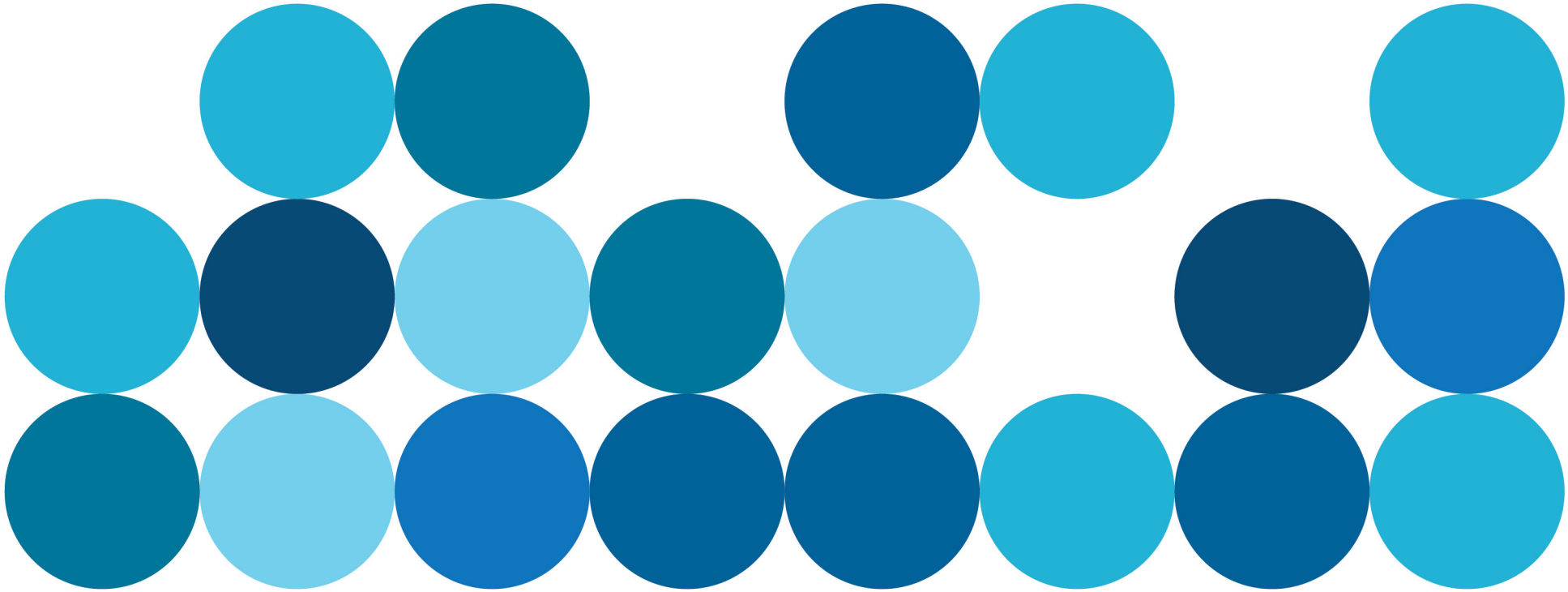
Wastewater Quality

Annual Report 2020 – 21



WATER CORPORATION

Contents

ISSN 2653-2034

List of tables

ISSN 2653-2034

WATER CORPORATION

List of figures

ISSN 2653-2034

About this report

Water Corporation's 2020-21 Wastewater Quality Annual Report is a review of performance for the financial year ending 30 June 2021.

This report is specifically designed to provide the Department of Health, our customers and the Western Australian public with information on wastewater services and how we manage metropolitan and regional wastewater and recycled water schemes to meet quality and health requirements.

This is the second Wastewater Quality Annual Report made available to the public on our website. Publication of this report allows us to meet the requirements of our Water Services Licence with the Economic Regulation Authority and Memorandum of Understanding for Wastewater Services and Groundwater Replenishment (GWR) with the Department of Health.

Information contained in this report is the exclusive property of Water Corporation and the respective copyright owners. It is subject to ongoing review and should be viewed in conjunction with the associated materials. No part of this production should be copied, modified, reproduced or published in any form other than that intended by the author.

We acknowledge the Traditional Owners throughout Western Australia and their continuing connection to the land, water and community. We pay our respects to all members of the Aboriginal communities, their cultures and to Elders past, present and emerging

Further information

- For further information about the wastewater services we provide, or to provide feedback on this report:
- email us at report@watercorporation.com.au
- call us on 13 13 85
- visit watercorporation.com.au/wastewaterquality

ISSN 2653-2034

Acronyms

Acronym	Description
ADWG	Australian Drinking Water Guidelines
AGWR	Australian Guidelines for Water Recycling
AWRP	Advanced Water Recycling Plant
BOD	Biological Oxygen Demand
CCP	Critical Control Point
cfu/100ml	Colony forming units per 100ml
DWER	Department of Water and Environmental Regulation
DoH	Department of Health
GAR	Goldfields and Agricultural Region
GSR	Great Southern Region
GWR	Groundwater Replenishment
GWRS	Groundwater Replenishment Scheme
LMS	Learning Management System
mg	Milligrams
µg	Micrograms
ML	Megalitre
MLD	Megalitres per Day
MoU	Memorandum of Understanding
MWR	Mid West Region

Acronym	Description
NWR	North West Region
ng/L	Nanograms per litre
NTU	Nephelometric Turbidity Units
pg/L	Picograms per litre
PCT	Process Control Table
pfu/100ml	Plaque forming units per 100ml
RO	Reverse Osmosis
RWQI	Recycled Water Quality Indicator
RWQMP	Recycled Water Quality Management Plan
RWQP	Recycled Water Quality Parameter
RWSA	Recycled Water Supply Agreement
SWR	South West Region
WRRF	Water Resource Recovery Facility
WWIMS	Wastewater Information Management Solution
WWQMS	Wastewater Quality Management System
WWTP	Wastewater Treatment Plant

ISSN 2653-2034

Summary

Water Corporation is committed to the safe and effective management of wastewater, recycled water, groundwater replenishment, and biosolids and sludge.

Adherence to the management process encompassed by our Wastewater Quality Framework ensures a consistent standard of wastewater quality performance.

We are committed to ensuring the regulatory compliance of all our wastewater operations, and to transparently report to and discuss with our health regulator Department of Health (DoH) any non-compliance. Our processes and procedures ensure the prompt mitigation of any wastewater incidents and complaints.

