COMPLIANCE AND PERFORMANCE REPORT

SEPTEMBER 2024
HUNTER WATER

Hunter Water acknowledges the Traditional Countries of the Awabakal, Gaewegal, Darkinjung, Wonnarua and Worimi peoples on which we operate and the Countries beyond where our water flows.

We recognise and respect their cultural heritage, beliefs and continuing connection to the lands and waters of our Traditional Custodians and pay respect to their Elders past, present and emerging.

Artwork by Tyson Jolly

EXECUTIVE SUMMARY

Hunter Water provides safe, reliable and efficient water and wastewater services to the households and businesses of the Lower Hunter. Our Operating Licence sets out the terms and quality expectations that govern the delivery of those services to the community.[1] This report details our compliance with and performance against requirements of the Operating Licence and Reporting Manual for 2022-23.[2]

Quality, safety and reliability are of critical importance to us. As a State-Owned Corporation, we strive to deliver these outcomes efficiently and with due regard to community and environmental values. Hunter Water performed at a consistent, high standard throughout 2023-24. We are undertaking programs in 2023-24 to ensure that we continue to deliver high quality services to the Lower Hunter. Key performance and operational outcomes during 2023-24 include:

Drinking water and recycled water quality management

- Conformance with the Drinking Water Quality Management System (DWQMS).
- Conformance with the Recycled Water Quality Management System (RWQMS).
- Compliance with regulatory requirements for verification monitoring as specified in the Australian Drinking Water Guidelines (ADWG).
- The *2023 Q3 Quarterly Exception Report – Drinking Water and Recycled Water Quality Exceptions* was submitted to NSW Health five days after the deadline, which was promptly discussed with NSW Health. To prevent future occurrence, an automated reporting requirement and compliance attestation was implemented.
- Reviewed water quality risks associated with our drinking water systems.
- Continued to consult with NSW Health about the implementation of our DWQMS and RWQMS.

Performance standards for service interruptions

- Met performance standards for water pressure, water continuity and wastewater overflows.

Customer and stakeholder relations

- Implementing our Customer Experience Strategy, with a focus on improving customer service and experience when interacting with Hunter Water.
- Complaints increased substantially in 2023-24. The main drivers were increased complaints regarding billing and water quality:
    - Water quality complaints relating to taste/odour have increased in line with detection of certain naturally occurring compounds at our main water treatment plant, and across NSW. The compounds are at acceptable levels in accordance with the ADWG.
    - Cost-of-living pressures are influencing billing complaints as customers are becoming increasingly concerned about their water consumption. We have increased our support programs to support customers experiencing vulnerability.
    - We experienced more meter reading errors this year, with a high level of staff turnover. We are focusing on better staff training to improve meter reading accuracy.

Provision of information and services

- Provided timely information to, and negotiated in good faith with, potential competitors and Water Industry Competition (WIC) Act licensees.

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[1] NSW Government 2022, Hunter Water Operating Licence 2022-2027.

[2] NSW Government 2022, Hunter Water Operating Licence Reporting Manual 2022-2027, re-issued 2024.

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2 INTRODUCTION

Hunter Water is a state-owned corporation that provides safe, reliable, and efficient water and wastewater services in the Lower Hunter region. We also manage trunk stormwater channels in the Newcastle, Lake Macquarie, and Cessnock local government areas. We are governed by the *State-Owned Corporations Act 1989* and *Hunter Water Act 1991*. The NSW government regulates Hunter Water's operations through a variety of regulatory bodies and instruments.

Our Operating Licence is the key regulatory instrument that enables and requires us to provide services. The Operating Licence contains terms and conditions that specify how services are to be provided, and quality and performance standards that must be achieved. Through it, we are accountable to the NSW government, our customers, and our community, for our performance. Our adherence to and performance against the Licence is monitored and reviewed by the Independent Pricing and Regulatory Tribunal (IPART).

This Compliance and Performance Report provides detailed information on our performance during 2023-24 concerning prescribed clauses of the Operating Licence and in accordance with the associated Reporting Manual.[3,4]

The contents of this report are as follows:

- **Chapter 2** - The water quality performance of our drinking water and recycled water systems.
- **Chapter 3** - Our performance against the minimum standards in our Operating Licence for water pressure, water continuity and wastewater overflows system performance.
- **Chapter 4** – Our complaint management performance.
- **Chapter 5** – Our performance in providing information and negotiating the provision of services to WIC Act licensees and potential competitors.
- **Chapter 6** – Appendices including IPART performance data, Licence data, and a glossary of technical terms and acronyms.

[3] NSW Government 2022, Hunter Water Operating Licence 2022-2027.

[4] NSW Government 2022, Hunter Water Operating Licence Reporting Manual 2022-2027, re-issued 2024.

3 WATER QUALITY MANAGEMENT

3.1 Drinking water

3.1.1 Overview of drinking water supply systems

Hunter Water supplies high quality drinking water to around 620,000 people in the Lower Hunter region of New South Wales, comprising the local government areas of Newcastle, Lake Macquarie, Maitland, Cessnock, Port Stephens, Dungog and small parts of Singleton.

As required under our Operating Licence, our drinking water systems are managed in accordance with our Drinking Water Quality Management System (DWQMS), complemented by our ISO 9001 Quality Management System. Our DWQMS is consistent with the Australian Drinking Water Guidelines 2011 (ADWG) framework for the management of drinking water quality.[5] This framework is based on the application of multiple barriers – preventive measures at all steps in the drinking water system – to ensure that consistently safe drinking water is provided to our customers and communities.

Drinking water systems consist of:

- **Drinking Water Catchments**

  Water is collected in the natural landscape by creeks, rivers, and groundwater systems. Water quality in our catchments is protected by regulations that control the activities that are allowed within them.[6] Developments are assessed to ensure it is undertaken in a manner appropriate for a drinking water catchment. We also work closely with our communities and stakeholders on catchment management initiatives. Figure 1 shows the locations of our drinking water catchments.

- **Bulk Water Storages**

  Water is stored in dams and groundwater sandbeds (aquifers) before we treat it to drinking standards. Our drinking water storages include Chichester Dam, Grahamstown Dam, Tomago Sandbeds and Anna Bay Sandbeds. We also source some water from the Paterson River (via Lostock Dam, which is owned by WaterNSW) and the Allyn River. The locations of our storages are shown in **Figure 1** and capacities are provided in **Table 1**.

- **Water Treatment Plants**

  We operate six water treatment plants (WTPs) that treat water to a quality suitable to drink. These water treatment plants are Dungog WTP, Grahamstown WTP, Lemon Tree Passage WTP, Anna Bay WTP, Nelson Bay WTP and Gresford WTP. **Figure 1** shows the locations of our WTPs.

- **Water Distribution Systems**

  A closed distribution network transports and stores the drinking water we supply. All drinking water tanks and storage reservoirs within the distribution system are enclosed and regular inspections are undertaken to ensure we maintain the integrity of the system. Security measures are in place to prevent unauthorised access to water storage facilities. We undertake maintenance and construction activities in accordance with procedures designed to ensure the protection of drinking water quality. We have backflow prevention measures in place to minimise the likelihood of potentially contaminated water from customers' properties from entering the water supply system. **Figure 2** shows the water supply systems. We describe these further in this chapter.

We also supply and receive some drinking water from outside of our area of operations. We supply a small volume of drinking water to MidCoast Council in Karuah (~6.4 ML in 2023-24) and can also supply and receive drinking water from Central Coast Council to the south. During 2023-24, we supplied 1,075 ML of drinking water to the Central Coast and received 1,386 ML from Central Coast Council's water supply system. Central Coast Council maintain a quality assurance program for their water supply systems in accordance with the *NSW Public Health Regulation 2012*. We also provided small volumes of water to private network operators located within our area of operations.

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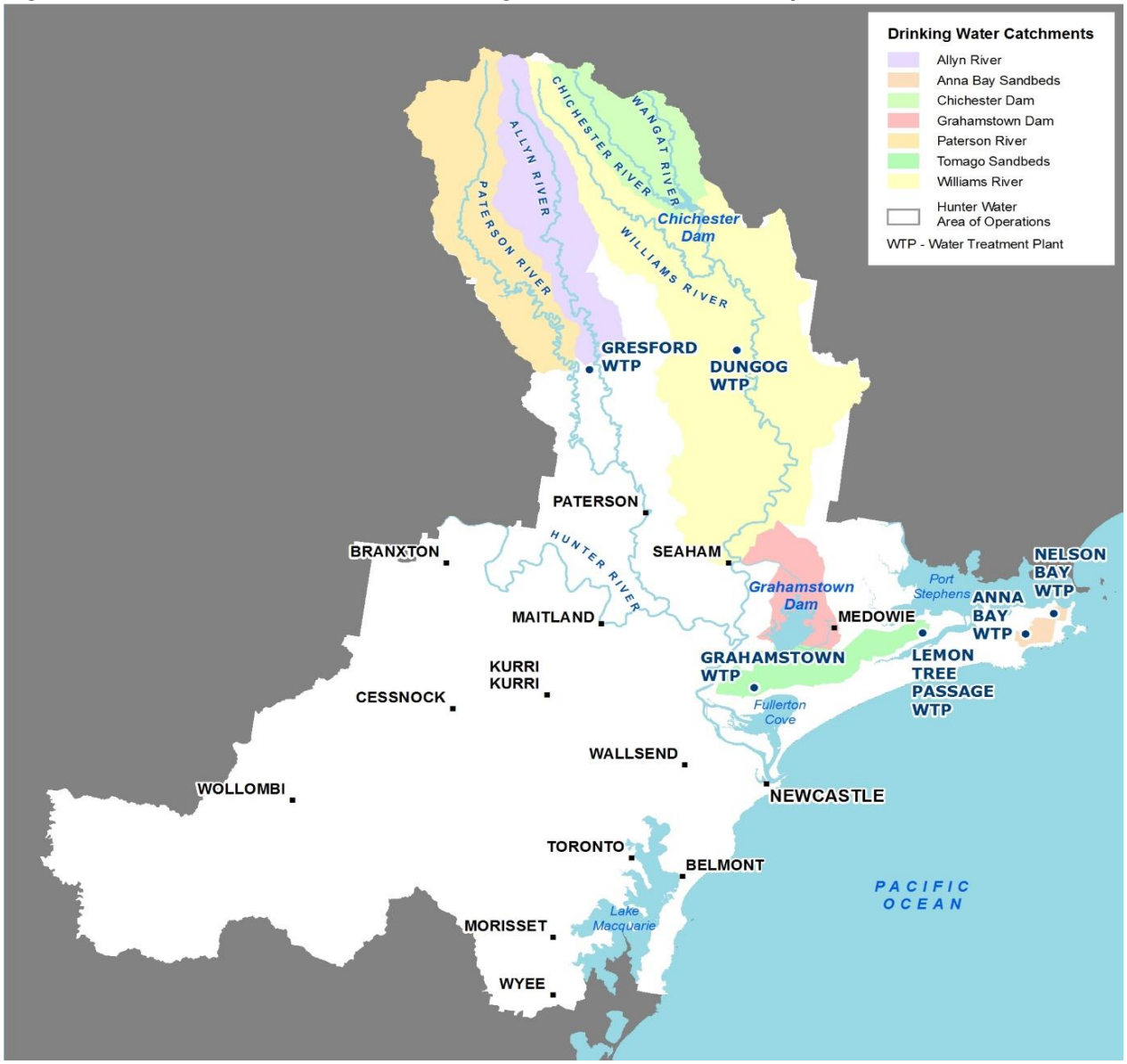
[5] National Health and Medical Research Council, 2016, Australian Drinking Water Guidelines 2011 – updated Sept 2022

[2] *Hunter Water Regulation 2015*, Part 2 – Special Areas.

