrations of chlorine, it is important to note that adequate disinfection is paramount for the provision of safe drinking water. In the interest of maintaining microbiological safety across the entire drinking water distribution system, the RIA intends to continue operating the distribution system using higher levels of chlorine that may exceed the ADWG aesthetic values to maintain disinfection. No complaints were recorded during the year with regards to odour.
- **Iron:** 11 of the 103 samples recorded iron concentrations above the ADWG aesthetic value of 0.3 mg/L, with the highest concentration reported at 1.40 mg/L in February 2023. The cause of the iron exceedances is likely to be related to rusted pipework. Iron has a taste threshold of 0.3 mg/L in water, and becomes objectionable above 3 mg/L.
- **pH:** 2 out of 411 in-situ samples reported pH values outside the ADWG aesthetic pH range of 6.5 to 8.5. The exceedances for the 2022-2023 period included:
 - pH of 8.73 on 26 July 2022 at sample point R12-005
 - pH of 9.10 on 30 August 2022 at sample point R12-005

To manage reactive upper and lower limit pH values at sample point R12-005:

- Flushing occurred on 26 July and 30 August at the R12-005 sample point as per the Rottnest Island Water Services Flushing Plan.
- R12-005 was sampled as per the weekly schedule to monitor pH levels.
- The subsequent weekly sample at R12-005 reported a pH of 8.1, within the limits.

6. Special Interest Performance

6.1 Compliance Summary for Drinking Fountains

The following tables summarise the outcomes for the Drinking Water Quality Monitoring Program completed at the Rottnest Island drinking fountains. This program monitors health and aesthetic related characteristics during the 2022-2023 reporting period.

Health - Rottnest Island Drinking Fountain Network 2022-23					
Health Characteristic	ADWG compliance criteria (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)
Antimony (Sb)	0.003	208	208	100%	0.002
Cadmium (Cd)	0.002	208	208	100%	0.0002
Lead (Pb)	0.01	208	208	100%	0.005
Nickel (Ni)	0.02	208	208	100%	0.0011

Aesthetic - Rottnest Island Drinking Fountain Network 2022-23					
Aesthetic Characteristic	ADWG compliance criteria (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)
Copper (Cu)	1	208	208	100%	0.22
Zinc (Zn)	3	208	208	100%	0.42

There were no health or aesthetic exceedance events during the 2022-2023 reporting period.

7. Radiological Performance

Radiological sampling for gross alpha and gross beta is required annually. Testing occurred in October 2022 at the eight designated distribution sampling locations. There were no exceedances identified for Gross Alpha and Gross Beta.

Rottnest Island Distribution System 2022-23					
Radiological Characteristic	ADWG screening values (Bq/L)	No. of Analyses	No. of Analyses Complying with ADWG screening value	% Compliance with ADWG	Max Value of Analysis (Bq/L)
Gross Alpha	0.5	8	8	100%	0.017 ±0.019 ³
Gross Beta	0.5	8	8	100%	0.084 ± 0.045 ⁴

³ The laboratory was contacted to provide clarification on the variability of the result, advising that the number indicates that the primary value of 0.017 is accurate to plus or minus 0.019 Bq/L which means the lowest possible concentration is below detection limit.

⁴ This number indicates that the primary value of 0.084 is accurate to plus or minus 0.045 Bq/L.

8. Customer Service & Notifiable Incidents

8.1 Customer Complaints

Water Quality Related Complaints 2022-23			
Complaint	Date(s)	Description	Resolution
Report of brown water at Units 505, 506, 523 and 541	9/02/2023 – 10/02/2023	Report received of brown water coming from taps and temporarily water cut off at units 505, 506 and 541. Water became clear after one minute flush.	Immediately delivered bottled water to guests then conducted water sampling at unit 523 on 13 February. There were no ADWG exceedances reported. RIA and PFM investigated the cause of the brown water and identified a section of galvanised pipe in that area of the distribution network which was likely responsible for the brown water. That section of pipe was isolated from the distribution network.

8.2 Notifiable Incidents

During the 2022-2023 reporting period there was one health exceedance result reportable to DOH concerning the drinking water distribution system. This result was related to a health exceedance for bromate. It is noted that a total of 411 water samples were analysed in total.

A number of other exceedances identified during the 2022-2023 reporting period were reported to DOH including:

- Two faecal coliform and *E. coli* detections associated with non-disinfection of water in Tank 7 in September 2022 and June 2023. These detections are discussed in greater detail in section 8.3.1.
- 11 iron exceedances
- Two pH exceedances.

The bromate exceedances identified at the Homestead during the reporting period were not reported to DOH at the time given that bromate sampling was deemed to be conducted on a voluntary basis, however, it was agreed upon in the June 2023 Quarterly Drinking Water meeting between DOH, RIA and PFM that any exceedances noted at the Homestead would be reported to DOH.

8.2.1 Improvements

During the reporting period, *E. coli* and Faecal coliforms were detected in samples taken on 6 September 2022 in Tank 7 at concentrations of 6 CFU/100mL and 16 CFU/100mL, respectively. All other samples including Tank 4 and Tank 5 reported microbiological results below the laboratory limit of reporting.