ISSN 2653-2034

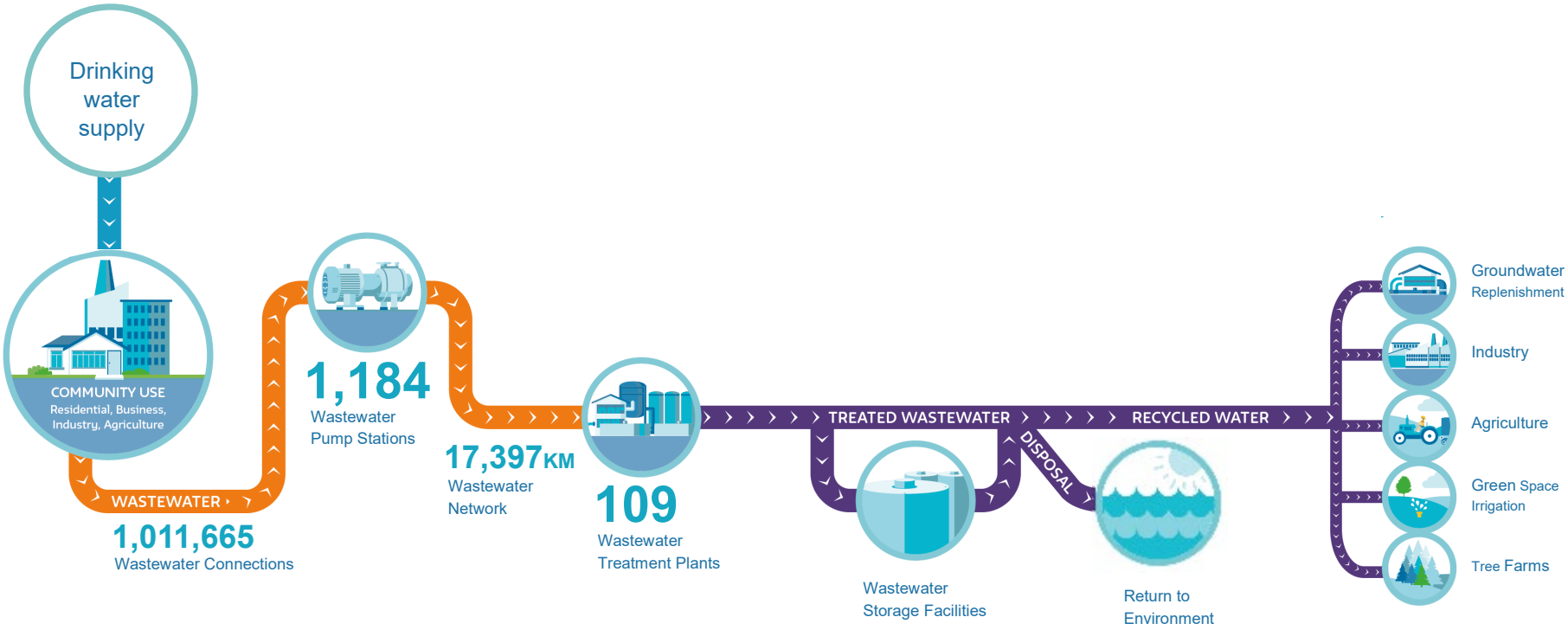


Figure 1: Wastewater assets and general scheme – as at 30 June 2021

* Includes 106 wastewater schemes owned, operated and managed by Water Corporation and three wastewater schemes managed by Water Corporation in the Indian Ocean Territories; does not include wastewater recycling plants.

ISSN 2653-2034

Our commitment

Water Corporation manages wastewater from industry and the community to meet public health, environmental and social expectations. We are committed to the responsible use and disposal of the products generated by our wastewater service to meet public health, environment and social expectations. Our products are treated wastewater, recycled water, biosolids gaseous emissions and residual wastes. We partner with our stakeholders and relevant agencies to deliver on our commitment to:

- Implement the Wastewater Quality Framework.
- Progressively adopt a best-practice management and multi-barrier approach to manage wastewater risks from source to end point. This ensures the quality of wastewater products.
- Meet public health, environmental, social and corporate expectations in the management of wastewater services as detailed in agreements, licences, regulations and corporate standards.
- Contribute to the development of wastewater regulations, guidelines, and other standards relevant to public health and the environment.
- Routinely monitor our systems and use effective reporting mechanisms to provide relevant and timely information on our performance.
- Use appropriate contingency planning and maintain incident response capability.
- Continually improve our practices by assessing performance against corporate objectives and stakeholder expectations.
- Engage with employees, contractors, stakeholders and the community to inform them of relevant issues related to wastewater management and products and listen to their expectations to maintain our social licence to operate.
- Maintain communication and partnerships with relevant agencies and users of wastewater products to continually improve wastewater quality and environmental outcomes.
- Participate in appropriate research and development activities to develop the necessary skills and knowledge to support the operation of the Wastewater Quality Framework.
- Implement and maintain processes and procedures consistent with the WA Guidelines for Biosolids Management to safely and sustainably manage biosolids and sludge recovery

ISSN 2653-2034

WATER CORPORATION

Introduction

Water Corporation provides wastewater services throughout Western Australia and the Indian Ocean Territories (Christmas and Cocos Islands). We manage the state's services through six regions: Goldfields and Agricultural region, Great Southern region, Mid-West region, North West region, Perth region (Metro) and South West region. As part of these services, we manage the daily treatment of approximately 466 million litres of wastewater (more than 170 billion litres for the year) through 109 treatment plants across these regions and the Indian Ocean Territories.

Products that are generated following the treatment process are either reused or safely disposed to the environment. There are 76 recycled water schemes, owned and operated by Water Corporation, local government or private industries, supplying recycled water for industrial reuse and irrigation of public open spaces and woodlots. All wastewater treatment and recycling plants are listed in Appendix A.

To ensure we continue to provide a high level of service to customers and produce treated wastewater that is safe and fit-for-purpose, we have ongoing engagement with internal and external stakeholders, local government, and regulators.

Memorandum of Understanding

Water Corporation operates under the Memorandum of Understanding (MoU) for Wastewater Services and Groundwater Replenishment (GWR) with DoH.

The MoU applies to the entire wastewater service from collection to disposal and/or beneficial use, including the Groundwater Replenishment Scheme (GWR).

The intent of the MoU is to ensure our wastewater services and GWR meet all required public health regulations and, therefore, do not negatively affect public health across Western Australia.

The MoU was reviewed and updated on 30 November 2018 and, as at 30 June 2021, a 2021 update is nearing endorsement. We had an independent review of our wastewater service and Groundwater Replenishment performance based on our MoU in the second half of 2020. It found our wastewater Quality Framework was broadly effective in maintaining effective mechanisms for managing our wastewater quality obligations and it successfully identified a number of opportunities for improvement, which we are addressing. The abridged report of the findings is available on our website at: watercorporation.com.au/Wastewater-quality

Both Water Corporation and DoH are committed to ensuring wastewater is managed in accordance with state and national guidelines to ensure public health is protected.

Figure 2: Woodman Point WRRF

ISSN 2653-2034

Wastewater quality and wastewater recycling policies

Water Corporation's Wastewater Quality Policy supports and promotes responsible use and management of wastewater products generated by its wastewater service, including recycled water, treated wastewater, biosolids, gaseous emissions (odour/greenhouse gases) and residual waste.

Further to this, our Wastewater Recycling Policy outlines our commitment to sustainable management of WA's limited water resources by maximising wastewater recycling and providing a framework for the management of wastewater recycling schemes.

Our Biosolids and Sludge Management Policy commits us to the responsible use and disposal of biosolids and sludge products generated by our wastewater service.

We use a risk-based Wastewater Quality Framework to deliver on these policies and align with the Australian Guidelines for Water Recycling (AGWR).

Wastewater Quality Policy

Water Corporation is committed to the responsible use and disposal of the products generated by our wastewater service to meet public health, environmental and social expectations and the corporate objectives and vision. These products are treated wastewater, recycled water, biosolids, greenhouse gas emissions (scope 1)[1] and residual wastes.

To achieve this, and in partnership with our stakeholders and relevant agencies, we will:

Manage wastewater services

Implement the "Wastewater Quality Framework" through existing and new Water Corporation processes.

Progressively adopt a best-practice management and multi-barrier approach to manage wastewater risks from source to end point to ensure the quality of our wastewater products.

Meet health and environmental standards

Meet public health, environmental, social and corporate expectations in the management of wastewater services as detailed in agreements, licences, regulations and corporate standards.

Contribute to the development of wastewater regulations, guidelines, and other standards relevant to public health and the environment.