Figure 1 - Hunter Water's catchments, storages, and water treatment plants

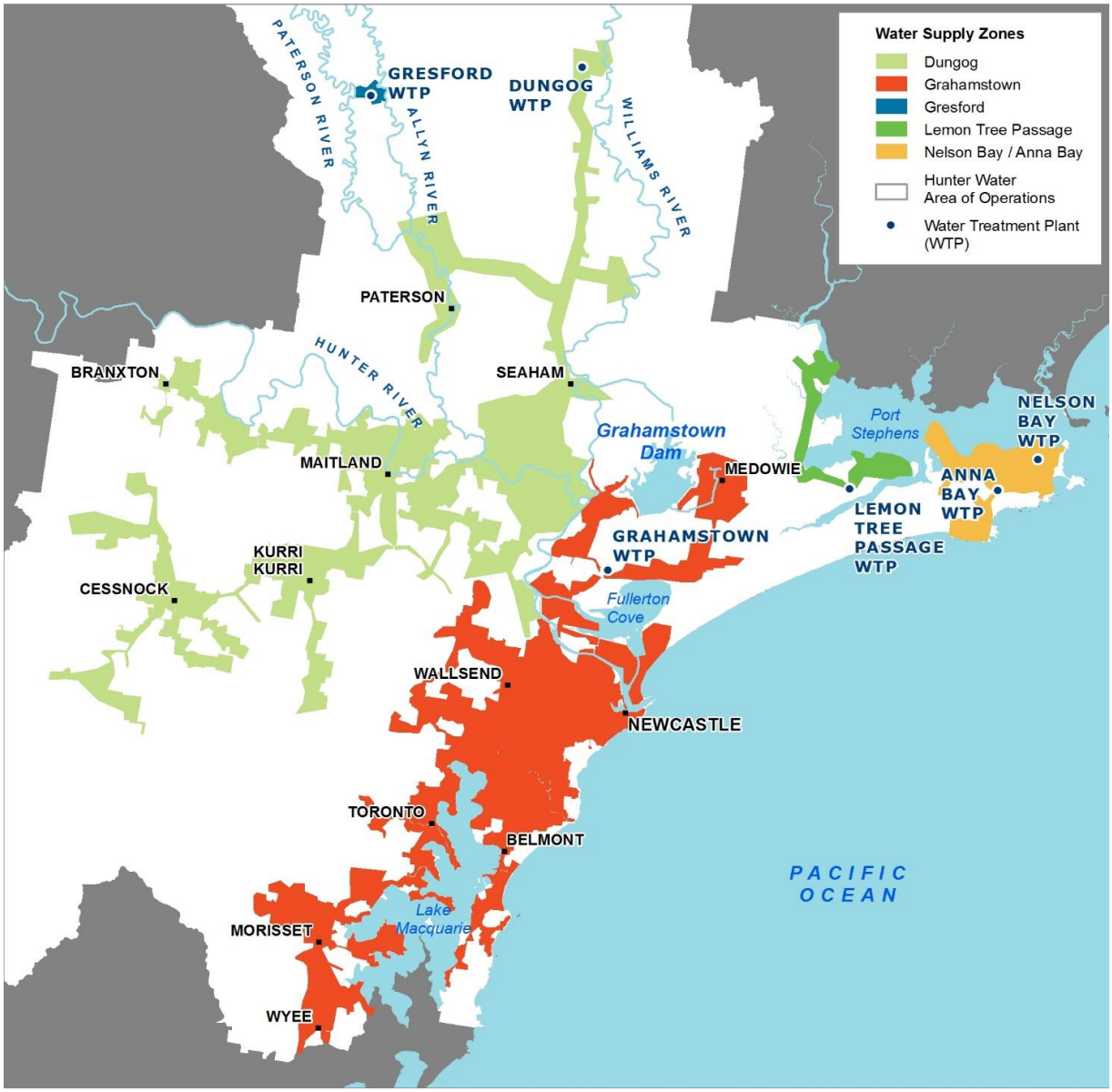


Source: Hunter Water

Table 1 - Capacity of Hunter Water's water storages

Water Source	Maximum Capacity (ML)
Chichester Dam	18,356
Grahamstown Dam	182,305
Tomago Sandbeds	54,000
Anna Bay Sandbeds	14,537
Total storage	**269,198**

Figure 2 - Hunter Water's drinking water supply systems



Source: Hunter Water

3.1.2 Performance at Critical Control Points

Where practical, we continuously monitor water quality parameters at Critical Control Points (CCPs) using a supervisory control and data acquisition (SCADA) system. Operational limits for CCPs are set at levels that are more stringent than the critical limit. Using SCADA, alarm limits are set so that we can take corrective action before the critical limit is reached.

Exceedance of a critical limit indicates a risk of unacceptable water quality being supplied to customers. If a critical limit is exceeded, an investigation is undertaken, and any necessary corrective action(s) are implemented. To minimise the likelihood of exceeding critical limits, we have implemented automatic shutdowns for key water quality parameters at all WTPs.

This performance review applies to Hunter Water's CCPs in place during the reporting period.

An outline of each of our water supply zones and performance at CCPs during 2023-24 is set out below. An exceedance of a CCP critical limit does not necessarily indicate that unsafe water quality was supplied to

customers, rather it means that the risk threshold was exceeded, and a corrective response was required. A brief explanation of each of the water treatment processes referenced in this section is included in the Glossary.

Dungog water supply system

We treat water from Chichester Dam at Dungog WTP. Dungog WTP is a direct filtration plant with a maximum capacity of 90 ML/day and the following treatment processes are in place:

- Raw water chlorination (event-based)
- Powdered activated carbon (PAC) dosing (event-based)
- Coagulation / flocculation
- Filtration
- pH correction
- Disinfection
- Fluoridation

Drinking water from Dungog WTP is transported via the Chichester Trunk Gravity Main (CTGM) to the Cessnock, Maitland and Newcastle areas. Dungog WTP also provides drinking water to some townships within Dungog Shire. We re-chlorinate water supplied to Maitland and Cessnock at the outlet of Four Mile Creek Reservoir. Water from the CTGM also gravitates to the Newcastle and Lake Macquarie areas (Grahamstown water supply zone), where it blends with water supplied from Grahamstown WTP. The Dungog water supply system supplies an estimated permanent population of 170,000 people.

Table 2 shows the performance at CCPs within the Dungog system.

Table 2 - Dungog water supply system: CCPs performance 2023-24

Critical control point	Critical limit	Compliant
Dungog WTP coagulation and filtration	Individual filters. Filtered water turbidity must not exceed 0.5 NTU for > 15 consecutive minutes at individual filter outlets	✓
Dungog WTP post-filtration disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) [a]	✓
	pH at clear water tank outlet must not be greater than 9 for > 15 consecutive minutes	✓
	Free chlorine residual at clear water tank outlet must not exceed 4.5 mg/L for > 15 minutes	✓
Dungog WTP fluoridation	Fluoride concentration at clear water tank outlet must not exceed 1.5 mg/L	✓
Four Mile Creek reservoir chlorinator	Free chlorine residual at water main re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	✓

Notes:

a) Chlorine Contact time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.3 mg/L free chlorine at the Clear Water Tank outlet applies.

Grahamstown water supply system

We treat water from Grahamstown Dam and the Tomago Sandbeds at Grahamstown WTP. Grahamstown WTP has a maximum capacity of 266 ML/day and the following treatment processes are in place:

- PAC dosing (event-based)
- Aeration (Tomago Sandbeds water only)
- Coagulation / flocculation
- Sedimentation
- Filtration
- pH correction
- Disinfection
- Fluoridation

We pump treated water from Grahamstown WTP to Newcastle and Lake Macquarie, as well as Medowie, Stockton and Kooragang Island. We re-chlorinate the water at four locations within the Newcastle and Lake Macquarie distribution systems to maintain chlorine residual for disinfection and minimise water quality risk within the distribution system. We also pump water from this supply zone to the Tomaree Peninsula to form part of the supply to Port Stephens. The Grahamstown water supply system supplies an estimated permanent population of 414,000 people. **Table 3** summarises performance at CCPs within the water supply system.

Table 3 - Grahamstown water supply system: CCPs performance 2023-24

Critical Control Point	Critical Limit	Compliant
Grahamstown WTP coagulation and filtration	Filtered water turbidity must not exceed 0.5 NTU for > 15 consecutive minutes at individual filter outlets	✓
Grahamstown WTP and mains disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) [a]	✓
	pH at clear water tank outlet must not be greater than 9 for > 15 consecutive minutes	✓
	Free chlorine residual post re-chlorination must not exceed 4.5 mg/L for > 15 consecutive minutes	✓
Grahamstown WTP fluoridation	Fluoride concentration at clear water tank outlet must not exceed 1.5 mg/L	✓
Cardiff South Chlorinator	Free chlorine residual at water mains re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	✓
Elermore Vale Chlorinator	Free chlorine residual at water mains re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	✓
North Lambton Chlorinator	Free chlorine residual at water mains re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	✓
Toronto Chlorinator	Free chlorine residual at water mains re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	✓
Adamstown Heights Chlorinator	Free chlorine residual at water mains re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	✓

Notes:

a) Chlorine Contact Time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.7 mg/L free chlorine at the Clear Water Tank outlet applies.

Lemon Tree Passage water supply system

We treat water from the Tomago Sandbeds at Lemon Tree Passage WTP. Lemon Tree Passage WTP has a maximum capacity of 5 ML/day and the following processes are in place:

- Aeration
- Coagulation / flocculation
- Two stage filtration
- pH correction
- Disinfection
- Fluoridation

We pump treated water from Lemon Tree Passage WTP to Tanilba Bay, Mallabula, Lemon Tree Passage, Swan Bay and Karuah. This system supplies an estimated permanent population of 9,300 people.

Performance at CCPs within the water supply system is summarised in **Table 4**.

Table 4 - Lemon Tree Passage water supply system: CCPs performance 2023-24

Critical Control Point	Critical Limit	Compliant
Lemon Tree Passage WTP coagulation and filtration	Filtered water turbidity must not exceed 1 NTU for > 15 consecutive minutes at secondary filter outlets	✓
Lemon Tree Passage WTP disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) [a]	✓
	pH at clear water tank outlet must not be greater than 9 for > 15 consecutive minutes	✓
	Free chlorine residual at the clear water tank outlet must not exceed 4.5 mg/L for > 15 consecutive minutes	✓
Lemon Tree Passage WTP fluoridation	Fluoride concentration at clear water tank outlet must not exceed 1.5 mg/L	✓

Notes:

a) Chlorine Contact Time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.4 mg/L free chlorine at the Clear Water Tank outlet applies.

Anna Bay and Nelson Bay water supply system

The Anna Bay Sandbeds are located within the protected catchment of the Tomaree National Park and groundwater is naturally filtered within the sandbeds. We extract the water using a network of production bores and treat the water at Anna Bay and Nelson Bay WTPs.

Anna Bay WTP and Nelson Bay WTP can each supply a maximum flow of approximately 12 ML/day and the following treatment processes are in place:

- Aeration
- pH correction
- Disinfection
- Fluoridation

Water from the WTPs supplies the Tomaree Peninsula including Anna Bay, Boat Harbour, Salamander Bay, Nelson Bay, Fingal Bay, Shoal Bay, Corlette and Soldiers Point. The system supplies an estimated permanent population of 34,000 people. Water from Grahamstown WTP can also supplement this water supply system. **Table 5** summarises the performance at CCPs within the water supply system.

Table 5 - Anna Bay/ Nelson Bay water supply system: CCPs performance 2023-24

Critical Control Point	Critical limits	Compliant
Anna Bay WTP disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) [a]	✓
	Free chlorine concentration at clear water tank outlet must not exceed 4.5 mg/L for > 15 minutes	✓
	pH at clear water tank outlet must not be greater than 9 for > 15 consecutive minutes	✓
	Turbidity at clear water tank outlet must not exceed 5 NTU for > 5 consecutive minutes	✓
Nelson Bay WTP disinfection	Disinfection prior to first customer (Chlorine Contact Time must be less than 15 min.mg/L) [a]	✓
	pH at the clear water tank inlet must not be greater than 9 for > 15 consecutive minutes	✓
	Free chlorine residual at clear water tank outlet must not exceed 4.5 mg/L for > 15 consecutive minutes	✓
	Turbidity at clear water tank outlet must not exceed 5 NTU for > 5 consecutive minutes	✓
Anna Bay/Nelson Bay WTP fluoridation	Fluoride concentration at clear water tank outlet must not exceed 1.5 mg/L	✓

Notes:

a) Chlorine Contact Time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.8 mg/L and 0.3 mg/L free chlorine applies at the Clear Water Tank outlets, at Anna Bay WTP and Nelson Bay WTP, respectively.

Gresford water supply system

We extract water from both the Allyn and Paterson Rivers at Gresford, and treat it at Gresford WTP. Gresford WTP has a maximum capacity of 0.5 ML/day and the following treatment processes are in place:

- Membrane microfiltration
- Disinfection

Performance at CCPs within the water supply system is summarised in **Table 6**.

Table 6 - Gresford water supply system: CCPs performance 2023-24

Critical Control Point	Critical Limit	Compliant
Gresford WTP microfiltration	Filtered water turbidity must not exceed 0.5 NTU for > 15 consecutive minutes at clear water tank inlet	✓
	Calculated pressure decay rate across membranes must not exceed 10 kPA/min	✓
Gresford WTP disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) [a]	✓
	pH at the clear water tank inlet must not be greater than 9 for > 15 consecutive minutes	✓
	Free chlorine concentration at the clear water tank outlet must not exceed 4.5 mg/L for > 15 minutes	✓

Notes:

a. Chlorine Contact Time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.2 mg/L free chlorine at the Clear Water Tank outlet applies.