E. coli and Faecal coliforms were also detected in samples taken on 7 June 2023 from Tank 7 at concentrations of 16 CFU/100mL and 16 CFU/100mL, respectively. All other samples including Tank 4 and Tank 5 reported microbiological results below the laboratory limit of reporting. A response and investigation was conducted in accordance with the RIA Drinking Water Emergency Response Protocol 8 for *E.coli* for each detection. The following actions were taken:

- The sample was verified by the laboratory.
- Repeat samples were taken from Tanks 4, 5 and 7 to test for faecal indicators, pH, electrical conductivity and free chlorine, no health exceedances were reported.
- The operational performance of the critical control points (CCPs) on the potable network were checked for the previous week. The CCPs are the three reverse osmosis trains at the desalination plant and the two chlorination systems at Tanks 4 and 5. All reverse osmosis trains were operating within their critical control limits (CCLs) during the previous week. Both chlorination stations were operating within their CCL of 0.5 milligrams per litre.
- Other indicators of contamination were checked such as HPC and electrical conductivity, all reporting below the LoR or within acceptable limits.
- The potable water storage tanks and distribution system was checked for contamination.
- Chlorine dosing at Tanks 4 and 5 was increased to achieve a free chlorine concentration > 1 mg/L throughout the entire potable water system.
- Further sampling was conducted from the Tanks 4, 5 and 7 with no health exceedances reported.
- CCPs were checked again and all were operating within CCLs.

The investigation into the cause of the *E. coli* detection concluded that heavy rainfall likely washed contaminants directly into the tank from its roof. Tank 7 stores permeate directly from the desalination plant with disinfection occurring at Tanks 4 and 5. Tank 7 is dosed with chlorine by recirculating chlorinated water from Tank 5 back to Tank 7. This micro-dose of chlorine has proven insufficient to eliminate an influx of pathogens on these occasions.

To prevent further health exceedances in Tank 7 the chlorine dosing concentration from the two dosing systems at Tanks 4 and 5 were increased from 1 milligrams per litre to 1.5 milligrams per litre which is the desired CCL for those systems and is in line with the Rottnest Island Drinking Water Quality Risk Management Plan. Subsequently, free chlorine concentrations in Tank 7 increased. Further modifications to the disinfection system are planned to be undertaken in the 2023-24 reporting period.

Tank 7 is being managed under the *2020 Interim Microbial Exceedance Management Plan for Tank 7* (accepted by DOH). The requirement for Tank 7 to be included within the drinking water supply system is being investigated as part of the water infrastructure upgrades that are planned across 2022-2025.

9. Comments

Ten Commandments for Safe Drinking Water

The Ten Commandments for Safe Drinking Water stand behind all internal drinking water operations on Rottnest Island. To remind all workers of the RIA's commitment to public health and safety relating to drinking water, the Ten Commandments for Safe Drinking Water have been installed in all pump stations and operational areas of the desalination plant (**Figure 3** and **Figure 4**). The Ten Commandments are shown in **Figure 5**.



Figure 3 and Figure 4 Ten Commandments for Safe Drinking Water at the Rottnest Island Desalination Plant

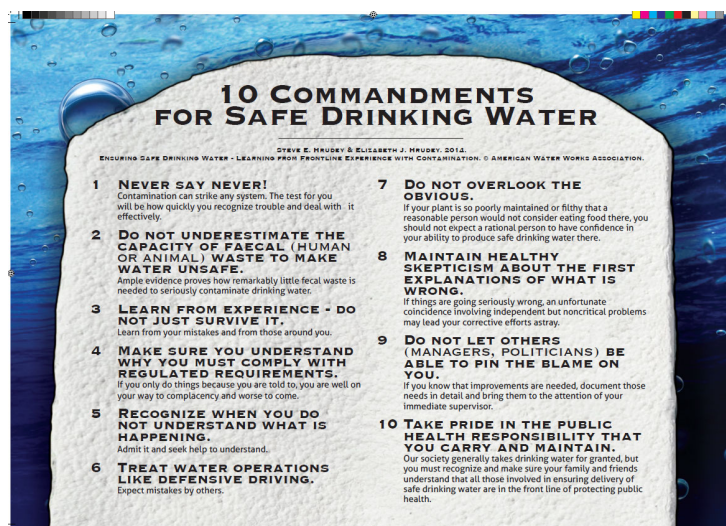


Figure 5 The Ten Commandments for Safe Drinking Water (Hruday SE & Hruday EJ, 2014)

Mock Incident Scenario

The Rottnest Island Mock Incident Scenario was held on 17 March 2023 and was based around the replacement of a water supply line valve to Kingstown with a subsequent detection of *E. coli* at the Kingstown sample point, with the cause identified as contamination introduced to the system during the valve replacement. The scenario involved all RIA directors (Incident Management Team [IMT]), relevant managers, operational staff and PFM staff and focused on their role in the relevant response protocol. Incident Protocol #8 was followed by the group to investigate and resolve the issue.