Monitor and respond

Routinely monitor our systems and use effective reporting mechanisms to provide relevant and timely information on our performance.

Use appropriate contingency planning and maintain incident response capability.

Engage with stakeholders

Maintain communication and partnerships with relevant agencies and users of wastewater products to continually improve public health and environmental outcomes.

Engage with employees, contractors, stakeholders and the community to inform them of relevant issues related to wastewater management and products and listen to their expectations.

Improve our practices

Continually improve our practices by assessing performance against corporate objectives and stakeholder expectations.

Participate in appropriate research and development activities to develop the necessary skills and knowledge to support the operation of the "Wastewater Quality Framework".

All Water Corporation employees, partners and contractors are responsible for understanding their role in implementing and continuously improving wastewater quality management and outcomes.

Pat Donovan
Chief Executive Officer, Water Corporation

PCY327
May 2020

[1] Scope 1 greenhouse gas emissions are the emissions released to the atmosphere as a direct result of an activity or series of activities at a facility level, as defined by the Clean Energy Regulator, Australia.

WATER CORPORATION

Figure 3: Wastewater Quality Policy

ISSN 2653-2034

Wastewater Quality Framework

12 Elements of the Wastewater Quality Framework

Water Corporation manages wastewater from industry and the community to meet public health, environmental and social expectations. To achieve this we are implementing the Wastewater Quality Framework; a risk-based approach to wastewater management aligned to the AGWR.

The 12 elements of the Wastewater Quality Framework (figure 4) covers fundamental concepts related to our commitment to deliver quality wastewater services, the analysis and management of these services, and their ongoing enhancement.

The structure of the Wastewater Quality Framework allows for and requires:

- articulation of our commitment to wastewater services quality
- clear definition of accountabilities and responsibilities across all risks
- identification of preventive measures and treatment barriers
- providing and documenting processes and procedures for operational control
- continuous improvement and review and optimisation of our systems.

Through our Wastewater Quality Policy endorsement, all employees or contractors involved in the wastewater services are responsible for understanding their role in implementing and continuously improving the Wastewater Quality Framework.

Process Control Tables

Water Corporation utilises a standard process reference document for each wastewater and wastewater recycling scheme, termed a Process Control Table (PCT). The PCT contains key sampling, operating and performance information. This information is used by the Wastewater Information Management Solution (WWIMS) to compare laboratory/site analysis data with agreed alert and violation ranges derived from PCTs and provide notifications of potential/actual non-conformances. Corrective actions to manage such issues are undertaken, with feedback processes for continuous improvement of the PCT.

We have 113 PCTs that are regularly reviewed, 11 of which incorporate a Water Corporation recycling scheme. We also have 64 separate PCTs for non Water Corporation recycling schemes. All compliance samples are scheduled through the Wastewater Quality Management System (WWQMS).

Evaluation, audit and continuous improvement

We review our provision of wastewater services from operator to senior executive to ensure all schemes are managed to meet operational and regulatory requirements. Our review processes engage all key stakeholders using internal and external reviews and audits, including an audit of the MoU for Wastewater Services and GWR with DoH.