3.1.3 Verification monitoring

The ADWG Drinking Water Quality Framework emphasises a preventive approach, including operational monitoring and process control, combined with verification monitoring to confirm that preventive measures have been effective: [7]

> *Verification of drinking water quality provides an important link back to the operation of the water supply system and additional assurance that the preventive measures and treatment barriers in the water supply system have worked, and are working, to supply safe drinking water.*

Verification monitoring is based on the results of water quality samples that are representative of water supplied to customers' taps. Water quality standards specified in the ADWG are considered safe for people to drink over an entire lifetime. Therefore, licence performance is a statistical analysis of results, based on percentage compliance rather than absolute figures.

In 2023-24, we achieved full compliance with the key microbiological and physical/chemical parameters shown in **Table 7, Table 8 and Table 9**. Descriptions of the parameters are provided in the glossary of this report.

[7] National Health and Medical Research Council, 2016, Australian Drinking Water Guidelines 2011 – updated Jan 2022, Element five, Section 9.5, p. 142.

Table 7 - Microbiological water quality 2023-24

Parameter	Health / Aesthetic	Measure of Compliance	Performance Standard	Whole of Hunter Water 12 Months Samples	Compliant
E.coli	Health	% of samples containing < 1 Most Probable Number (MPN) per 100 mL	>98% of samples shall contain <1 MPN per 100 mL	99.89% of samples contained < 1 MPN per 100 mL	✓

Table 8 - Key health physical / chemical analytes 2023-24

Analyte	Units of Measure	ADWG health guideline value	Performance standard (assessment over 12 months)	95th Percentile over the last 12 months	Compliant
Fluoride	mg/L	1.5	95th percentile of test results less than respective ADWG health guideline value	1.00	✓
Chlorine	mg/L	5		1.60	✓
Copper	mg/L	2		0.015	✓
Lead	mg/L	0.01		0.001	✓
Manganese	mg/L	0.5		0.011	✓
Trihalomethanes	mg/L	0.25		0.155	✓

Table 9 - Key aesthetic physical / chemical analytes 2023-24

Analyte	Units of Measure	ADWG aesthetic guideline value	Performance standard (assessment over 12 months)	12 month average result	Compliant
Iron	mg/L	0.3	Average of test results less than respective ADWG aesthetic guideline value	0.033	✓
Aluminium	mg/L	0.2		0.048	✓
Copper	mg/L	1		0.006	✓
Zinc	mg/L	3		0.003	✓
Turbidity	NTU	5		0.3	✓
True colour	HU	15		5	✓
pH	pH units	6.5-9.2	Average of results between 6.5 and 9.2	7.55	✓

3.1.4 Drinking water quality management activities and programs in 2023-24

Improvements to drinking water quality management undertaken or underway during 2023-24 are shown in **Table 10**. Water quality objectives are aligned to the actions of the ADWG Framework and the strategic objective to maintain the safety of drinking water.

Table 10 - Drinking water quality management activities and programs 2023-24

ADWG framework sub-element		Water quality objective	Activity / Program	Results / Outcomes
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources and hazardous events.	Grahamstown WTP risk assessment review	Risk assessment update was finalised, and risk management priorities developed.
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources and hazardous events.	Update catchment to tap risk assessment guideline.	Guideline updated.
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources and hazardous events.	Review and update of Health Based Targets requirements	Ongoing work for groundwater catchment categorisation.
3.1	Preventive Measures and Multiple Barriers	Maintain effective secondary disinfection barrier.	Maintain effective chlorine residual throughout the network.	The chlorine residual >0.2mg/L was achieved for greater than 75% of customers (rolling 12 month to 30 June 2024).
3.1	Preventive Measures and Multiple Barriers	Improved barriers to pathogen contamination.	UV upgrade at Grahamstown WTP.	Project progressing according to program.
3.1	Preventive Measures and Multiple Barriers	Improved barriers to pathogen contamination.	Gresford water quality upgrade.	Revised business case progressing to ensure the optimal option is selected for ensuring safe water is provided to customers supplied via the Gresford WTP.
3.1	Preventive Measures and Multiple Barriers	Improved barriers to pathogen contamination.	Catchment fencing project.	Project completed.
3.1	Preventive Measures and Multiple Barriers	Improved chlorine residuals across the network.	Disinfection Optimisation Strategy (DOS) Stage 1B.	Project progressing. Cardiff South chlorinator online (upgraded), Adamstown Heights chlorinator online (new site)
3.1	Preventive Measures and Multiple Barriers	Evaluate additional preventive measures where improvement is required.	Dungog WTP valve and pipework configuration.	Business Case approved to reduce risk of ingress of raw water into treated water streams for Dungog WTP. Design complete.
4.2	Operational Monitoring	Ensure drinking water quality meets ADWG	CCP alarm improvements	Standard function block for CCP alarms being developed for rollout to WTP and network chlorinators.
9.2	Validation of Processes	CCP performance reporting for filtration	Filter performance reporting to Water Quality Committee and NSW Health	Filtered water turbidity performance for all WTPs reported monthly to Water Quality Committee and quarterly to NSW Health.
10.1	Management of Documentati	Document information pertinent to all aspects of drinking	DWQMS manual update.	Manual updated with information about existing practices across various elements and consolidated CCP table

ADWG framework sub-element		Water quality objective	Activity / Program	Results / Outcomes
	on and Records	water quality management.		

3.1.5 Proposed drinking water quality management activities and programs

Table 11 outlines proposed activities to improve drinking water quality management in the future. Water quality objectives are aligned to the actions of the ADWG Framework and the strategic objective to maintain the safety of drinking water.

Table 11 - Proposed drinking water quality management activities and programs

ADWG framework sub-element		Water quality objective	Activity / Program	Scope / Expected Outcomes / Timeframe
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources and hazardous events.	Review and update of Health Based Targets requirements	Ongoing work for groundwater catchment categorisation.
2.3	Hazard Identification and Risk Assessment	Identify and manage existing, new and emerging risks.	Naegleria Fowleri Strategy.	Continue to implement strategy. Timetable – ongoing.
3.1	Preventive Measures and Multiple Barriers	Water quality in Tomago catchment.	Tomago PFAS Operating Strategy.	Continue to implement strategy. Timetable – ongoing.
3.1	Preventive Measures and Multiple Barriers	Maintain effective secondary disinfection barrier.	Maintain effective chlorine residual throughout the network.	Free chlorine residual >0.2mg/L to at least 90% of customers (rolling 12 month). Timetable – ongoing.
3.1	Preventive Measures and Multiple Barriers	Improved barriers to pathogen contamination.	UV upgrade at Grahamstown WTP.	Project progressing according to revised program. Timetable – as per revised delivery program.
3.1	Preventive Measures and Multiple Barriers	Improved barriers to pathogen contamination.	Gresford water quality upgrade.	Revised business case progressing to ensure the optimal option is selected for ensuring safe water is provided to customers supplied via the Gresford WTP.
3.1	Preventive Measures and Multiple Barriers	Improved chlorine residuals across the network.	Disinfection Optimisation Strategy (DOS) Stage 1B.	Project delivery progressing. Timetable – as per delivery program.
3.1	Preventive Measures and Multiple Barriers	Improved barriers to pathogen contamination.	Grahamstown WTP Stage 2 filter refurbishment.	Revised business case progressing to ensure the optimal option is selected.
3.1	Preventive Measures and Multiple Barriers	Improved barriers to chemical contamination.	Water Treatment plants chemical systems backflow prevention.	Project progressing according to program. Timetable – as per delivery program.
3.2	Critical Control Points	Establish mechanisms for operational control	SCADA function block	Implement upgrades to SCADA system at WTPs and CCP alarm reporting in 2024-25
4.2	Operational Monitoring	Develop monitoring protocols.	Improved treated water quality standards.	Performance against daily treated water targets for filtered water turbidity and

ADWG framework sub-element		Water quality objective	Activity / Program	Scope / Expected Outcomes / Timeframe
				chlorine residual reported monthly. Timetable – ongoing.
4.2	Operational Monitoring	Monitoring of drinking water supplied to customers	Revise and update the Water Quality Monitoring Plan	Review of operational monitoring completed with remaining recommendations being completed 2024-25.
4.2	Operational Monitoring	Minimise treated water manganese concentrations.	Planned operation of the Tomago Borefields.	Information communicated to key stakeholders. Treated water manganese concentrations minimised. Timetable – 2024-25.
4.2	Operational Monitoring	Validate overall performance of the system and quality of drinking water supplied to consumers.	Review of Treatment Operations Contract	The Treatment Operations service contract is under review and new contract award expected in 2025.
5.1	Verification Monitoring	Drinking water quality monitoring	Sampling of additional 15 verification monitoring locations	New sampling locations being established and sampling to commence mid-late 2024
10.1	Management of Documentation and Records	Document information pertinent to all aspects of drinking water quality management.	DWQMS manual update.	Review of the manual to update with references to Health Based Targets (HBT) methodology and information available for Hunter Water catchments.
10.2	Reporting	Establish procedures for effective internal and external reporting	Implementation of Protecht software	Progressive implementation of Protecht software to improve reporting and management of incidents.
11.2	Internal auditing	Maintain reservoir integrity.	Distribution network reservoir inspections for online reservoirs.	At least 95% of inspections completed by scheduled due date. Timetable – ongoing.

3.1.6 Continual improvement in 2023-24

Hunter Water Management provides support and oversight focused on operation and continuous improvement of our drinking water systems. We document, prioritise, and track drinking water quality improvement initiatives in the drinking water quality improvement plan (DWQIP).

Example improvements undertaken in 2023-24 include:

- Delivery of treatment actions to address the risk of non-compliance with agreed drinking water standards
- Progressive implementation of Protecht software to improve reporting and management of water quality incidents.
- Water Quality Investment Plan

The Water Quality Committee (a committee of management) is responsible for ensuring the effective management and implementation of Hunter Water's Drinking Water Quality Management System (DWQMS) in compliance with Hunter Water's Operating Licence. The Water Quality Committee meetings consider factors such as:

- Quality and supply issues
- Audit outcomes

- Training
- Monitoring and reporting

Findings and actions from the Water Quality Committee meetings are communicated to, and reviewed by, senior management on an as-required basis.

The Executive Management Team (EMT) reviews and endorses the drinking water quality policy, with final approval provided by the Managing Director. The EMT also regularly reviews water quality performance and findings from IPART's operational audit. We develop action plans to address recommendations and findings, including the allocation of additional resources as required. The Executive Manager Customer Delivery attends the quarterly liaison meetings with NSW Health to review the effectiveness of the DWQMS and discuss operational issues.

We ensure resources are dedicated to the development, review, and implementation of the DWQMS through our water quality committee and a dedicated DWQMS coordinator. All Hunter Water management, employees, and contractors involved in the supply of drinking water are responsible for understanding, implementing, maintaining and continuously improving the DWQMS.

3.1.7 Significant changes to the drinking water quality management system

There was no proposed potential significant change to the Drinking Water Quality Management System in 2023-2024.

3.1.8 Non-conformances with the Drinking Water Quality Management System

There were no major non-conformances with the Drinking Water Quality Management System in 2023-24.

The 2023 Q3 Quarterly Exception Report – Drinking Water and Recycled Water Quality Exceptions was submitted to NSW Health five days after the deadline, which was promptly discussed with NSW Health. To prevent future occurrence, an automated reporting requirement and compliance attestation was implemented.

The following recommendations were identified and have been subsequently addressed and/or planned for resolution:

Operating Licence audit recommendations:

- **Recommendation 2023-5-15(3):** Ensure, by 30 June 2024 that "Potential Contamination Threat" and "Reservoir Integrity Failure" are updated in Protecht System so that when such incidents are input, they immediately require an email and phone call notification to NSW Health
- **Recommendation 2023-6-15(3):** Prior to 30 June 2024 engage with NSW Health to seek clarification as to whether it is appropriate to incorporate a 1 NTU turbidity COP at the point of disinfection, and if so, whether the 5 NTU turbidity reporting limit is required. If considered appropriate, implement the new COP as soon as practicable.
- **Recommendation 2023-7-15(3):** Review the CCP table and explicitly incorporate the Chlorine Contact time (CT) as a critical limit to match the alarm in SCADA
- **Recommendation:** By 30 June 2024 discuss the suitability of a variable shut down limit for the Dungog WTP (and any other similar system) in the NSW Health Liaison Committee meeting, and implement any change recommended.

3.2 Recycled water

Hunter Water manages its recycled water schemes in a way that protects human health, the environment and complies with customer agreements as well as other relevant regulatory requirements. Our 2022-2027 Operating Licence requires us to maintain and implement a system for managing recycled water quality that is consistent with the *Australian Guidelines for Water Recycling 2006* (AGWR). A key component of complying with the AGWR is the implementation of a risk-based management framework, including Critical Control Points (CCPs).