The key learnings from the activity comprised:

- The estimated period of cessation of water supply was too short. The Infrastructure and Environment team should be relied upon to a greater degree to provide more accurate period of outage.
- The IMT needed to have their structure and roles more defined and to identify an Incident Controller and backup roles.
- The response to the scenario got sidetracked on visitor welfare/accommodation/media issues and attention was lost on the incident response flowcharts.
- The incident response flowcharts needed to be updated to remove the requirement seek approval from DOH to close the incident, unless the incident escalates to Binding Protocol 3, whereby a serious contamination incident occurs. For the *E.coli* incident used in this mock incident then DOH did not need to provide approval.
- Record keeping was not being undertaken and a team member needs to be allocated to complete this activity.

10. References

Hrudey S E, Hrudey E J, *Ten Commandments For Safe Drinking Water* Canadian Water Network 2020, and American Water and Wastewater Association, 2014

Neale O, *Bromate Remediation Plan*, Programmed Facility Management 2018.

11. Acknowledgements

The RIA acknowledges the work of PFM in managing Drinking Water Quality at Rottnest Island, and the assistance of DOH throughout the year.

This report was produced by PFM on behalf of the RIA.

The RIA recognises and supports the ongoing work of the Advisory Committee for the Purity of Water⁵.

12. Enquiries

To request further information, or to seek clarification on information provided within this Rottnest Island Annual Drinking Water Report, please contact the RIA Administration by phone at (08) 9432 9300 (8:30 am to 5:00 pm, Monday to Friday). Alternatively, enquiries may be sent by e-mail to rotnnest.compliance@dbca.wa.gov.au.

⁵ 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



13. Appendices

Appendix A: Annual Data Summary

Health Characteristic	Australian Drinking Water Guidelines (mg/L)	July-September 2022				October-December 2022				January-March 2023				April-June 2023				2022-23 Summary			
		No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)
Antimony	0.003	32	32	100%	< 0.001	24	24	100%	0.001	24	24	100%	< 0.001	25	25	100%	< 0.001	105	105	100%	0.001
Bromate	0.02	100	99	99%	0.025	111	111	100%	0.012	104	104	100%	0.016	104	104	100%	0.019	419	418	100%	0.025
Cadmium	0.002	7	7	100%	< 0.0001	0	-	-	NA	8	8	100%	< 0.0001	4	4	100%	< 0.0001	19	19	100%	0
Chlorine (Total Residual)	5	100	100	100%	1.37	113	113	100%	1.58	104	104	100%	1.04	104	104	100%	1.04	421	421	100%	1.58
Copper	2	3	3	100%	0.003	4	4	100%	0.016	3	3	100%	0.066	4	4	100%	0.013	14	14	100%	0.066
Fluoride	1.5	23	23	100%	< 0.1	23	23	100%	< 0.1	32	32	100%	0.1	24	24	100%	0.6	102	102	100%	0.6
Lead	0.01	3	3	100%	< 0.001	4	4	100%	< 0.001	3	3	100%	0.001	4	4	100%	0.001	14	14	100%	0.001
Manganese	0.5	7	7	100%	< 0.005	0	-	-	-	0	-	-	-	4	4	100%	< 0.005	11	11	100%	0
Nickel	0.02	3	3	100%	< 0.001	4	4	100%	< 0.001	3	3	100%	< 0.001	4	4	100%	< 0.001	14	14	100%	0
Nitrate (as NO ₃ -)	50	3	3	100%	< 0.02	3	3	100%	< 0.02	3	3	100%	< 0.02	4	4	100%	< 0.02	13	13	100%	0
Nitrite (as NO ₂ -)	3	10	10	100%	< 0.02	10	10	100%	< 0.02	14	14	100%	< 0.02	10	10	100%	< 0.02	44	44	100%	0
Total THM	0.25	10	10	100%	0.081	10	10	100%	0.044	14	14	100%	0.004	10	10	100%	0.0054	44	44	100%	0.081

Aesthetic Characteristic	Australian Drinking Water Guidelines (mg/L)	July-September 2022				October-December 2022				January-March 2023				April-June 2023				2022-23 Summary			
		No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)
Aluminium	0.2	3	3	100%	< 0.05	3	3	100%	0.09	4	4	100%	< 0.05	4	4	100%	< 0.05	14	14	100%	0.09
Ammonia	0.5	7	7	100%	< 0.02	10	10	100%	< 0.02	14	14	100%	0.05	10	10	100%	< 0.02	41	41	100%	0.05
Chloride	250	1	1	100%	190	1	1	100%	110	1	1	100%	110	1	1	100%	120	4	4	100%	190
Chlorine (Free Residual)	0.6	44	2	5%	1.19	43	5	12%	1.36	104	1	1%	0.99	104	0	0%	1.02	295	8	4%	1.36
True Colour	15HU	6	6	100%	< 5	6	6	100%	< 5	6	6	100%	< 5	6	6	100%	< 5	24	24	100%	0
Hardness	200	1	1	100%	13	1	1	100%	13	1	1	100%	12	1	1	100%	13	4	4	100%	13
Iron	0.3	31	27	88%	0.47	24	22	92%	0.52	24	21	88%	1.4	24	21	88%	0.45	103	91	89%	1.4
pH	6.5-8.5	100	98	98%	9.1	103	103	100%	8.14	104	104	100%	8.31	104	104	100%	8.5	411	409	100%	9.1
Sodium	180	100	100	100%	110	103	103	100%	150	104	104	100%	150	104	104	100%	130	411	411	100%	150
Sulphate	250	1	1	100%	2.1	1	1	100%	2.3	1	1	100%	2.1	1	1	100%	2.5	4	4	100%	2.5
Sulphide	0.05	3	3	100%	< 0.05	3	3	100%	< 0.05	3	3	100%	< 0.05	4	4	100%	< 0.05	13	13	100%	0
TDS	600	1	1	100%	330	1	1	100%	230	1	1	100%	200	1	1	100%	280	4	4	100%	330
Turbidity	5NTU	6	6	100%	1.2 (NTU)	5	5	100%	0.8 (NTU)	5	5	100%	0.4 (NTU)	7	7	100%	0.2 (NTU)	23	23	100%	1.2 (NTU)
Zinc	3	3	3	100%	0.008	4	4	100%	0.036	3	3	100%	0.027	4	4	100%	0.042	14	14	100%	0.042