ISSN 2653-2034

WATER CORPORATION

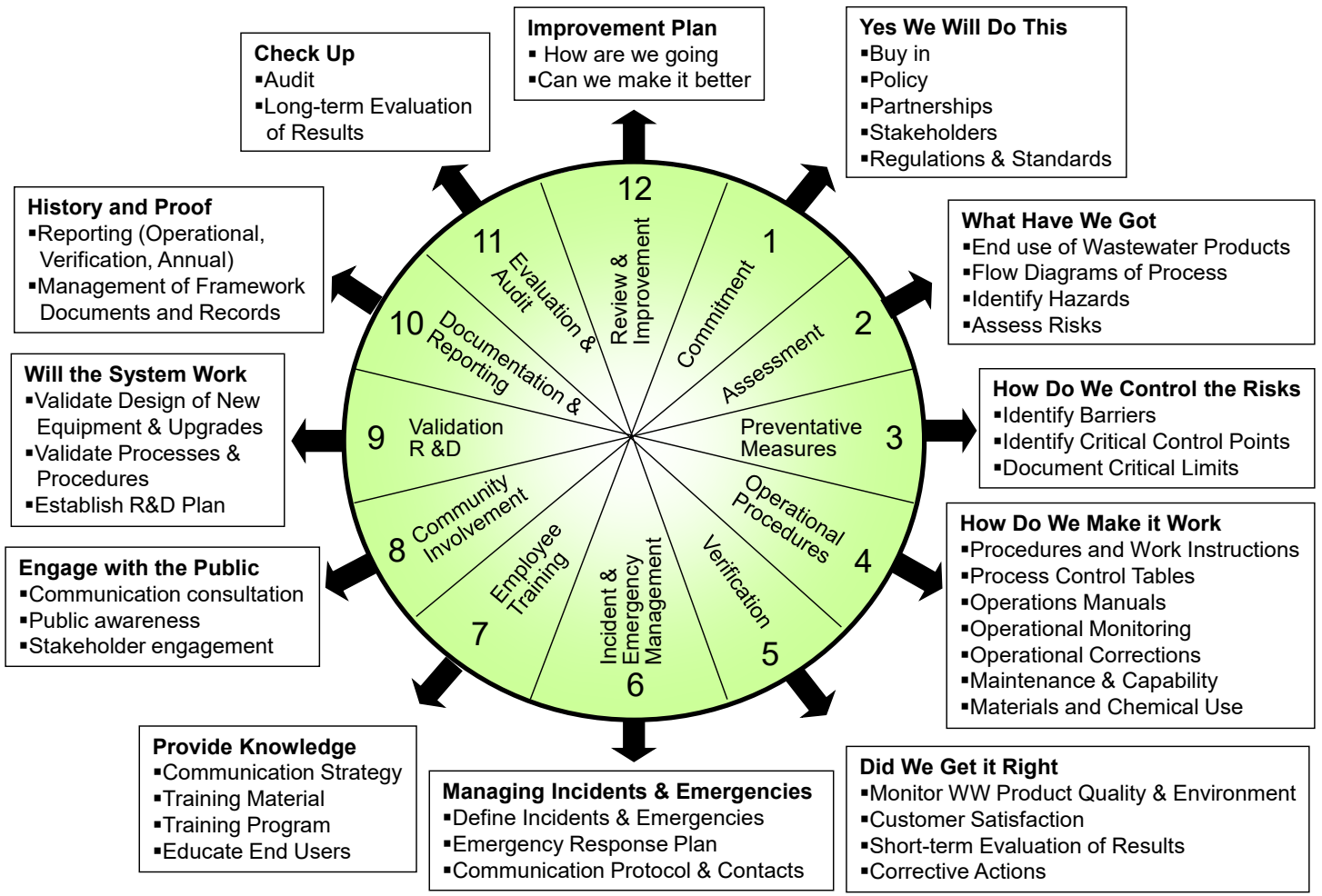


Figure 4: The 12 Elements of the Wastewater Quality Framework

ISSN 2653-2034

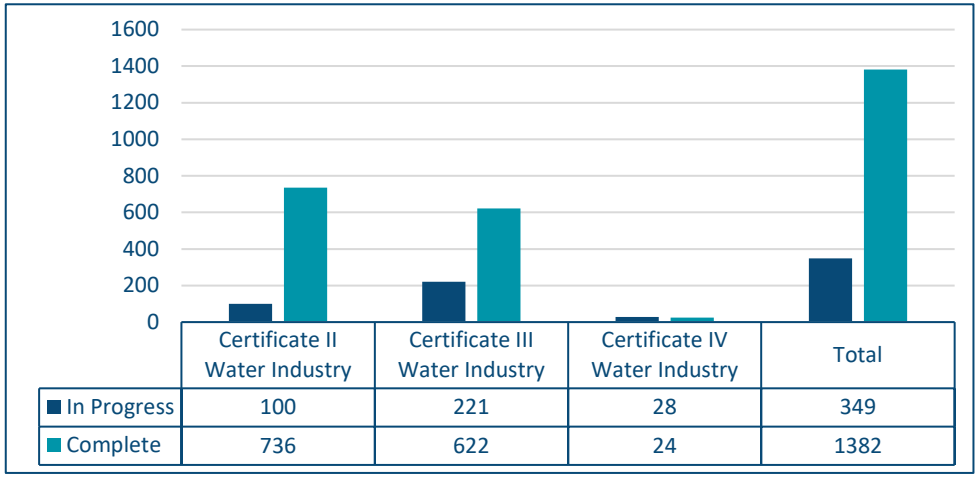
Operator training and competence

Water Corporation has a mature nationally accredited training program. All operators who perform wastewater treatment, quality management and sampling tasks, are identified to complete the program. This consists of a Certificate II, III or IV from the National Water Package (NWP). The accredited program, which is internally developed and delivered, allows employees to attain a nationally recognised qualification (refer figure 5). Water Corporation has an auspicing arrangement with North Metropolitan TAFE who provide quality control over the course development, delivery and assessment, and issue credentials. As part of this partnership, Water Corporation offers traineeships to its new and existing workforce, and Vocational Education and Training in schools pathway.

The program also includes a suite of water quality courses which contribute to our implementation of element 7, Employee Training, of the 12-element framework (refer page 12). This is important as training for operators ultimately determines the ability for Water Corporation to successfully provide recycled water users with the quality of water they require to manage their systems and for disposal of water, not recycled, safely to the environment.

Water Corporation has a contemporary Learning Management System (LMS) which allows for the correct qualification or part thereof, to be assigned to each employee, to ensure they are adequately trained to perform their role safely and competently. The LMS data is regularly monitored through a network of training coordinators to maintain accuracy, therefore ensuring the correct training is allocated for the role being performed or the asset being operated.

Innovation in training is ongoing and includes a move towards virtual delivery, exploration of visual intelligence technologies to provide hands free point of vision capabilities, and the use of eLearning to supplement existing face-to-face courses. Water Corporation is proud of the investment made towards its workforce's current and future capability, and the maturity of the process.



	Certificate II Water Industry	Certificate III Water Industry	Certificate IV Water Industry	Total
In Progress	100	221	28	349
Complete	736	622	24	1382

Figure 5: Certificate training completed

ISSN 2653-2034

Wastewater catchment

Wastewater in Western Australia generally comes from two sources, domestic wastewater and trade waste.

Figure 6: Wastewater catchment sampling

Domestic wastewater

Domestic wastewater is largely consistent in quality and quantity. The volume generally follows a diurnal cycle with a morning and evening peak and low overnight flows. Wastewater is usually considered to be 99.7 per cent fresh water and 0.3 per cent contaminants.

Controlled waste

Controlled waste is managed by Water Corporation in accordance with the requirements of the *Environmental Protection (Controlled Waste) Regulations 2004*. The substances considered to be controlled waste are listed in the regulations and include sewage waste from the reticulated sewerage system, septage waste, trade waste (e.g. from grease traps) and non-toxic salts. Private carriers dispose of controlled waste to Water Corporation main sewers and wastewater treatment plants. Transport of controlled waste is tracked using the DWER Controlled Waste Tracking System.

Septage

Septage is a by-product from the storage of household wastewater in a septic tank where the sludge accumulates over time and must be removed every 4 to 5 years and disposed in a dedicated disposal facility. Under the *Health Act (1911)* Local Government Authorities (LGAs) are responsible for the acceptance and disposal of septage and can charge ratepayers for this service. Septage must be disposed of in a dedicated disposal facility.

Water Corporation's wastewater treatment is designed, operated and maintained to treat domestic wastewater for subsequent disposal and

ISSN 2653-2034

reuse. The capacity of a wastewater scheme to receive septage, without detriment to the treatment process and quality of the treated wastewater, is governed by the quality and volume of septage, as well as the design, capacity and operation of the plant.

Although Water Corporation is not legally responsible to accept septage, a small number of wastewater treatment plants accepted septage in this financial year to assist LGAs under temporary arrangements. To ensure these plants operate continuously within their licence and performance criteria, a management framework has been developed.

The management framework ensures formal agreements exist with each contractor who disposes of septage at each wastewater scheme. These agreements define the volume and quality of the septage that can be disposed to a plant, and the cost of disposing septage. The framework provides assurance the wastewater scheme has ongoing capacity to receive septage, and the volumed accepted will allow compliance with regulatory requirements for reuse and environmental disposal.

Trade waste

Trade waste is the wastewater discharged from commercial or industrial premises other than domestic type wastewater. At the end of June 2021 there were 14,182 trade waste customers connected to Water Corporation's wastewater system. Trade waste can be highly variable in quality and quantity and this can pose significant risks for the operation of the wastewater system. The most numerous trade waste dischargers are small retail food outlets such as restaurants and fast food chains, which generate greasy waste. Large industrial customers such as dairies, beverage manufacturers, meat processors, metal finishers, laundries and waste treatment facilities can be significant point sources of trade waste.

Metal finishers, laboratories and chemical formulators typically discharge small to intermediate trade waste volumes, but these wastes may contain compounds of concern for the wastewater system.

Trade waste management and wastewater source control is focussed on five key objectives to manage wastewater input, as defined in the Australian Sewage Quality Management Guidelines (Water Services Association of Australia, 2012):

- safety of people
- protection of assets (pipes, plant and equipment)
- protection of treatment processes
- facilitation of regulatory and licence compliance
- facilitation of recycling.

Water Corporation has a centre of expertise for trade waste management. It manages trade waste operations state wide using a trade waste framework which includes:

Assessment and approval

Commercial and industrial customers must obtain approval to discharge trade waste to sewer, usually in the form of a trade waste permit. This permit will specify pre-treatment requirements and other conditions which may include limits on mass and volumetric discharge, monitoring and reporting requirements and maintenance of pre-treatment and monitoring equipment.

Fats, oils and grease management program

This program monitors the servicing of 7,719 grease arrestors (as at end June 2021) installed at businesses generating greasy waste, to ensure

ISSN 2653-2034

that the arrestors are pumped out at the required frequency to prevent the discharge of grease and solids into the wastewater system. Unmanaged discharges from these businesses can result in sewer blockages and overflows, and extra loading in treatment plants.

Surveillance of large and high-risk customers

An ongoing program of sampling and compliance inspections of industrial customers discharging large organic loads or waste streams of potential quality concern is maintained to monitor loading on the wastewater system and compliance with permit conditions.

Permit capture program

An ongoing program is maintained to identify, invariably small, businesses discharging to sewer without a permit. Businesses are required to obtain a permit and meet the relevant permit conditions.

Acceptance criteria and other information

A set of trade waste acceptance criteria is published on Water Corporation's website. These specify the levels of various wastewater quality parameters that may be discharged to sewer by trade waste customers under a permit. Compounds not included in the acceptance criteria are evaluated on a case by case basis and, as appropriate, published in the criteria. In addition to the acceptance criteria, there is a range of other information about trade waste on our website.