The AGWR requires that we develop Recycled Water Quality Management Plans (RWQMPs) for all recycled water schemes. A RWQMP is a documented system for managing the production and supply of recycled water and consolidates all essential information about the operation and management of the recycled water system.

We have developed RWQMPs for all our recycled water schemes, addressing the 12 elements described in the AGWR. We undertake a rolling review process for our RWQMPs.

In this section of the report, we describe:

- Hunter Water's recycled water schemes
- Performance at CCPs during 2023-24
- Recycled water management continual improvement activities undertaken during 2023-24
- Proposed future recycled water quality management activities
- Significant changes to the Recycled Water Quality Management System (RWQMS) in 2023-24
- Any non-conformances with the RWQMS

3.2.1 Overview of recycled water schemes

During 2023-24, Hunter Water's recycled water schemes provided recycled water to customers from the Branxton, Cessnock, Clarence Town, Dora Creek, Dungog, Edgeworth, Karuah, Kurri Kurri, Morpeth, and Shortland Wastewater Treatment Works (WWTW) and dual reticulation recycled water from the Morpeth and Farley Recycled Water Treatment Plants (RWTP). **Table 12** provides the volume of recycled water provided from each source and

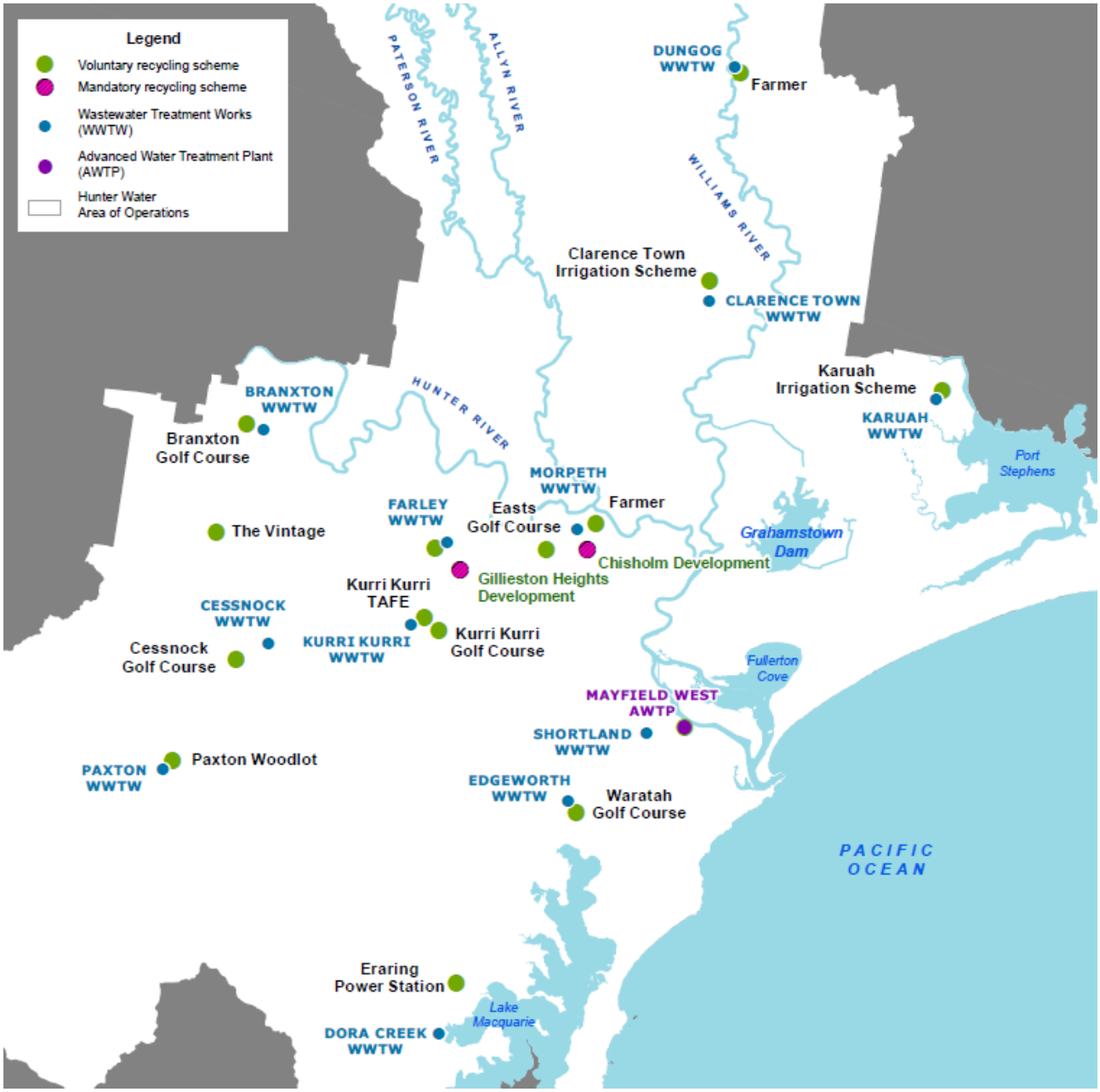
Figure 3 shows the location of the recycled water schemes.

Table 12 - Hunter Water's recycled water schemes

Recycled water source	Recycled water use	2023-24 reuse volumes (ML)
Branxton WWTW	Branxton Golf Course and The Vintage Golf Course	241.51
Cessnock WWTW	Cessnock Golf Course	0.00
Clarence Town WWTW	Clarence Town Irrigation Scheme	36.43
Dora Creek WWTW	Eraring Power Station	885.33
Dungog WWTW	Local farmer	171.10
Edgeworth WWTW	Waratah Golf Course	93.81
Farley RWTP	Gillieston Heights dual reticulation	65.05
Karuah WWTW	Karuah Irrigation Scheme	12.38
Kurri Kurri WWTW	Kurri Kurri Golf Course and Kurri Kurri TAFE	30.41
Shortland WWTW	Kooragang Water (Mayfield West AWTP)	3017.11
Morpeth WWTW	Easts Golf Course and local farmer	63.49
Morpeth RWTP	Chisholm dual reticulation	25.44
Total		**4642.05** [a]

a) Total excludes use by Hunter Water onsite at WWTW and indirect agricultural reuse.

Figure 3 - Hunter Water's recycled water schemes



3.2.2 Performance of critical control points

The following sections describe performance at CCPs. A brief explanation of each of the wastewater treatment terms referenced is included in the glossary.

Branxton wastewater treatment works

Branxton WWTW receives wastewater from Branxton East, Branxton, and Greta. Influent entering the system is primarily residential (domestic) with only a small volume of trade waste flows from retail outlets, hotels, and small automotive repair garages.

Branxton WWTW includes the following processes:

- Screening and grit removal
- Bioreactor
- Membrane filtration
- Chlorination

We supply recycled water from Branxton WWTW to Branxton Golf Course and The Vintage Golf Course. **Table 13** shows performance at CCPs within the Branxton WWTW.

Table 13 - Branxton WWTW: recycled water scheme CCPs performance 2023-24

Critical control point	Critical limit	Compliant
Membranes filtration	Turbidity of permeate at each individual membrane train must not exceed 0.5 NTU for > 120 seconds	✓
Chlorination system	Chlorine contact time must be at least 8.3 min.mg/L	✓
	pH upstream of chlorine contact tank must not exceed 9	✓

Cessnock wastewater treatment works

Cessnock WWTW receives wastewater from the Cessnock local government area. Influent entering the system is primarily residential (domestic). There are also a number of commercial trade waste customers discharging to the system.

Cessnock WWTW includes the following processes:

- Screening
- Clarification
- Trickling filters
- Maturation ponds
- Dissolved air floatation
- UV disinfection

We supply recycled water from the Cessnock WWTW to the Cessnock Golf Course. **Table 14** shows performance at CCPs within the Cessnock WWTW.

Table 14 - Cessnock WWTW: recycled water scheme CCPs performance 2023-24

Critical control point		Critical limit	Compliant
Lagoon ponding	Flow rate	<280 L/s for more than 60 minutes when supplying recycled water to the customer	✓
UV System	UV operation	UV unit must be on when supplying recycled water to the customer	✓
		Bypass valve must be closed when supplying recycled water to the customer	✓
	UV calculated dose	>32mJ/cm^2 with UV transmissivity at >40% at ADWF of 12ML/d when supplying recycled water to the customer	✓
	UV lamps	Minimum of 30 lamps operating when supplying recycled water to the customer	✓
	UV flow rate	<140L/s when pumping recycled water to the customer	✓

Clarence Town wastewater treatment works

Clarence Town WWTW receives wastewater from the township. Influent entering the system is primarily residential (domestic).

Clarence Town WWTW includes the following processes:

- Oxidation ponds
- Maturation ponds
- Effluent storage ponds.

We supply recycled water from the Clarence Town WWTW to an irrigation scheme. **Table 15** shows performance at CCPs within the Clarence Town WWTW.

Table 15 - Clarence Town WWTW: recycled water scheme CCPs performance 2023-24

Critical control point		Critical limit	Compliant
Lagoon ponding	Flow rate	<252 kL/d when irrigating at the reuse area	✓
	Valve position	V1102 must be closed	✓
		V1100 must be open when irrigating on the reuse area	✓

Dora Creek wastewater treatment works

Dora Creek WWTW receives wastewater from Bonnells Bay, Silverwater, Morisset Park, Yarrawonga Park, and Sunshine Brightwaters. Influent entering the system is primarily residential (domestic) with a number of trade waste customers also discharging to the treatment plant.

Dora Creek WWTW includes the following processes:

- Screening
- Grit removal
- Bioreactor
- Clarification
- Effluent storage dam

We supply recycled water from Dora Creek WWTW to the Eraring Power Station. **Table 16** shows performance at CCPs within the Dora Creek WWTW.

Table 16 - Dora Creek WWTW: recycled water scheme CCPs performance 2023-24

Critical control point	Critical limit	Compliant
Secondary treatment process	Flow rate < 367 L/s for more than 60 minutes	✓
Effluent balance dam ponding	Flow rate < 734 L/s for more than 60 minutes	✓

Dungog wastewater treatment works

Dungog WWTW receives primarily residential (domestic) influent into the system.

The Dungog WWTW includes the following processes:

- Screening
- Secondary treatment modified Ludzack-Ettinger
- Membrane bioreactor
- UV disinfection
- Irrigation pond storage

We supply recycled water from Dungog WWTW to a local farmer. **Table 17** shows performance at the CCP within the Dungog WWTW. We have developed a new CCP for the MBR process and in consultation with NSW Health; this CCP is awaiting finalisation.

Table 17 - Dungog WWTW: recycled water scheme CCP performance 2023-24

Critical control point	Critical limit	Compliant
Membrane filtration	Membrane permeate turbidly >0.5 NTU for >15 consecutive minutes	✓

Edgeworth wastewater treatment works

Edgeworth WWTW receives wastewater from the Charlestown, Cardiff and Speers Point wastewater catchment area. Influent entering the system consists primarily of residential (domestic) wastewater. There are also a number of commercial and industrial trade waste customers discharging to the system.

Edgeworth WWTW includes the following processes:

- Screening
- Bioreactor
- Clarification
- UV disinfection

We supply recycled water from the Edgeworth WWTW to the Waratah Golf Course. **Table 18** shows performance at CCPs within the Edgeworth WWTW.

Table 18 - Edgeworth WWTW: recycled water scheme CCPs performance 2023-24

Critical control point		Critical limit	Compliant
Secondary Treatment	Flow rate	<873L/s for more than 60 minutes when pumping to customer	✓
	Aeration monitoring	0 m^3/h in either tank for more than 8 hours while customer is taking recycled water	✓
UV System	UV operation	Must be on when reuse customer is being supplied recycled water	✓
	UV lamps	Minimum of 18 lamps per bank operating when supplying recycled water to the customer	✓
	UV calculated dose	Minimum dose 40 mJ/cm^2 with UV transmissivity of 40% when reuse customer is being supplied with recycled water	✓
	UV flow rate	<80L/s per unit for 60 minutes when pumping recycled water to the customer	✓
		<160L/s for both units for 60 minutes when pumping recycled water to the customer	✓

Farley recycled water treatment plant

Farley RWTP receives secondary treated effluent from the Farley WWTW.

Farley RWTP includes the following processes:

- Membrane filtration
- UV disinfection
- Chlorination

We use the treated recycled water from Farley RWTP to supply the dual reticulation scheme at Gillieston Heights. **Table 19** shows performance at CCPs within the Farley RWTP.