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ROTTNEST ISLAND AUTHORITY

		July-September 2022			October-December 2022			January-March 2023			April-June 2023			2022-23 Summary		
Microbial Characteristic	Memorandum of Understanding Compliance Criteria	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG
Bacterial																
<i>E.coli</i>	Non Detect	57	57	100%	62	62	100%	59	59	100%	59	59	100%	237	237	100%
Amoeba																
Thermophilic																
<i>Naegleria</i>	Non Detect	26	26	100%	28	28	100%	29	29	100%	24	24	100%	107	107	100%

		July-September 2022				October-December 2022				January-March 2023				April-June 2023				2022-23 Summary			
Drinking Fountain Analytes	Australian Drinking Water Guidelines (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)	No. of Analyses	No. of Analyses Complying with ADWG	% Compliance with ADWG	Max Value of Analysis (mg/L)
Health Characteristics																					
Antimony	0.003	64	64	100%	< 0.001	48	48	100%	< 0.001	48	48	100%	< 0.001	64	64	100%	< 0.001	224	224	100%	< 0.001
Cadmium	0.002	64	64	100%	0.0002	48	48	100%	< 0.0001	48	48	100%	< 0.0001	64	64	100%	0.0001	224	224	100%	0.0002
Lead	0.01	64	64	100%	0.004	48	48	100%	0.003	48	48	100%	0.005	64	64	100%	0.004	#REF!	224	#REF!	0.005
Nickel	0.02	64	64	100%	0.004	48	48	100%	0.005	48	48	100%	0.006	64	64	100%	0.011	#REF!	224	#REF!	0.011
Aesthetic Characteristics																					
Copper	1	64	64	100%	0.19	48	48	100%	0.14	48	48	100%	0.21	64	64	100%	0.18	224	224	100%	0.21
Zinc	3	64	64	100%	0.3	48	48	100%	0.2	48	48	100%	0.42	64	64	100%	0.37	224	224	100%	0.42

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Appendix B: ADWG Sample Point Graph Summaries (Health)

The following graphs provide a summary of all data collected over the monitoring period for each health-related parameter. There were either none or very few detects for the following analytes during the reporting period, therefore there are no graphs for the following analytes:

- Antimony;
- Cadmium;
- Fluoride (Rottnest Island's drinking water is not fluoridated);
- Lead;
- Manganese;
- Nickel; and
- Nitrite.