Investigations

Water Corporation conducts a range of investigations to assist trade waste management, including characterising wastewater from industry sectors, assessing pre-treatment products, and investigating unusual discharges observed in the wastewater system. A review of commercial and industrial discharges on the Woodman Point WRRF catchment was underway during 2020-21.

Figure 7: Woodman Point WRRF trade waste recieval

ISSN 2653-2034

Wastewater treatment

Water Corporation managed 106 wastewater treatment schemes across Western Australia and three in the Indian Ocean Territories, treating more than 170 billion litres of wastewater in 2020-21. The emphasis in wastewater treatment is on reducing biological oxygen demand (BOD), in the form of soluble carbon, for environmental, aquatic and public health protection. Effective management of the whole wastewater treatment process is essential in maintaining consistent treatment performance levels. This is achieved through implementation of a wastewater treatment management framework, progression of wastewater system improvements and upgrades, and implementation of research outcomes to improve wastewater treatment practices.

How wastewater is treated

Wastewater treatment is generally classified into the following stages:

Preliminary treatment – physical removal of inorganic particles that may damage or block equipment in later treatment stages:

- Screens – remove items such as rags, paper, cotton buds that may block equipment.
- Grit tanks – remove sand and grit.

Primary treatment – physical removal of suspended solids using gravity to settle particles, in a primary sedimentation tank followed by the mechanical removal of these settled solids. Generally, also includes the mechanical removal of floating contaminants.

Secondary treatment – follows on from primary treatment and consists of biological removal of biodegradable dissolved and suspended organic compounds by converting them into biomass. Secondary sedimentation tanks are used to separate the solid biomass from the secondary treated water prior to the water being discharged or processed further. Secondary treatment processes used by Water Corporation include:

- Lagoons or ponds – have long detention times for the wastewater in excess of one month. The larger the inflow volume the greater the area of the ponds. Treatment relies on natural biological processes at the various layers within the pond that will be anerobic at the base and aerobic at the surface. Requires less management than more complex treatment processes. May include aerators to increase the oxygen and mixing, allowing biological processes to occur at a faster rate and reduce the required detention time and pond size.
- Biological filtration systems (e.g. trickling filters) – have filter media, such as crushed stone, with a large surface area to support a biofilm. Wastewater is trickled over the filter media and the organic content of the wastewater is used by the organisms in the biofilm to grow and reproduce, thus converting the organic matter to biomass.
- Activated sludge, such as extended aeration (e.g. Intermittently Decanted and Extended Aeration plant - IDEA), oxidation ditches and sequencing batch reactors – uses returned biomass (activated sludge) and dissolved oxygen to rapidly convert the incoming organics into more biomass.

Advanced wastewater treatment (sometimes referred to as tertiary) – used when the removal of more intractable contaminants is required. This stage is generally employed to reduce nutrients (mostly nitrogen (ammonia), with phosphorus at some plants) that may be required for environmental disposal options and pahogens. For more specialised

ISSN 2653-2034

reuse or disposal into sensitive environments other contaminants may also be targeted.

Disinfection – used to protect public health by reducing or inactivating pathogenic microorganisms. Not all disposal methods require disinfection – it is only used if there is some risk of contact with people.

All wastewater treatment plants (WWTPs) are designed with sufficient redundancy for BOD reduction. All Water Corporation wastewater treatment systems are able to consistently reduce BOD to acceptable levels (filtered BOD of less than 20mg/L). Most of Water Corporation's WWTPs have secondary treatment, with the majority of regional plants being pond plants, with added disinfection if there is beneficial reuse on a public open space. Appendix A contains a complete list of our wastewater treatment plants showing treatment type and associated recycling schemes.

The solid waste generated by the wastewater treatment process is termed biosolids or sludge depending on the treatment process. Both solids and sludge cake are rich in nutrients and organic matter making a great natural fertiliser and soil improver (refer to *Biosolids and sludge management*, page 23). We supply biosolids to farms to help grow crops such as canola. Current design of wastewater treatment plants considers the intended sludge reuse or disposal options; while some older wastewater treatment plants require upgrades to accommodate this.

Wastewater Resource Recovery Facilities

A number of our Wastewater Treatment Plants recycle a significant amount of:

- Water for use in industry and/or irrigating public open space
- Nutrients
- Biosolids and/or
- Energy from wastewater

Wastewater Treatment Plants that recover resources to recycle as part of the treatment process have been renamed Water Resource Recovery Facilities (WRRF) to reflect the true functionality of these facilities.