Table 19 - Farley RWTP: recycled water scheme CCPs performance 2023-24

Critical control point		Critical limit	Compliant
Membrane Filtration	Turbidity	Membrane permeate turbidity > 0.15 NTU for > 15 consecutive minutes.	✓
	Rate of decay in pressure differential	The membrane integrity test (MIT) result correlated with 4.0 log10 removal of 3 micron particles is > 3.9 kPa per 5 min at a test pressure of 130 kPa.	✓
UV System	Online UV intensity meter and UV Transmissivity (UVT) analyser	UV adenovirus RED < 65.3 mJ/cm2 for > 15 consecutive minutes.	✓
		UVT is < 40.1% for > 15 consecutive minutes.	✓
Chlorination	Free chlorine concentration (to meet the CT requirements)	Ct < 22 min•mg/L for > 15 consecutive minutes.	✓
	pH range	pH > 8.5 for > 15 consecutive minutes.	✓

Karuah wastewater treatment works

Karuah WWTW receives wastewater from the Karuah township. Influent entering the system is primarily residential (domestic).

Karuah WWTW includes the following processes:

- Screening
- Bioreactor
- UV disinfection
- Effluent storage dam

We supply recycled water from Karuah WWTW to an irrigation scheme. **Table 20** shows performance at CCPs within the Karuah WWTW.

Table 20 - Karuah WWTW: recycled water scheme CCPs performance 2023-24

Critical control point		Critical limit	Compliant
Biological treatment	Inlet flow meter	<48.3 L/s for more than 60 minutes when irrigation is occurring	✓
	Aeration control	No aerators available/running during six consecutive IDEA cycles	✓
UV System	UV operation	UV bank must be on when irrigation is occurring	✓
	UV calculated dose	>35mJ/cm2 with a transmissivity of greater than 55% at 44L/s when irrigation is occurring	✓
	UV flow rate	<44L/s when irrigation is occurring	✓

Kurri Kurri wastewater treatment works

Kurri Kurri WWTW receives wastewater from the Kurri Kurri catchment area. Influent entering the system is primarily residential (domestic).

Kurri Kurri WWTW includes the following processes:

- Screening
- Bioreactor
- Clarification
- Tertiary filtration (dual media)
- UV disinfection

We supply recycled water from the Kurri Kurri WWTW to the Kurri Kurri TAFE and Kurri Kurri golf course. **Table 21** shows performance at CCPs within the Kurri Kurri WWTW.

Table 21 - Kurri Kurri WWTW: recycled water scheme CCPs performance 2023-24

Critical control point		Critical limit	Compliant
Biological treatment	Inlet flow meter	<172 L/s for more than 60 minutes when the golf course is pumping recycled water	✓
	Aeration process	Air flow rate 0 m3/h for no more than 8hrs when pumping to the Golf course or effluent storage ponds	✓
Media filtration	Filter lift flow	<172 L/s for more than 60 minutes when pumping to the golf course or effluent storage ponds	✓
UV System	UV operation	Must not be off for more than 60 minutes when pumping to the golf course or Kurri TAFE storage pond	✓
	UV lamps	At least 18 lamps per bank must be on when pumping to the Golf course or Kurri TAFE storage ponds	✓
	UV calculated dose	>35mJ/cm2 for 60 minutes when pumping to the golf course or Kurri TAFE storage ponds	✓
	UV flow rate	<400L/s when pumping to the golf course or Kurri TAFE storage ponds	✓

Morpeth wastewater treatment works

Morpeth WWTW receives wastewater from Morpeth, Metford, Thornton, Tenambit, Ashtonfield, Beresfield, East Maitland and parts of Maitland. Influent entering the system is primarily residential (domestic).

Morpeth WWTW includes the following processes:

- Screening
- Bioreactor
- Clarification
- UV disinfection
- Maturation ponds

We supply recycled water from Morpeth WWTW to a local farmer and golf course. **Table 22** shows performance at CCPs within the Morpeth WWTW.

Table 22 - Morpeth WWTW: recycled water scheme CCPs performance 2023-24

Critical control point		Critical limit	Compliant
Secondary treatment processes	Biological treatment flow rate	< 500 L/s when valve to maturation pond is open	✓
UV System	UV operation	Must be on when valve to the maturation pond is open	✓
	Flow rate through UV	< 500 L/s when valve to maturation pond is opened	✓
	UV calculated dose	>32 mJ/cm^2 with UV transmissivity at 40%	✓
	UV operation	Must be at least 48 out of 60 lamps when maturation pond valve is open and reuse customer is pumping	✓
Lagoon ponding	Inlet flow rate	<500 L/s when maturation pond valve is opened	✓

Morpeth recycled water treatment plant

Morpeth RWTP receives secondary treated effluent from the Morpeth WWTW. We use the treated recycled water to supply the dual reticulation scheme at Chisholm.

Morpeth RWTP includes the following processes:

- Membrane filtration
- UV disinfection
- Chlorination

Table 23 shows performance at CCPs within the Morpeth RWTP.

Table 23 - Morpeth RWTP: recycled water scheme CCPs performance 2023-24

Critical control point		Critical limit	Compliant
Membrane Filtration	Turbidity	Membrane permeate turbidity > 0.15 NTU for > 15 consecutive minutes.	✓
	Rate of decay in pressure differential	The membrane integrity test (MIT) result correlated with 4.0 log10 removal of 3 micron particles is > 3.9 kPa per 5 min at a test pressure of 130 kPa.	✓
UV System	Online UV intensity meter and UV Transmissivity (UVT) analyser	UV adenovirus RED < 65.3 mJ/cm2 for > 15 consecutive minutes.	✓
		UVT is < 40.1% for > 15 consecutive minutes.	✓
Chlorination	Free chlorine concentration (to meet the Ct requirements)	Ct < 22 min•mg/L for > 15 consecutive minutes.	✓
	pH range	pH > 8.5 for > 15 consecutive minutes.	✓

Shortland wastewater treatment works

The Shortland WWTW receives wastewater from the communities of Sandgate, Shortland, Birmingham Gardens and Maryland as well as drawing in effluent from the Burwood catchment via a wastewater pumping station (WWPS) in Newcastle. Influent entering the system is partly residential (domestic) and partly non-residential (commercial).

Shortland WWTW includes the following processes:

- Screening
- Activated sludge secondary treatment via two intermittently decanted aerated lagoons (IDAL)
- Chlorination
- De-chlorination (prior to environmental discharge)

We supply effluent from Shortland WWTW to the Mayfield West Advanced Water Treatment Plant owned by coNEXA. The Shortland WWTW does not have CCP requirements as the additional recycled water treatment is undertaken at the advanced water treatment plant.

3.2.3 Recycled water quality management activities and programs 2023-24

Table 24 describes improvements to recycled water quality management undertaken during 2023-24. Recycled water objectives are aligned to the actions of the AGWR Framework and the strategic objective to maintain the safety of recycled water.

Table 24 - Recycled water activities and programs 2023-24

AGWR Framework sub-element		Recycled water objective	Activity / Program	Results / Outcomes
2.4	Hazard identification and risk assessment	Undertake a risk assessment.	Identify and document hazards and hazardous events, estimate the level of risk and determine preventive measures.	An updated risk assessment was undertaken on the Kurri Kurri and Dora Creek WWTW recycled water schemes.
9.1	Validation of Processes	Validate processes to ensure they control hazards effectively.	Document the validation of recycled water schemes.	A review of the Hunter Water Recycled Water Validation Report was undertaken and updated to reflect current practice. Validation programs commenced at Edgeworth and Cessnock WWTW's.
10.1	Recycled water quality management plans	Documentation of all aspects of recycled water quality management.	Update the Kurri Kurri WWTW RWQMP.	The Kurri Kurri WWTW RWQMP has been updated to address internal and external review comments.
10.1	Recycled water quality management plans	Documentation of all aspects of recycled water quality management.	Update the Dora Creek WWTW RWQMP.	The Dora Creek WWTW RWQMP has been updated to address internal and external review comments.
10.1	Management of documentation and records	Documentation of all aspects of recycled water quality management.	Update recycled water internal intranet page to allow for easy access to information.	A new internal recycled water intranet page has been created to reflect current information.
11.2	Audit of Recycled water quality management	Establish process for external audits.	Audit of recycled water schemes.	Audits were undertaken on the Kurri Kurri and Dora Creek WWTW's recycled water schemes.
12.2	Recycled water quality improvement plans	Ensure the plan is communicated and implemented and that the improvements are monitored for effectiveness.	Complete the recycled water quality improvement plan actions.	The improvement plan is routinely communicated to NSW Health and other stakeholders with actions progressed as required.

3.2.4 Proposed recycled water quality management activities and programs

Table 25 outlines proposed measures to improve recycled water quality management in the future. Recycled water objectives are aligned to the actions of the AGWR Framework and the strategic objective to maintain the safety of recycled water.

Table 25 - Proposed recycled water activities and programs 2024-25

AGWR Framework sub-element		Recycled water objective	Activity / program	Scope / expected outcomes / timetable
2.4	Hazard identification and risk assessment	Undertake a risk assessment.	Identify and document hazards and hazardous events, estimate the level of risk and determine preventive measures.	Review and update risk assessments. Timetable – ongoing
6.2	Incident and emergency response protocols	Document procedures.	Review current incident management procedures.	Update current Recycled Water Incident procedures. Timetable – 2024-25
9.1	Validation of Processes	Validate processes to ensure they control hazards effectively.	Document the validation of recycled water schemes.	Continue to review recycled water validation for existing schemes to reflect current practice. Timetable – 2024-25
10.1	Recycled water quality management plans	Documentation of all aspects of recycled water quality management.	Update management plans following risk assessments.	Bring together all aspects of recycled water management. Timetable – 2024-25
10.1	Recycled water quality management plans	Documentation of all aspects of recycled water quality management.	Document the changes associated with the additional recycled water scheme from the Edgeworth WWTW.	Bring together all aspects of recycled water management and updated documentation. Timetable – 2024-25
12.2	Recycled water quality improvement plans	Ensure the plan is communicated and implemented and that the improvements are monitored for effectiveness.	Complete recycled water quality improvement plan actions.	Successful completion of improvement actions. Timetable – 2024-25

3.2.5 Continual improvement in 2023-24

Recycled water quality improvement initiatives are documented and prioritised within the Recycled Water Quality Improvement Plan (RWQIP) and reported as a standing agenda item through monthly recycled water quality operational meetings involving key internal stakeholders. Example improvements over this period include:

- Review and update of recycled water quality management plans
- Review and update risk assessments
- Review recycled water customer agreements and communication

The monthly operational recycled water quality meetings consider factors such as:

- Quality and supply issues
- Audit outcomes
- Training
- Monitoring and reporting

Outcomes and actions from the recycled water quality meetings are communicated to and reviewed by senior management as required.

We develop action plans to address recommendations and outcomes, including the allocation of additional resources as required. The Executive Manager Customer Delivery attends quarterly liaison meetings with NSW Health to review the effectiveness of the RWQMS and discuss operational issues. The EMT reviews and endorses the recycled water quality policy, with final approval provided by the Managing Director

We ensure resources are dedicated to the development, review, and implementation of the RWQMS through our recycled water quality meetings and a dedicated Recycled Water Quality Assurance Lead. All Hunter Water management, employees and contractors involved in the supply of recycled water are responsible for understanding, implementing, maintaining and continuously improving the RWQMS.

3.2.6 Significant changes to the recycled water quality management system

There was one proposed potential significant change to the Recycled Water Quality Management System in 2023-24:

- As a result of a process upgrade at Cessnock WWTW, new Critical Controls Points (CCPs) have been proposed.

This potentially significant change was communicated to both IPART and NSW Health, in line with our IPART Operating Licence Reporting Manual obligations.

3.2.7 Non-conformances with the Recycled Water Quality Management System

There were no major non-conformances with the Recycled Water Quality Management System during 2023-24.

The following Operating Licence audit recommendations were identified and have been subsequently addressed and/or planned for resolution:

- **Recommendation - 2023-1-16(3):** By 30 June 2024, engage with the (Dungog) farmer to ensure that the end user requirements identified in the signed contract are implemented.
- **Recommendation - 2023-2-16(3):** By 30 June 2024, ensure specific end user requirements are included in audit templates so that the relevant requirement is clearly identified prior to going on site, and the end user compliance can be appropriately assessed.

- **Recommendation - 2023-9-16(3):** By 30 June 2024, implement a procedure so that water quality samples that are nominated to be collected and analysed at a frequency of less than daily, but were missed are made up on the next work day.
- **Recommendation - 2023-10-16(3):** By 30 June 2024, align Figure 7-1 and Table 7-1 in Man-3077 HW Morpeth RWTP – Chisholm Scheme RWMP, and ensure SCADA matches these limits.