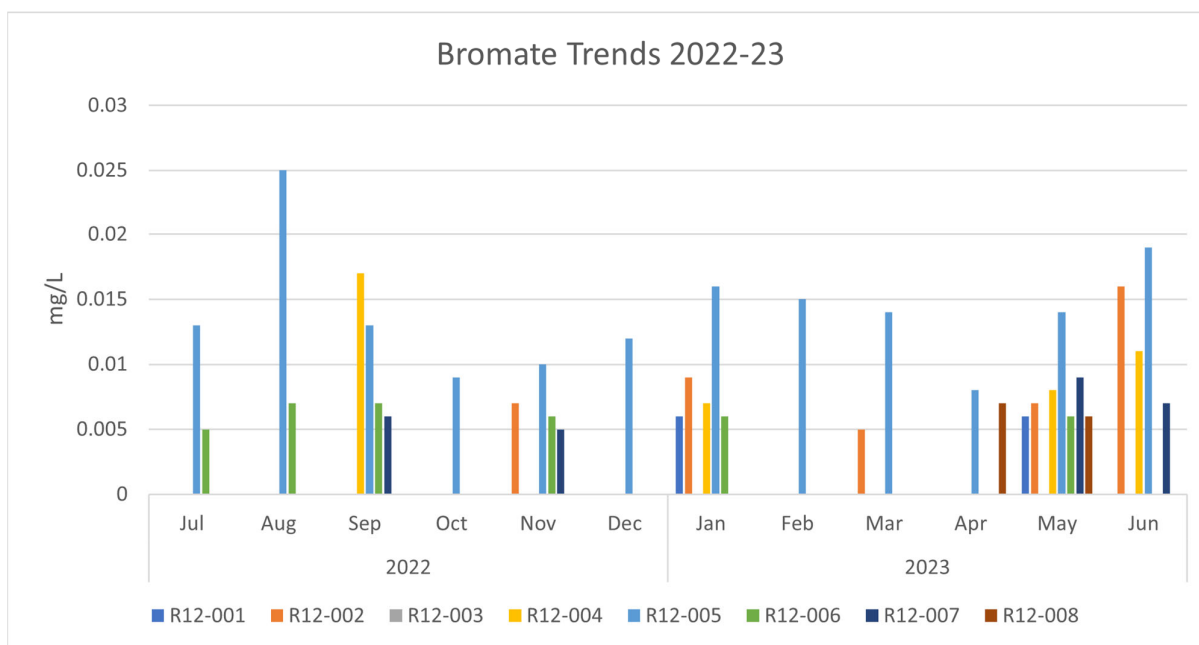


Figure B.1: Bromate trends during the 2022 – 23 monitoring period (ADWG limit 0.02 mg/L).

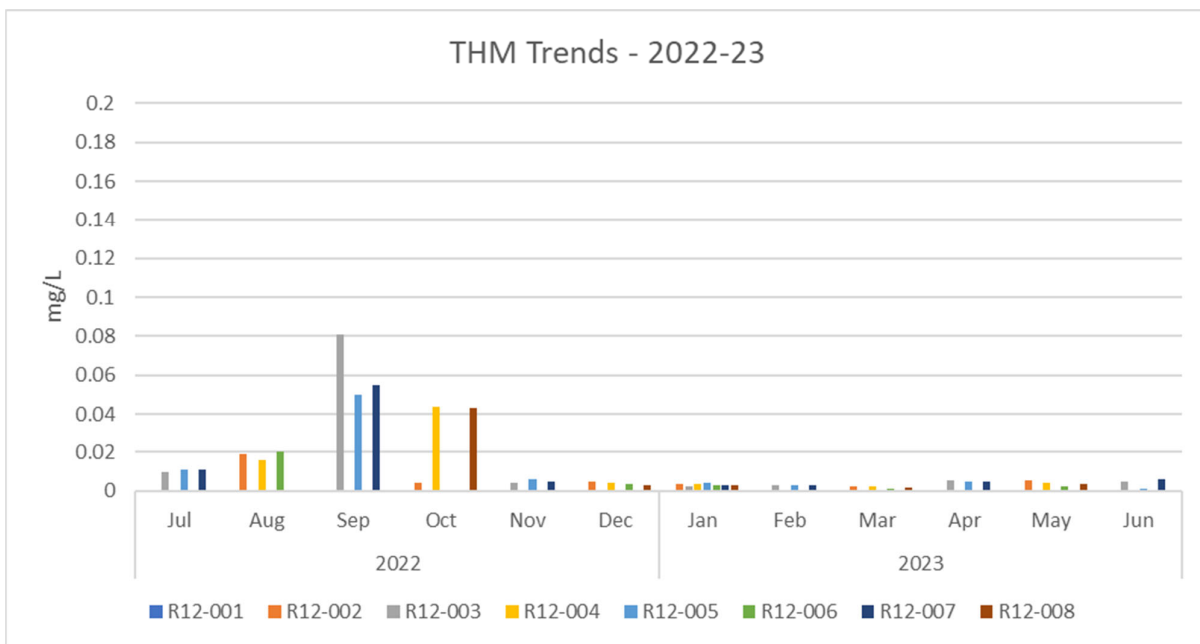


Figure B.2: THM trends during the 2022 – 23 monitoring period (ADWG limit 0.25 mg/L)