ISSN 2653-2034

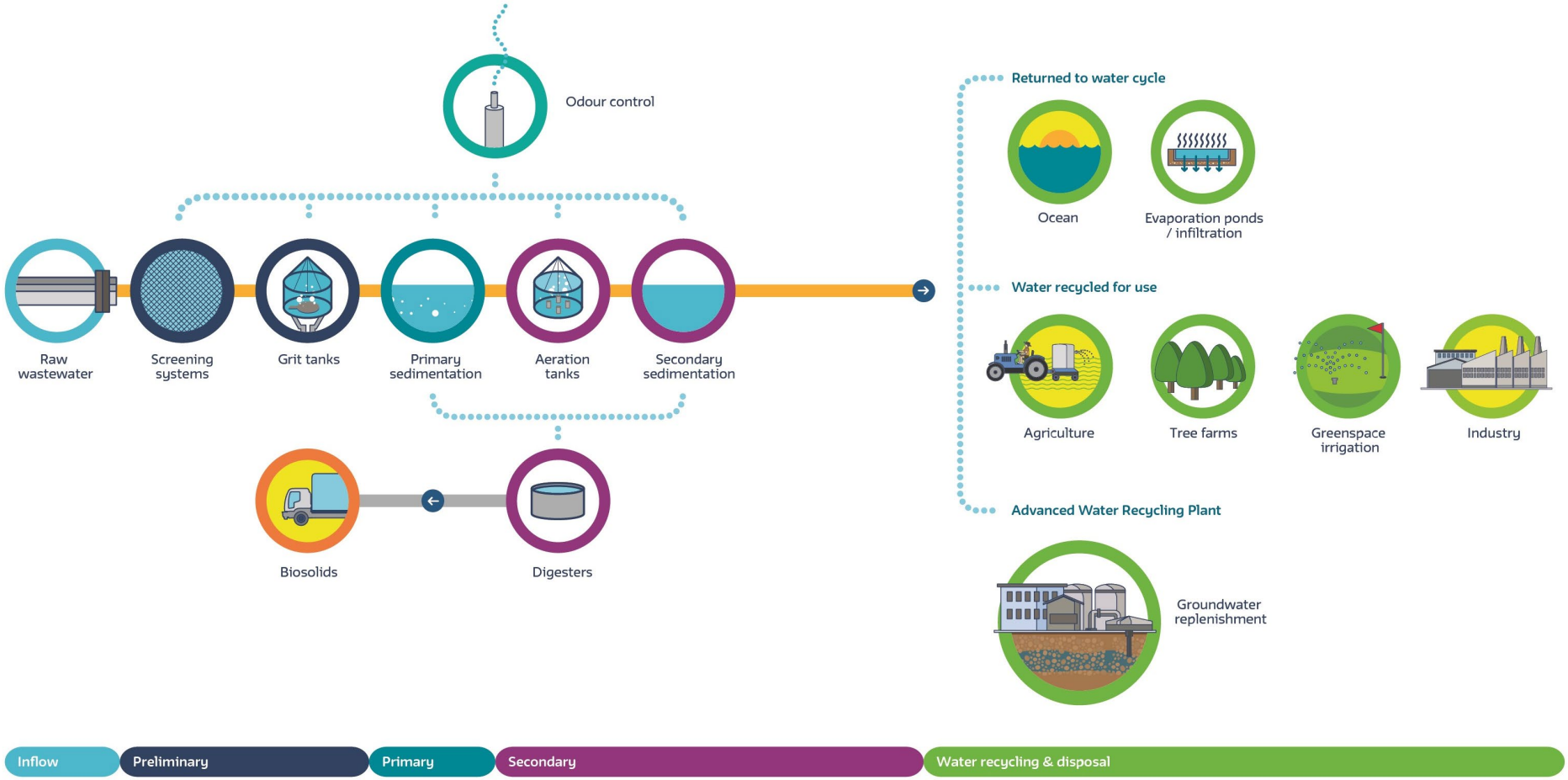


Figure 8: Wastewater treatment, recycling and disposal

ISSN 2653-2034

Wastewater schemes - new and upgrades

Four wastewater treatment plants had upgrades completed in the 2020-21 financial year as part of Water Corporation's Asset Investment Program, which aims to maintain or improve wastewater treatment quality through prioritised and targeted capital expenditure.

- Woodman Point WRRF
- Gnarabup WWTP
- Carnarvon WRRF
- Pemberton WRRF

The Albany WRRF upgrade commenced in 2017-18 and, due to scope and complexity of the upgrades, remains in progress. Information on this upgrade will be provided in a future report.

A number of additional scheme upgrades were commenced, but not finalised, in 2020-21. Information on these upgrades will be provided in future reports once they have been completed. Upgrades that commenced design or construction in 2020-21 include:

- Derby WRRF
- Northam WRRF
- Bridgetown WRRF
- Wickham WRRF
- Kojonup WRRF

Woodman Point WRRF

This 180 megalitres per day (MLD) upgrade was completed in 2020-21. Works completed and commissioned in 2020-21 included:

- Replacement of old grit tanks with new and larger grit tanks
- Addition of 4 new primary sedimentation tanks
- Conversion of sequencing batch reactor to a continuous secondary treatment process
- Six new secondary sedimentation tanks
- Upgrade of the odour control facility with the addition of 4 bio-trickling filters

Further works are planned to upgrade the solids processing capacity to 120 tons dry solids per day in 2024-25.

Figure 9: Woodman Point WRRF

ISSN 2653-2034

Gnarabup WWTP Steel & Concrete Refurbishment

- Secondary treatment processes including aerators, diffusers and bioselector have been upgraded to improve treated effluent quality.
- New analysers and control systems have been installed to ensure the plant is stable under a wide range of operational conditions.

Figure 10: Gnarabup WWTP

Carnarvon WRRF

- Replacement of faulty/ outdated Copper ionizer unit.

Pemberton WRRF

- Upgrade of treatment plant for increased flows (0.09 MLD to 0.3 MLD).
- New inlet works incorporating fine screening, grit and FOG removal.
- Secondary treatment process includes Oxidation ditch, clarifier and denitrification filtration system.
- New disinfection system and new dewatering screw press for sludge processing.

Figure 11: Pemberton WRRF

ISSN 2653-2034

Biosolids and sludge management

All wastewater treatment plants produce solid waste which, depending on the treatment method, is categorised as biosolids or sludge cake.

Biosolids is the term for organic sludge from domestic and industrial wastewater that has undergone treatment to reduce pathogens and volatile organic matter significantly. This results in a stabilised product suitable for beneficial use in agriculture. This treatment method is only available in our larger metropolitan wastewater treatment plants.

Sludge cake is partially treated dewatered organic sludge that has not undergone the process of controlled stabilisation, and therefore requires further treatment by third party composters prior to beneficial use.

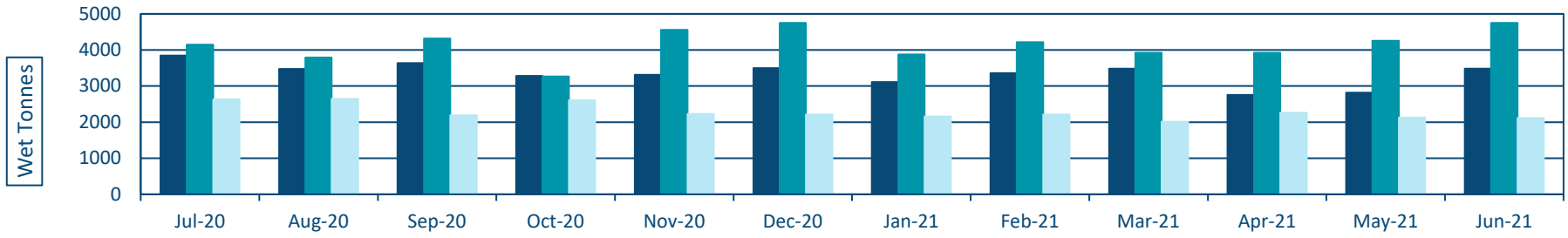
Water Corporation is committed to the vision of the Waste Avoidance and Resource Recovery Strategy 2030, for WA to become a sustainable, low-waste, circular economy in which human health and the environment are protected from the impacts of waste. Biosolids and sludge cake are the largest single contributors to Water Corporation's solid waste footprint, and we recover 100 per cent of these valuable resources from Perth metro region and aim to recover at least 75 per cent from regional areas. We are committed to the responsible use and disposal of biosolids and sludge products generated by our wastewater service to meet public health, environmental and social expectations.

The Figures 12 and 13 below show the volumes of biosolids and sludge cake produced in our metropolitan wastewater treatment plants. Figure 14 shows the regional sludge cake volume produced and Table 1 shows the percentage of this sludge cake going to beneficial use. The majority of regional wastewater schemes are pond/ lagoon type plants that don't produce a continuous solid waste stream, therefore the sludge is usually removed in asset maintenance programs called pond desludging. As these ponds are desludged intermittently, the regional yearly sludge volumes are highly variable.

Water Corporation has undertaken research and development to verify sludge stabilisation in drying beds and geobags, with the aim of increasing sludge recovery in pond-based treatment plants, particularly in MWR and NWR, to meet the 75 per cent recovery target by 2030. Research results are being evaluated and will inform future resource recovery opportunities. Additional market development of third-party composters and other treatment providers continues to be undertaken to meet this target and new research is always ongoing in regard to new and innovative ways for beneficially using wastewater products.