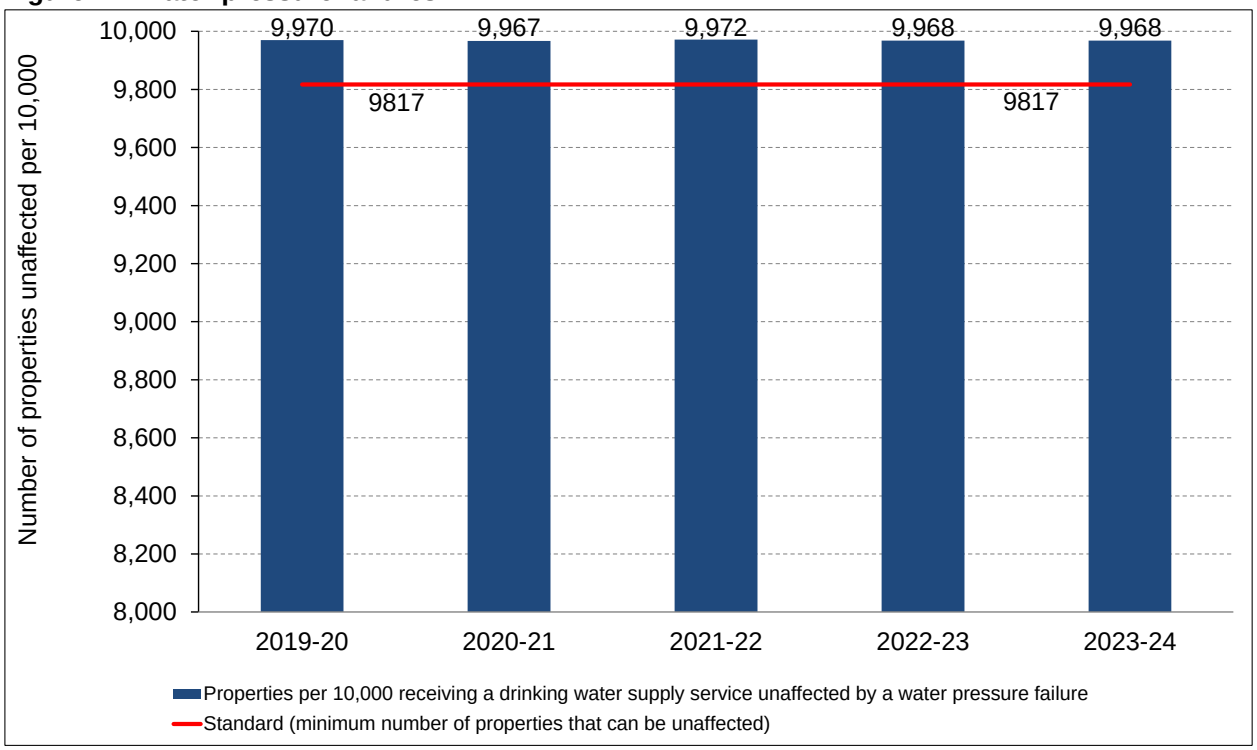
4 PERFORMANCE STANDARDS FOR SERVICE INTERRUPTIONS

The Operating Licence sets the service levels that customers can expect from Hunter Water in three core areas: water pressure, water continuity, and wastewater overflows. We describe performance against licence limits below. We present five-year results for these metrics in **Figure 4** through **Figure 7**.

4.1.1 Water pressure standard

Hunter Water must ensure that, in each financial year, at least 9,817 Properties per 10,000 Properties (in respect of which Hunter Water provides a Drinking Water supply Service) receive a Drinking Water supply Service that is not affected by a Water Pressure Failure, (the Water Pressure Standard).[8]

Figure 4 – Water pressure failures



Note: In order to present data in a visually meaningful way, the y-axis begins at '8,000' rather than '0'.

We met the performance requirement of this standard for 2023-24, with 9,968 properties per 10,000 unaffected by a water pressure failure. This equates to 936 properties in total experiencing low pressure.

The number of properties affected in 2023-24 was higher than last year. This was driven by warmer weather in December 2023 which resulted in higher customer demand and hence higher consumption which can result in lower pressure across our network.

Water pressure failures occur for a range of reasons including:

[8] NSW Government, 2022, Hunter Water Corporation Operating Licence 2022-2027, Clause 18 (1)

- Customer water usage during periods of high-water demand, which can be seasonal (i.e. higher demands in summer compared to winter), diurnal (peak demand periods in morning and evening) and weather-related (e.g. during periods of extreme hot and dry weather).
- Location of customer properties, including properties that are located close to water network reservoirs and therefore do not have sufficient elevation difference between the property and the reservoir.
- Water network design and configuration, such as older parts of the network that were not designed to current standards or areas where water demand has increased over time with increased development ahead of system upgrades.

4.1.2 Water continuity standard

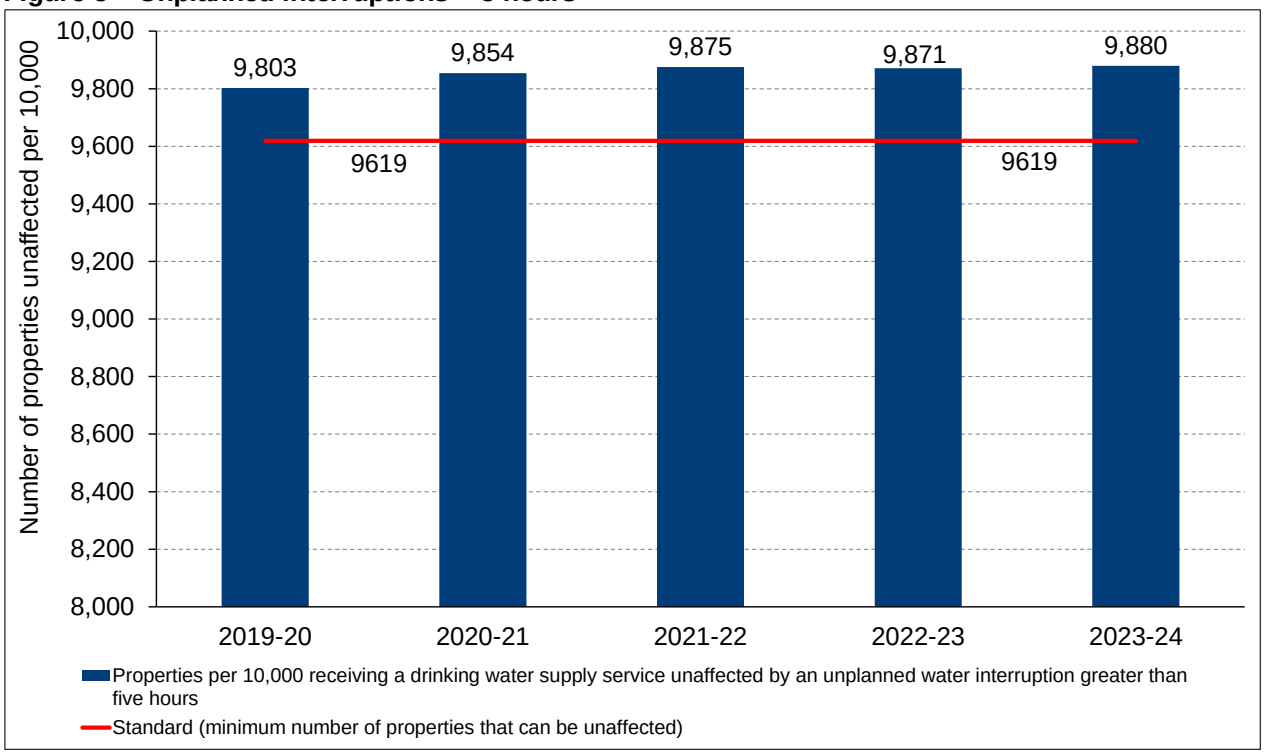
Hunter Water must ensure that, in each financial year, at least 9,619 per 10,000 Properties (in respect of which Hunter Water provides a Drinking Water supply Service) receive a Drinking Water supply Service unaffected by an Unplanned Water Interruption (the Water Continuity Standard).[9]

A Property is taken to have experienced an unplanned water interruption where, in relation to a Property:

(a) the supply of Drinking Water at the first cold water tap of the Property is interrupted without the Customer or Consumer having received prior notice of that interruption from Hunter Water; and

(b) it takes more than 5 continuous hours for normal supply of Drinking Water to be restored to the Property.[10]

Figure 5 – Unplanned interruptions > 5 hours



Note: In order to present data in a visually meaningful way, the y-axis begins at '8,000' rather than '0'.

[9] NSW Government, 2022, Hunter Water Corporation Operating Licence 2022-2027, Clause 17 (1)

[10] NSW Government, 2022, Hunter Water Corporation Operating Licence 2022-2027, Clause 17 (2)

We met the performance requirement of the water continuity standard for 2023-24, with 9,880 properties per 10,000 unaffected by an unplanned water interruption exceeding five hours. This equates to 3,519 properties in total experiencing an unplanned water interruption exceeding five hours. A slight increase from our performance in 2022-23, however, this is still low compared to historic performance.

Performance can be variable from year to year, with the metric being primarily influenced by large water main breaks that are difficult to access or complex to shut down. Continued performance in achieving lower interruptions under this metric is in part attributed to Hunter Water maintaining availability of first responders and on-call crews to respond to breaks and minimise the duration of interruptions.

Water main breaks can occur because of asset condition and performance as well as weather conditions. The change in weather conditions with a cooler and drier last half of the financial year resulted in a less stable soil moisture content, which contributes to a reduced frequency of breaks. The number of properties impacted by an unplanned water interruption is also influenced by network configuration. The duration of the unplanned water interruption is affected by the location and complexity of the required repair, resource availability, job prioritisation, and the condition of and access to valves.

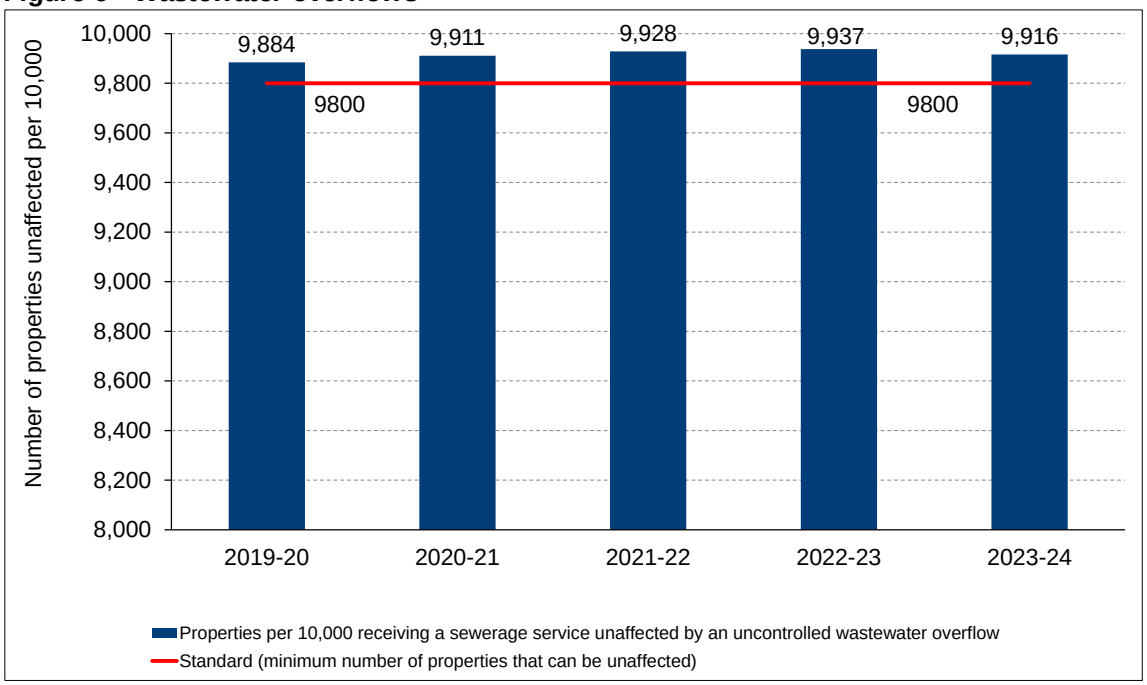
4.1.3 Wastewater overflow standard

Hunter Water must ensure that, in each financial year, at least:

a) *9,800 Properties per 10,000 Properties (in respect of which Hunter Water provides a sewerage service but excluding Public Properties) receive a sewerage service unaffected by an Uncontrolled Wastewater Overflow; and*

b) *9,998 Properties per 10,000 Properties (in respect of which Hunter Water provides a sewerage service but excluding Public Properties) receive a sewerage service affected by fewer than 3 Uncontrolled Wastewater Overflows, (the Dry Weather Wastewater Overflow Standard).*[11]