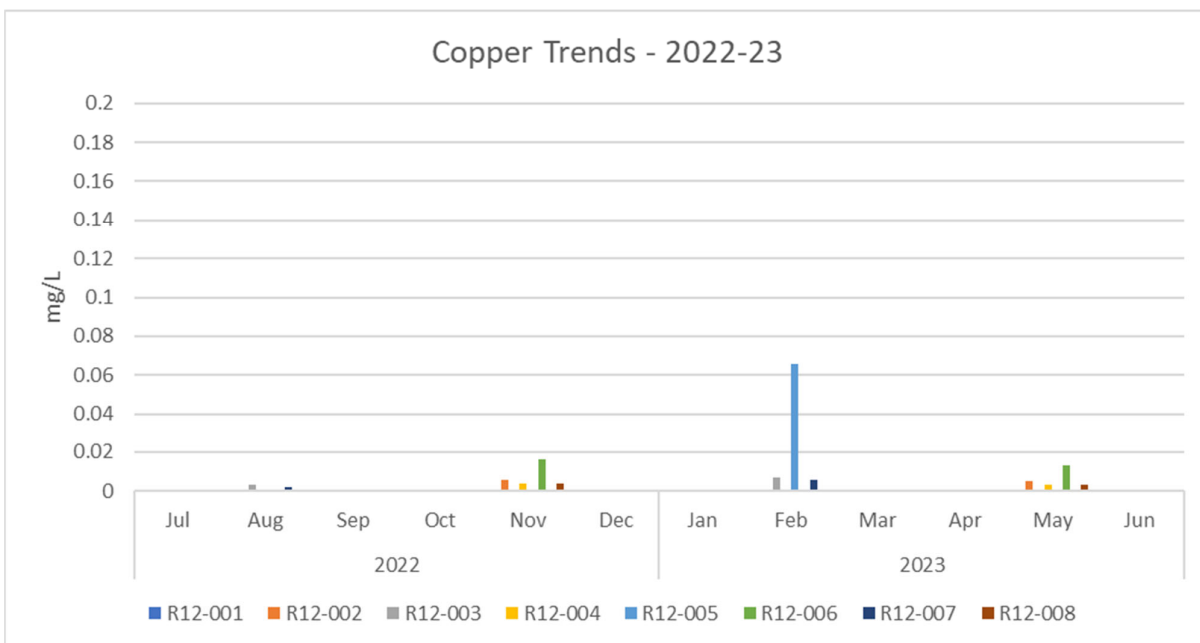


Figure B.3: Copper trends during the 2022 – 23 monitoring period (ADWG limit 2 mg/L)

Appendix C: ADWG Sample Point Graph Summaries (Aesthetic)

The following graphs provide a summary of all data collected over the monitoring period for each aesthetic related parameter. Graphs have not been included for the following analytes as there were either no or very few detects during the reporting period:

- Aluminum;
- Ammonia;
- Chloride;
- Colour;
- Hardness;
- Sulfate;
- TDS;
- Turbidity; and
- Hydrogen Sulphide.

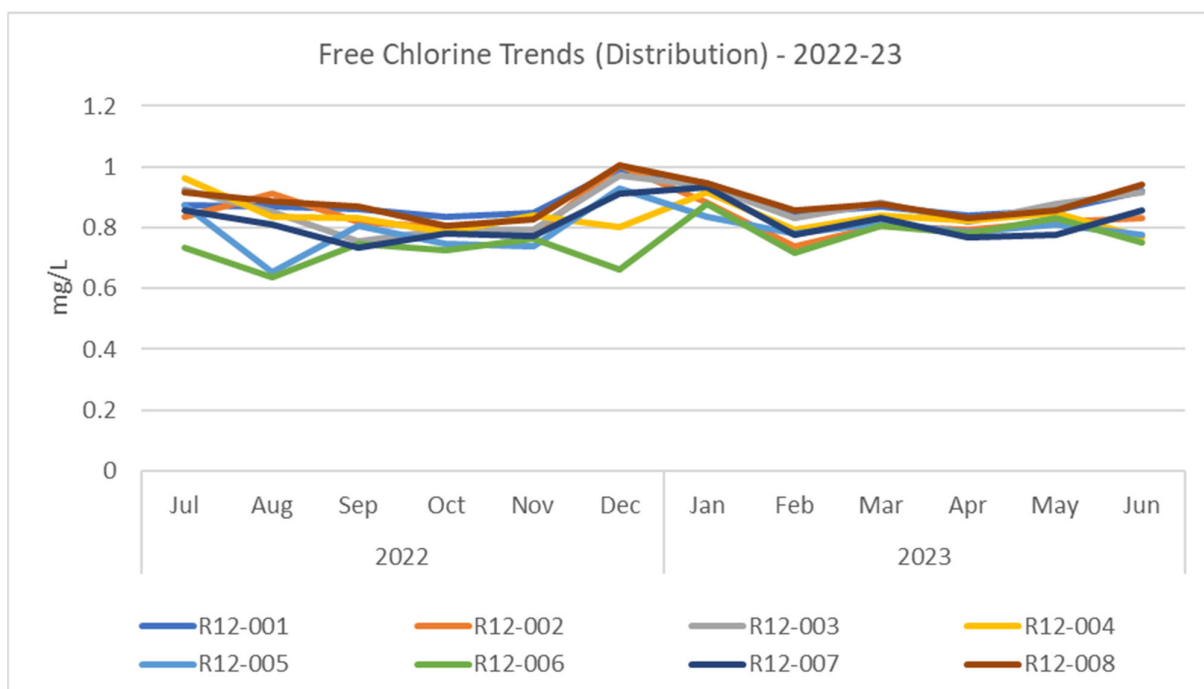


Figure C.1: Free chlorine trends during the 2022 – 23 monitoring period (ADWG limit 5.0 mg/L)