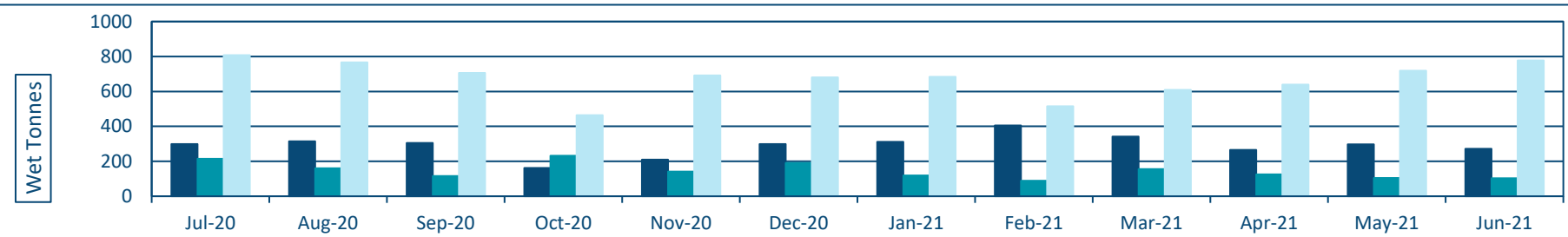
ISSN 2653-2034

Metropolitan (Perth-Peel) biosolids & sludge cake production



	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21
Beenyup WRRF	3848	3476	3633	3277	3311	3496	3110	3361	3484	2757	2820	3484
Woodman Point WRRF	4146	3794	4319	3269	4558	4754	3874	4213	3921	3919	4252	4750
Subiaco WRRF	2635	2650	2192	2605	2227	2210	2158	2210	2009	2257	2127	2112

Figure 12: Biosolids produced for beneficial use in agriculture 100 per cent recovery

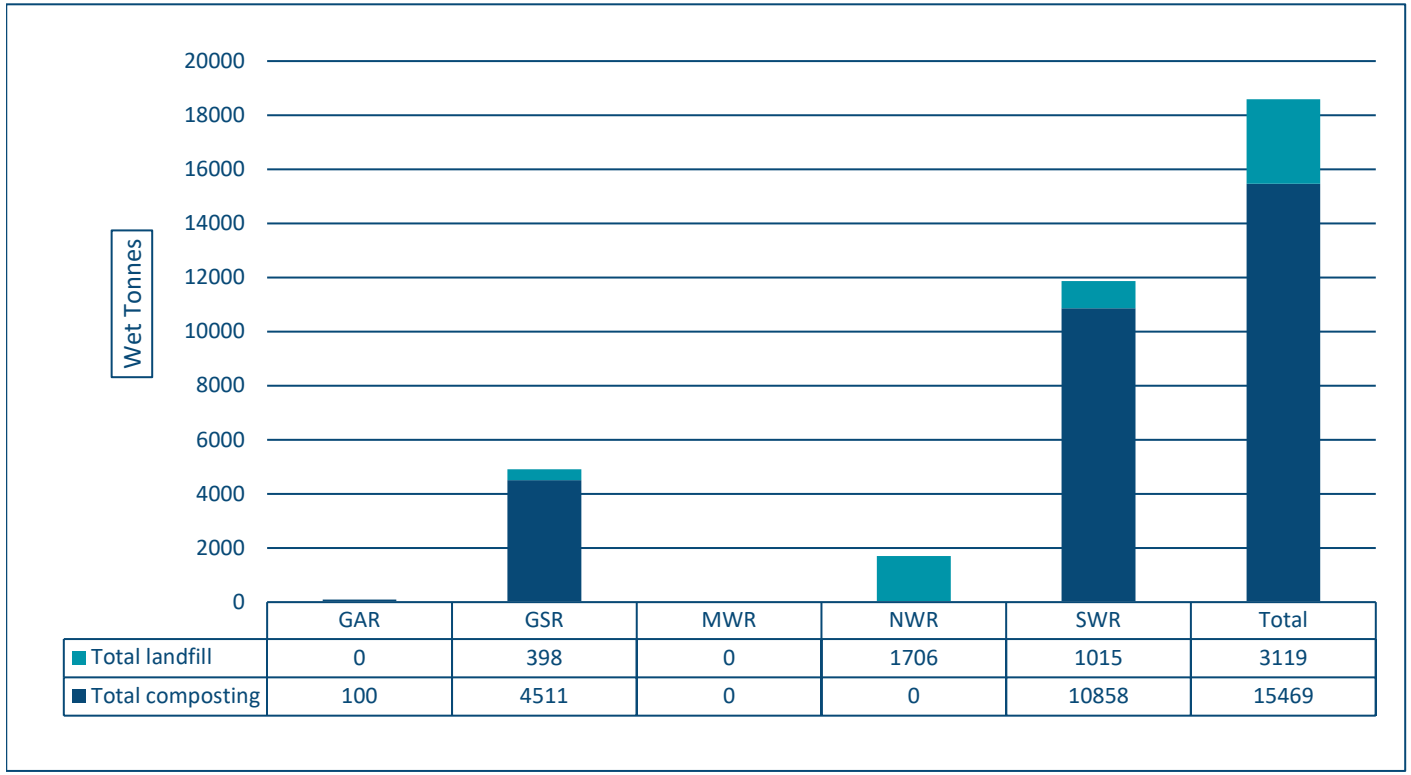


	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21
Kwinana WRRF	299	314	305	162	210	298	311	406	341	266	297	271
East Rockingham WRRF	215	160	116	232	141	191	119	89	155	126	104	103
Gordon Road WRRF	808	767	706	464	691	681	683	515	609	639	718	777

Figure 13: Sludge cake produced for beneficial use in composting 100 per cent recovery

ISSN 2653-2034

Regional sludge cake management



	GAR	GSR	MWR	NWR	SWR	Total
Total landfill	0	398	0	1706	1015	3119
Total composting	100	4511	0	0	10858	15469

Note:
GAR = Goldfields & Agricultural region
GSR = Great Southern region
MWR = Mid West region
NWR = North West region
SWR = South West region

Figure 14: Regional sludge cake volume and distribution 2020-21

Table 1: Regional sludge cake recovery for beneficial use

Region	GAR	GSR	MWR	NWR	SWR	Regional total
% Recovery	100%	92%	0%	0%	91%	83%

ISSN 2653-2034

Biosolids product quality compliance

Table 2: Biosolids product quality compliance

Treatment Plant	Sludge treatment process	Biosolids product name (grade)	Biosolids product quality compliance											
			Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21
Beenyup WRRF	Anaerobic digestion	Biosolids cake (P3 C2)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subiaco WRRF	Lime amendment	Lime amended biosolids (P3 C2)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Woodman Point WRRF	Anaerobic digestion	Biosolids cake (P3 C2)	✓	(1)	✓	✓	(2)	(2)	(3)	(4)	✓	✓	(5)	(5)

Comments:

(1) A drop in Woodman Point WRRF temperature was recorded due to recirculation pump maintenance on Digester 1. Not a true reading (19/08/2020 to 23/08/20).

(2) A drop in Woodman Point WRRF temperature was recorded due to ongoing cmmissioning of new treatment infrastructure related to a major capital upgrade project (Oct-20 to Nov-20).

(3) A drop in Woodman Point WRRF temperature was recorded as Digester 3 was offline (01/01/21 to 19/01/21).

(4) A drop in Woodman Point WRRF temperature was recorded on Digester 1 due to a recirculation pump fault. Not a true reading (07/02/21).

(5) Low *E.coli* log reduction at Woodman Point WRRF, however product remained classed as pathogen grade 3 (P3) (May-21 to Jun-21).

- As per the WA Guidelines for Biosolids Management (DEC 2012), pathogen grade 3, contaminant grade 2 (P3 C2) biosolids is suitable for direct beneficial use in broad-acre agriculture, forestry, and/or mine site rehabilitation.
- Biosolids cake critical control points for anaerobic digestion are Sludge Retention Time ≥15 days, and Temperature 35°C ± 3°C.
- Lime amended biosolids critical control point for lime amendment is pH ≥ 12 for > 3 hrs.

ISSN 2653-2034

Wastewater recycling and disposal

Water Corporation operates 52 water recovery facilities with at least one wastewater recycling scheme, with a total of 79 reuse recipients (including 5 from the Kwinana Water Recycling Plant) across the state. These recycling schemes supply recycled water for a range of purposes, including industrial uses and the irrigation of public open space and woodlots. Some treatment schemes have beneficial reuse only, while others have a combination of reuse and environmental disposal or environmental disposal only. We recycled approximately 20.57 billion litres of treated wastewater this financial year, not including the Groundwater Replenishment Scheme.