Figure 6 - Wastewater overflows



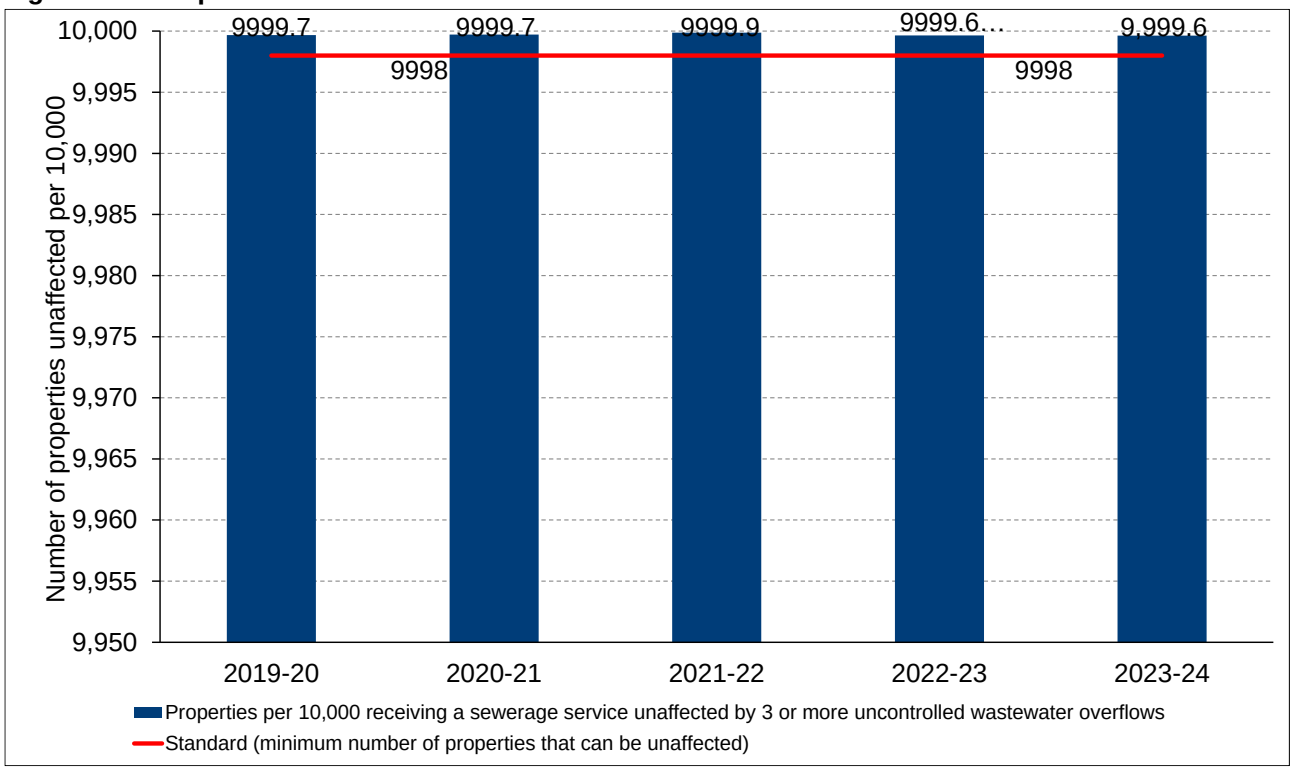
Note: In order to present data in a visually meaningful way, the y-axis begins at '8,000' rather than '0'.

[11] NSW Government, 2022, Hunter Water Corporation Operating Licence 2022-2027, Clause 19 (1)

We met the performance requirement of this standard for 2023-24, with 9,916 properties per 10,000 unaffected by an uncontrolled wastewater overflow in dry weather. This equates to 2,323 properties in total experiencing an uncontrolled wastewater overflow in dry weather.

Dry weather overflows affecting private properties increased since 2022-23 (which was the lowest in 7 years). The number of incidents remains significantly lower than the long-term average. This result is influenced by weather and preventative maintenance jetting, which has been successful in reducing overflows by approximately 40% over the last 2 years.

Figure 7 - Multiple wastewater overflows



Note: In order to present data in a visually meaningful way, the y-axis begins at '9,950' rather than '0'. The amount of properties unaffected is expressed in one decimal place numbering to avoid inaccurate rounding.

This indicator measures repeat impact to private properties.

We met the performance requirement of this standard for 2023-24, with 9,999 properties per 10,000 unaffected by three or more uncontrolled wastewater overflows in dry weather. This equates to 10 properties in total experiencing three or more uncontrolled wastewater overflows in dry weather.

Multiple overflows affecting private properties were the lowest in seven years. The number of incidents remains significantly lower than the standard.

Factors influencing repeat overflows include preventative jetting programs, the quality of jetting work, and processes to identify pipes for rehabilitation or repair. An increased preventative jetting program and community education on the wastewater system has contributed to this good result.

5 CUSTOMER AND STAKEHOLDER RELATIONS

In this chapter, we identify underlying complaint drivers and describe the actions taken to resolve root causes for complaints.

5.1 Understanding our customers, their needs and experiences

As part of our Customer Experience Strategy, we recognise the complaint journey is a critical aspect of our overall experience network. We regularly survey customers to understand their complaint experience and learn where we can do better. Across the last 12 months we have surveyed 100 customers to seek their feedback on their complaint experience and we know that customers value most highly ease of getting information, fixing their issue and speed of resolution as the most influential drivers for complaint satisfaction. These service attributes remain our focus with process improvements and training for our people and strongly align to our customer promises in our strategy.

We continue to see customer expectations changing at a rapid speed and the importance of our customer promises when we create, deliver, and improve experiences. Recently, we have experienced a downward shift in our customer experience score that has historically been quite favourable. This decline has also been seen in complaint satisfaction scores, with an observed increasing complexity in our customer interactions and nature of the complaints. Across the water industry, similar challenges are being observed, which may be somewhat attributable to the current macro-economic environment and cost-of-living pressures.

In response to these challenges, we have undertaken a review of our complaint and enquiry processes to identify gaps and opportunities to improve our ability to be faster and more effective across our complaint handling and management process. A series of improvement actions will be implemented in 2024-25, leading to improved resolution and customer satisfaction. New feedback opportunities will be introduced to broaden our understanding of experience and satisfaction across a broader range of channels, services and customers, especially across our digital platforms.

5.2 Complaint types and volumes across the last 12 months

In 2023-24, the total water and sewerage complaints increased by 31.85% compared to 2022-23. Our analysis of the cause of this increase led us to three main drivers which are being addressed with various strategies suited to each cause. The drivers and requisite actions are detailed below.

Billing complaints have increased from last year but remain lower than historical averages. Challenging labour market conditions have continued throughout 2023-24 with meter reading staff turnover remaining high, resulting in an increase in meter read errors. Specialised training for the onboarding of new staff and ongoing refresher training for existing staff continues to be our focus to improve meter reading accuracy.

Cost of living pressures for our customers continue to drive increases in billing consumption complaints linked to affordability in our community. We continue to offer support through our vulnerable customer program to better support those customers experiencing vulnerable circumstances via personalised support options including increased payment assistance.

Water Quality complaints related to taste and odour have increased this year by 39.74%. A primary driver for this increase relates to the naturally occurring MIB and Geosmin compounds detected at Grahamstown Water Treatment Plant that was present in the potable water supply between March and June of 2024. These compounds were found to be at acceptable levels in accordance with the ADWG (Australian Drinking Water Guidelines) and posed no risk to public health. This complaint increase was anticipated following an alert provided by NSW Health confirming these compounds being detected in the water supply more broadly across NSW.

Sewer service complaints also increased by 17.3% in 2023-24. Whilst there was not an increase in the number of blockages and overflows occurring within the wastewater network throughout the year, a higher number of odour complaints were received. These complaints relate to dry weather blockages and overflows occurring during the warmer months of the year. An increase in storm and wet weather events across our region this year also resulted in a higher number of our customers being impacted by wastewater overflows occurring during wet weather with infiltration and ingress of stormwater into the wastewater system.

6 PROVISION OF INFORMATION AND SERVICES

This chapter outlines performance in providing information and services to licensees under the Water Industry Competition (WIC) Act and potential competitors.

Number of agreements for the provision of Services established with WIC Act licensees and Potential Competitors

No new agreements were established during the 2023-24 financial year. Hunter Water has three existing agreements in place to provide services to WIC Act licensees:

- Altogether Pty Ltd – Huntlee
- Altogether Pty Ltd – Cooranbong
- Kooragang Water Pty Ltd – Kooragang Industrial Water Scheme (KIWS)

The number of negotiations for the provision of Services commenced with WIC Act licensees and Potential Competitors that did not eventuate in an agreement

During the 2023-24 financial year, Hunter Water commenced negotiations with the following WIC Act licensees and Potential Competitor without these eventuating into an agreement:

- Altogether Pty Ltd Coorabong trade waste agreement renewal, negotiations occurring between July 2023 and July 2024.
- Altogether Pty Ltd Huntlee trade waste discharge request for Hunter Water to determine if it could accept surplus recycled water to the Hunter Water network, negotiations occurring between July 2023 and February 2024.
- Kooragang Water Pty Ltd (coNEXA Pty Ltd) sewer mining application for new Services from Hunter Water's Edgeworth Wastewater Treatment Plant in support of Hydrogen Headstart applications in the region, negotiations occurring between October 2023 and June 2024.
- Hunter Water's request for site tours and education room use at Kooragang Water Pty Ltd (coNEXA Pty Ltd), negotiations occurring between November 2023 and March 2024.
- Kooragang Water Pty Ltd (coNEXA Pty Ltd) request to access surplus effluent under its existing Supply Agreement, negotiations occurring between March 2024 and June 2024.

A timeline of each negotiation Hunter Water undertook with WIC Act licensees and Potential Competitors (both successful and those that did not eventuate in an agreement) and reasons for any significant delays to those negotiations

Hunter Water held the following negotiations with existing WIC Act licensees and Potential Competitors:

Negotiation activity / milestone	Timing
Altogether Pty Ltd trade waste agreement renewal for Cooranbong	
Discussion between the parties for renewal of recycled water discharge from Altogether Pty Ltd Cooranbong development to Hunter Water's wastewater network	July 2023
Hunter Water requests information on volume and quality	July 2023
Hunter Water requests meter telemetry installation for trade waste agreement	October 2023
Draft trade waste agreement issued by Hunter Water to Altogether	July 2024
Altogether Pty Ltd Huntlee trade waste discharge negotiations	

Hunter Water received a preliminary servicing application to discharge high-quality recycled water from Altogether Pty Ltd. Huntlee development to Hunter Water's wastewater network	July 2023
Hunter Water has investigated the Altogether Pty Ltd request for high quality discharge into our network in consultation with the EPA and NSW Health and have provided next steps to advance this work to Altogether Pty Ltd. Hunter Water awaits response from Altogether Pty Ltd to continue this negotiation	February 2024
Kooragang Water Pty Ltd (coNEXA Pty Ltd) sewer mining application	
Formal response to coNEXA's sewer mining application	July 2023
Requirements determination, scope and commercial treatment of Hunter Water's treated effluent supply	September 2023
coNEXA issued Hunter Water with a Request for Information for treated effluent supply for quality and flow information	October 2023
Hunter Water issued our response to the coNEXA RFI	October 2023
coNEXA requested capital and operational expenditure values for treated effluent supply requirement	November 2023
Hunter Water issue of CAPEX guide for large scale treated effluent supply	February 2024
Hunter Water issue of OPEX guide for large scale treated effluent supply	March 2024
Hunter Water issue of updated pricing guides for large scale treated effluent supply	May 2024
Kooragang Water Pty Ltd (coNEXA Pty Ltd) request to access surplus effluent	
coNEXA requested Hunter Water confirm availability of additional effluent from Shortland to augment existing agreement supply requirements	March 2024
Information on effluent availability provided by Hunter Water to coNEXA	April 2024
coNEXA request for pricing associated with additional Shortland effluent	May 2024
Meeting between the parties to confirm requirements and assumptions	June 2024
Guidance on options and estimates provided by Hunter Water to coNEXA for additional Shortland effluent	June 2024
Request for site tours and education room use at Kooragang Water Pty Ltd	
Hunter Water discussed the shared use of Kooragang Water Pty Ltd's educational room for school and community engagement on purified recycled water, as well as site tours supported by the treatment plant operator, Suez	November 2023
coNEXA requested scope specifics, tour group details and proposed dates	November 2023
Hunter Water provided a scope of work and proposed lease terms to coNEXA	February 2024
coNEXA advised facility upgrades would prevent near-term access to site for site tours and educational facility use	March 2024

The type of information WIC Act licensees and Potential Competitors requested in addition to information that is publicly available, and the time taken for Hunter Water to respond to requests for provision of information or Services.