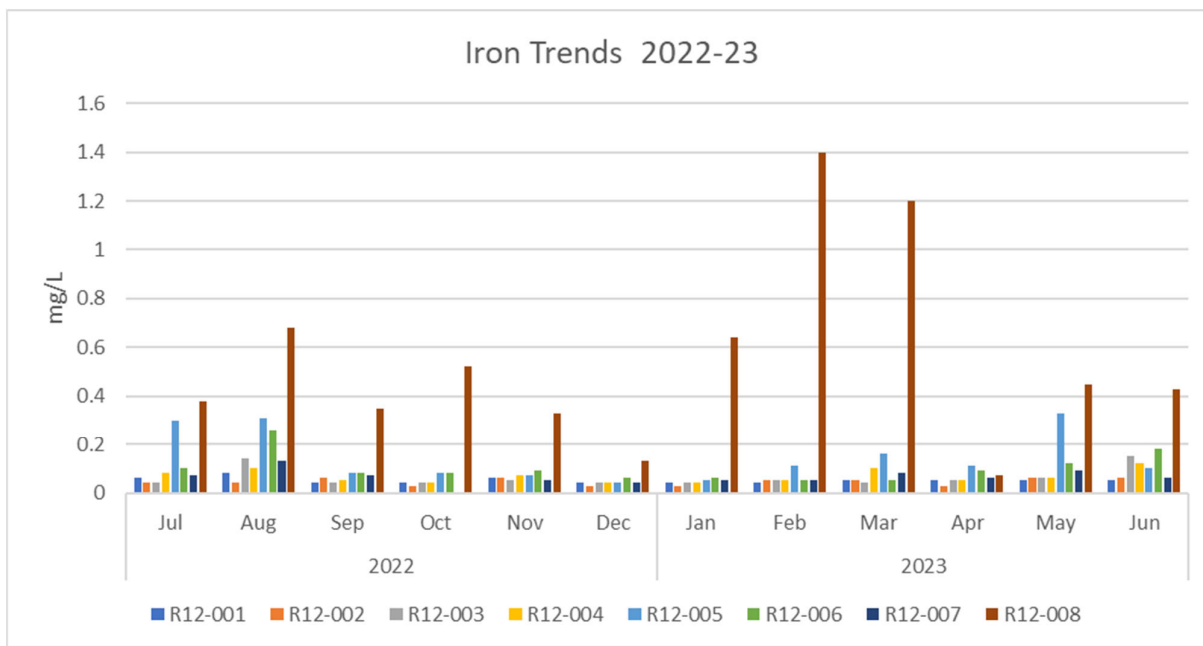


Figure C.2: Iron trends during the 2022 – 23 monitoring period (ADWG limit 0.3 mg/L)

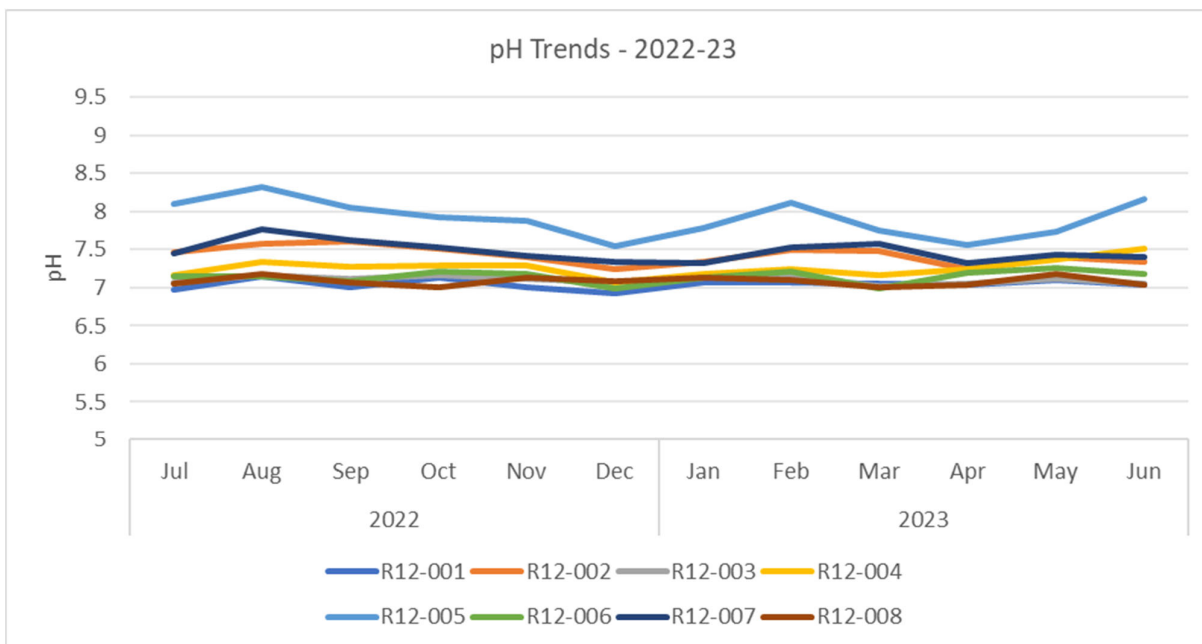


Figure C.3: pH trends during the 2022 – 23 monitoring period (ADWG limit range: 6.5 – 8.5)