Hunter Water provided additional treated effluent quality and flow data for our Edgeworth Wastewater Treatment Works plant to coNEXA as well as for additional supply under the Kooragang Water Pty Ltd Supply Agreement operating from Hunter Water's Shortland Wastewater Treatment Works as follows:

Kooragang Water Pty Ltd (coNEXA Pty Ltd) sewer mining application	
coNEXA issued Hunter Water with a Request for Information for treated effluent supply for quality and flow information	October 2023
Hunter Water issued our response to the coNEXA RFI	November 2023
Kooragang Water Pty Ltd (coNEXA Pty Ltd) request to access surplus effluent	
coNEXA requested Hunter Water confirm availability of additional effluent from Shortland to augment existing agreement supply requirements	March 2024
Information on effluent availability and time step data provided by Hunter Water to coNEXA	March 2024

7 APPENDICES

7.1 IPART Performance Indicators

Indicator Number	Indicator	2023-24 Value
A1	Number of Properties that experience an Unplanned Water Interruption that lasts for more than five continuous hours	3,519
A2	Number of Properties that experience three or more Unplanned Water Interruptions that each last for more than one hour	885
A10	Number of Properties that experience a Water Pressure Failure	936
A11	Number of Properties that experience an Uncontrolled Wastewater Overflow in dry weather	2,323
A12	Number of Properties that experience three or more Uncontrolled Wastewater Overflows in dry weather	10

7.2 Licence Data

Data Number	Definition	2023-24 Value
L8	The number of connected residential properties receiving Recycled Water services from the utility during the reporting year (properties 000s).	1.123
L9	The number of connected non-residential properties receiving Recycled Water services from the utility during the reporting year (properties 000s).	0.010

7.3 Acronyms

Process	Description
ADWG	Australian Drinking Water Guidelines
AGWR	Australian Guidelines for Water Recycling
AWTP	Advanced Water Treatment Plant
CCP	Critical control point
CT	Contact time
CTGM	Chichester Trunk Gravity Main
DOS	Disinfection Optimisation Strategy
DWQIP	Drinking Water Quality Improvement Plan
DWQMS	Drinking Water Quality Management System
EMT	Executive Management Team
HU	Hazen unit
IPART	Independent Pricing and Regulatory Tribunal
ISO	International Organization for Standardization
KIWS	Kooragang Industrial Water Scheme
ML/day	Megalitres per day – one megalitre is a measure of volume equal to one million litres
MPN	Most probable number
NTU	Nephelometric Turbidity Units
PFAS	Per- and poly-fluoroalkyl substances
RWQIP / RWQMP	Recycled Water Quality Improvement Plan / Recycled Water Quality Management Plan
RWQMS	Recycled Water Quality Management System
RWTP	Recycled Water Treatment Plant
SCADA	Supervisory control and data acquisition
WICA	Water Industry Competition Act
WTP	Water Treatment Plant
WWPS	Wastewater Pumping Station
WWTW / WWTP	Wastewater Treatment Works / Wastewater Treatment Plant

7.4 Water treatment terminology

Process	Description
Aeration	Aeration is typically used as a first step in the treatment of groundwater. The main function is to remove carbon dioxide and hydrogen sulphide from water, and to add oxygen, which assists in iron removal. Water extracted from Anna Bay Sandbeds and treated at Anna Bay and Nelson Bay Water Treatment Plants is naturally very low in iron and hydrogen sulphide. Aeration at these plants is essentially to remove carbon dioxide and add oxygen.
Coagulation / Flocculation	During coagulation, liquid aluminium sulphate (alum) and/or polymer is added to untreated water (raw water). When mixed with water, this causes tiny particles that are naturally present in source water, when extracted, to stick together or coagulate. The heavier/larger coagulated material ('floc') is easier to remove by settling or filtration.
Disinfection	Water is disinfected before it enters the distribution system to ensure that any disease-causing bacteria, viruses, and parasites are destroyed. Chlorine is used because it is a very effective disinfectant, and residual concentrations can be maintained to guard against possible biological contamination in the water distribution system. CT values are used to calculate disinfectant dosage for the chlorination of drinking water. The CT value is the product of the concentration of chlorine and the contact time with the water being disinfected. It is expressed in units of min.mg/L.
Filtration	Water flows through a filter designed to remove particles in the water. The filters are made of layers of sand and gravel, and in some cases, crushed anthracite. Filtration collects the suspended impurities in water and enhances the effectiveness of disinfection. The filters are routinely cleaned by backwashing. Microfiltration is a filtration process which removes particles from water by passage through a microporous membrane.
Fluoridation	Water fluoridation is the treatment of community water supplies for the purpose of adjusting the concentration of the free fluoride ion to the optimum level sufficient to reduce dental decay. Hunter Water is required to fluoridate in accordance with the NSW *Fluoridation of Public Water Supplies Act 1957*.
Membrane microfiltration	Membrane microfiltration is a type of physical filtration process where water is passed through a special pore-sized membrane to separate microorganisms and suspended particles from the raw water.
Powdered activated carbon (PAC) dosing (event based)	Powdered Activated Carbon (PAC) dosing is used to remove organic compounds from the water supply such as Geosmin and Methyl-Isoborneol (MIB) that periodically occur in surface waters. Geosmin and Methyl-Isoborneol (MIB) are naturally occurring compounds that have a musty, earthy taste and odour.
pH Correction	Lime is added to the filtered water to adjust the pH and stabilise the naturally soft water to minimise corrosion in the distribution system, and within customers' plumbing.
Sedimentation	As the water and the floc particles progress through the treatment process, they move into sedimentation basins where the water moves slowly, causing the heavy floc particles to settle to the bottom. Floc which collects on the bottom of the basin is called sludge and is piped to drying lagoons.
Two-stage filtration (Lemon Tree Passage Water Treatment Plant)	Flocculation occurs within roughing filters (also referred to as adsorption clarifiers) before separation is achieved. In the roughing filter the coagulated water is fed upwards through a bed of granular plastic media where the flocs are trapped within the filter media and the filter overflow exits for further treatment.

Process	Description
	Final polishing of water from the roughing filters occurs within the dual media (ie coal/sand) rapid gravity filters.

7.5 Wastewater treatment terminology

Process	Description
Bioreactor	A bioreactor is a device that supports an aerobic or anaerobic biological environment.
Chloramine dosing	The application of chlorine and ammonia to water to form chloramines for the purpose of disinfection.
Chlorination	The application of chlorine to wastewater, generally for the purpose of disinfection, but frequently for accomplishing other biological or chemical results - aiding coagulation or controlling odours or sludge bulking in wastewater.
Clarification	Any process or combination of processes the main purpose of which is to reduce the concentration of suspended matter in a liquid.
Dissolved air floatation	Dissolved air flotation is a water treatment process where wastewater is clarified by the removal of suspended matter such as oil or solids. Air is dissolved under pressure in wastewater and then released at atmospheric pressure in a tank. The released air forms tiny bubbles which stick to the suspended matter causing it to float to the surface, where it is removed by a skimming device.
Grit removal	Grit removal is accomplished by providing an enlarged channel or chamber that causes the flow velocity to be reduced and allows the heavier grit to settle to the bottom of the channel where it can be removed.
Maturation pond	A shallow pond that ensures sunlight penetrates the full depth for photosynthesis to occur. Oxygen is provided by algae during photosynthesis and wind-aided surface aeration. These ponds are often mixed by recirculation to maintain dissolved oxygen throughout their entire depth.
Membrane filtration	Membranes are thin and porous sheets of material able to separate contaminants from water when a driving force is applied. They are used to remove bacteria and other microorganisms, particulate material, micropollutants, and natural organic material.
Microfiltration	A pressure-driven membrane filtration process that separates particles down to approximately 0.1 µm diameter from influent water using a sieving process.
Oxidation ponds	A man-made body of water in which waste is consumed by bacteria.
Reverse osmosis	The Reversed Osmosis (RO) process uses a semi-permeable membrane to separate and remove dissolved solids, organics, pyrogens, submicron colloidal matter, viruses, and bacteria from water. The process is called 'reverse' osmosis since it requires pressure to force pure water across a membrane, leaving the impurities behind.
Screening	Screening removes gross pollutants from the wastewater stream to protect downstream operations and equipment from damage. The screen has openings that are generally uniform in size. It retains or removes objects larger than the openings. A screen may consist of bars, rods, wires, gratings, wire mesh, or perforated plates.
Secondary treatment	Typically, a biological treatment process that is designed to remove approximately 85% of the biological oxygen demand and influent suspended solids. Some nutrients may incidentally be removed, and ammonia may be converted to nitrate.
Sedimentation	The process of settling and depositing of suspended matter carried by water or wastewater. Sedimentation usually occurs by gravity when the velocity of the liquid is reduced below the point at which it can transport the suspended material.

Process	Description
Sludge digesters	Tank in which complex organic substances like sewage sludges are biologically dredged. During these reactions, energy is released and much of the sewage is converted to methane, carbon dioxide, and water. These changes take place as microorganisms feed on sludge in anaerobic or aerobic digesters.
Tertiary filtration (dual media)	Filtration is used to separate nonsettleable solids from water and wastewater by passing it through a porous medium. Dual media filters use two media, commonly crushed anthracite coal and sand. Tertiary treatment is the final cleaning process that improves wastewater quality before it is reused, recycled or discharged to the environment.
Total Nitrogen	Excessive amounts of Total Nitrogen may lead to low levels of dissolved oxygen, therefore load limits are set to protect downstream water quality from algal blooms.
Trickling filters	Trickling filters are processes that use a static medium such as rocks for growing a film or biomass and then trickling the wastewater over this medium.
UV disinfection	Ultraviolet irradiation achieves disinfection by inducing photobiochemical changes within microorganisms. When ultraviolet radiation is absorbed by the cells of microorganisms, it damages the genetic material in such a way that the organisms are no longer able to grow or reproduce, thus ultimately killing them.

7.6 Key physical, chemical and microbiological drinking water quality parameters

Water Quality Parameter	Description
Aluminium	Aluminium occurs naturally in untreated water in the form of silts and clays. Aluminium sulphate (alum) is also used as a flocculent to remove unwanted colour and turbidity from water supplies. Research has shown that aluminium in drinking water does not make up a substantial proportion of aluminium ingested, and that aluminium in drinking water is no more bio-available than any other source.
Chlorine	Chlorine is used as a disinfectant in water treatment. It controls potentially harmful micro-organisms to ensure the safety of drinking water.
Colour	Colour is measured in Hazen Units (HU). Colour can originate from organic matter in the soil through, or over, which the water has passed.
Copper	Copper is naturally present in both treated water and throughout the distribution system. However, soft water in contact with copper plumbing systems can on occasion give higher concentrations of copper at the customer tap. The incidence of high copper concentrations within Hunter Water's area of operation is very low, and customer complaints are infrequent.
E. coli	*Escherichia coli* is an indicator bacteria, that is, bacteria which are not normally harmful in themselves, but may indicate the presence of other pathogenic (disease-causing) micro-organisms. *E. coli* is a type of thermo-tolerant coliform bacteria, and is nearly always present in the faeces of humans and other warm-blooded animals. *E. coli* is generally regarded as the most specific indicator of faecal contamination, and therefore an important indicator for public health.
Fluoride	In accordance with the *Fluoridation of Public Water Supplies Act 1957*, fluoride is added to the water to help prevent tooth decay and generally improve dental health.
Iron and Manganese	Iron and manganese may occur naturally at low levels in the water and may be responsible for taste and staining problems with the water.
Lead	Lead levels in Hunter Water's distribution system are typically less than the 0.001 mg/L limit of detection and well below the health guideline of 0.01 mg/L. Lead levels in customer plumbing can occasionally be elevated where water has lengthy residence time in contact with brass plumbing fittings. These contain small quantities of lead, and leaching into the water can occasionally occur. However this is very unlikely to cause continually elevated lead levels. Note that within the area serviced by Hunter Water, there is little or no lead pipework left in the plumbing systems.
pH	pH is a measure of the hydrogen ion concentration of water. A pH of 7 is neutral, greater than 7 is alkaline, and less than 7 is acidic. pH is important because it can affect the disinfection process.
Trihalomethanes	THMs are formed during the disinfection process by reaction between chlorine and mainly naturally-occurring organic substances. Treatment processes are controlled to minimise their production.
Turbidity	Turbidity refers to the cloudiness or dirtiness of water, and is measured by a light scattering technique. Turbidity is measured in Nephelometric Turbidity Units (NTU).
Zinc	As with other heavy metals, treated and reticulated water supplied by Hunter Water contains only very low levels of naturally occurring zinc. Some elevated levels in customer plumbing can be caused by old galvanised pipes and some leaching ("dezincification") from older style brass fittings. Newer plumbing systems do not use galvanised steel, and brass fittings are normally "dezincification resistant", so levels of zinc at the tap are rarely elevated.

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