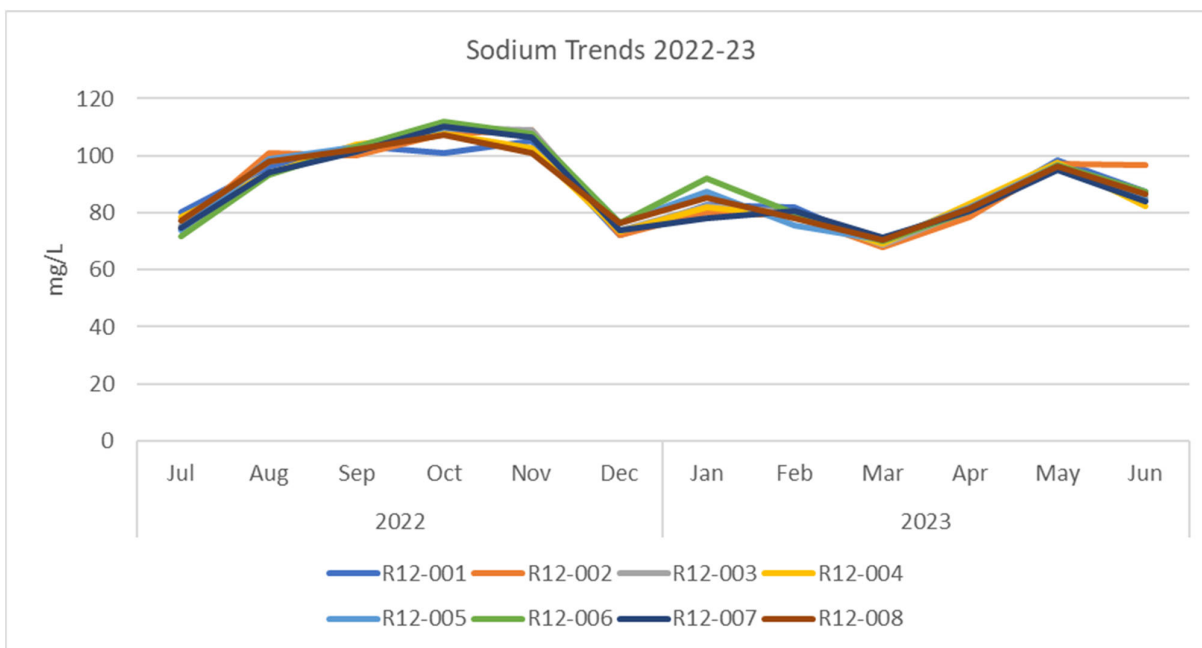


Figure C.4: Sodium trends during the 2022 – 23 monitoring period (ADWG limit: 180 mg/L)

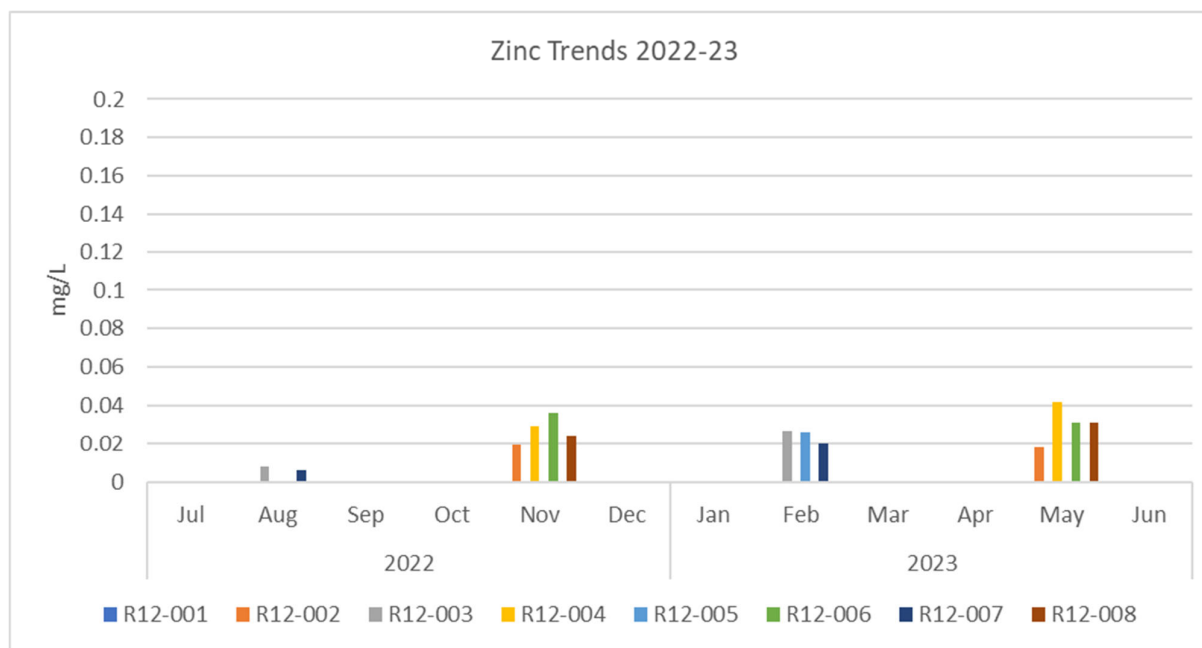


Figure C.5: Zinc trends during the 2022 – 23 monitoring period (ADWG limit 3 mg/L).