Water Corporation owns and manages 11 recycling schemes, while others are owned and managed by third parties, many of which are local government and others are privately-run schemes. Water Corporation provides water of an agreed quality to these schemes, with further treatment and obligation to meet health department requirements being the responsibility of the third party. A complete list of recycling schemes is in Appendix A.

Recycling scheme management

Our approach to managing the treated wastewater recycling process is based on the 12 element framework of the Australian Guidelines for Water Recycling and the DoH *Guidelines for the Non-Potable Uses of Recycled Water in Western Australia*. We have systems in place to fulfil the criteria of the 12 elements and we continue on our journey for ongoing improvement in scheme performance.

Figure 15: Irrigation of public open space with recycled water

Water Corporation operations

Water Corporation operates 11 treated wastewater recycling schemes with formal DoH approval. The schemes are mostly irrigation of woodlots with one Rhodes Grass crop in Broome North. We also reuse treated wastewater for internal use at other WRRFs; however, this reuse is not subject to formal DoH approval under the Guidelines for Non-potable Uses of Recycled Water in Western Australia.

ISSN 2653-2034

Water Corporation's water quality performance against DoH approval conditions, where Water Corporation is responsible for the scheme or to point of supply in private schemes, are presented in Appendix C. This provides a summary of almost 4,600 results from relevant sampling points. The data demonstrates water quality sampling guideline values were met with one exception for *E. coli* at Manjimup which was identified as an operational issue that was resolved promptly with negligible impact on public health.

Capital and operational investment

Capital investment within the water recycling investment portfolio to improve infrastructure at reuse only schemes continued to progress over 2020-21. Reuse scheme improvements in delivery during 2020-21 included developing new disinfection facilities at Narembeen (to be commissioned in 2021-22), and Kellerberrin, Wyalkatchem, and Wundowie (to be commissioned in 2022-23). Improvements also included upgrades to tertiary barriers such as recycled water signage at storage and irrigation sites. Planning and design are under way for improvements to the following schemes:

- Corrigin
- Northam
- Merredin
- Exmouth

Internal audit process

Water Corporation supports DoH and the ongoing compliance of recycling schemes by undertaking audits of third-party recycling schemes. These internal audits are a compliance requirement of the third parties' DoH Approval. Audits are conducted by representatives from the Water Corporation and the third party.

Water Corporation undertook 10 audits in 2020-21 and plans to undertake 21 audits across the state in 2021-22, as agreed with the DoH.

Future focus

The key points of focus for wastewater recycling are:

- Progress on capital projects related to treated wastewater recycling (York Woodlots, Wyalkatchem, Kellerberrin).
- Provide support to recipients to help them address the audit findings.
- Regularly review recipient water sampling results, to aid the proactive management of emerging water quality issues.
- Research and development to improve technology and beneficial reuse opportunities to maximise beneficial reuse in WA to meet Water Corporation's wastewater reuse target of 30 per cent by 2030.
- Work with recipients to provide support in the development and management of key recycling documentation such as Recycled Water Quality Management Plans.
- Work to improve the environmental management of recycling schemes.

ISSN 2653-2034

Case Study – Margaret River WRRF 3MLD upgrade project

Background

The Margaret River Water Resource Recovery Facility (WRRF), in the Shire of Augusta-Margaret River, is located 277 km south of Perth in the South West Region. Originally constructed in 2001, with a design capacity of 1.5 megalitres per day (MLD), the existing wastewater treatment plant consisted of an Intermittent Decant Extended Aeration (IDEA) process designed for biological nitrogen removal and chemical phosphorus removal.

Figure 16: Original Margaret River WRRF

To accommodate rising population and ensure the reliability and effective treatment of wastewater for reuse, Water Corporation recently doubled the treatment capacity to 3 MLD. The revolutionary project included new inlet works, continuous reactor (oxidation ditch), secondary clarification treatment equipment, and a sludge dewatering system.

Treated wastewater is then stored in a 421 ML on-site storage dam and, following filtration and disinfection, fully reused.

Figure 17: New Oxidation Ditch and Clarifier

Design and construction

The design and construction team arranged for the creation of a 3D model of the existing site using a drone equipped with high definition photography. 3D models of each new treatment process were progressively added into the 3D site model, resulting in a site wide 3D view of the new plant. This model, combined with virtual reality technology, enabled the experience of walking around the virtual, yet to be constructed, plant - similar to a video game. Learnings from interacting with this technology by multiple stakeholders were then used to design a safe and operable plant, with significant cost saving achieved through early and pointed design changes.

ISSN 2653-2034

The Margaret River WRRF was a working site, which meant it was essential to maintain operations during construction and commissioning. Initial filling of the new process plant and timing of sludge system changes were co-ordinated to enable a smooth transfer.

New treatment plant

The plant upgrade has reduced the Margaret River WRRFs environmental footprint and improved regulatory compliance. The upgrade resulted in other significant improvements including:

- A considerable reduction in nutrient loads (total nitrogen and total phosphorous) - refer to table 3.
- A substantial increase in dewatered waste activated sludge dry solids content resulting in a 50 per cent reduction in biosolids truck movements.
- Improved biological treatment stability and remote monitoring ability.

Table 3: Pre and post upgrade treated effluent nutrient analysis results

Margaret River WWTP	NH4 (mg/L)	BOD (mg/L)	SS (mg/L)	TN (mg/L)	TP (mg/L)
Treated effluent pre upgrade average (Jan 2019 - Oct 2020)	23.3	12.5	10.0	27.0	1.1
Treated effluent average post upgrade (Dec 2020 - June 2021)	0.1	5.0	5.0	3.0	0.5

NH_4 – Ammonium
BOD – Biological Oxygen Demand
SS – Suspended solids
TN – Total Nitrogen
TP – Total Phosphorous

All resources recovered from the Margaret River WRRF are fully recycled within the community:

- 100 per cent of the water treated at the plant is reused to irrigate 130 hectares of adjacent Forest Products Commission pine plantation and multiple locations within the Margaret River townsite.
- All dewatered waste activated sludge produced is utilised as a soil conditioner on a nearby licensed farm.

Conclusion

Successfully engineering a new treatment plant, such as the Margaret River WRRF, evolves through collaboration between operational staff, project team members, design management, consultants, construction contractors and the commissioning process team. Strong collaboration and communication throughout this project and the use of lessons learnt from previous regional treatment plant upgrades produced a treatment plant which exceeded expectations.

Figure 18: New inlet works and grit removal system

ISSN 2653-2034

Groundwater replenishment

Introduction

Groundwater replenishment (GWR) is the process by which secondary treated wastewater undergoes advanced treatment, at the Advanced Water Recycling Plant (AWRP). Water is produced which meets or exceeds the Australian Drinking Water Guidelines (ADWG) prior to being recharged to an aquifer for later use as a drinking water source. Groundwater replenishment has been identified by Water Corporation as a safe, sustainable water source option for the Perth Integrated Water Supply Scheme (IWSS).

Stage 1 of the Perth Groundwater Replenishment Scheme (GWRS) gained approval to recharge in August 2017. GWRS Stage 2 commenced construction in late 2017 with above-ground infrastructure completed in late 2019. Approval for recharge of the GWRS Stage 2 expansion was granted in 2020. The Stage 2 expansion is currently being commissioned and tested and is on track to be operational in 2022.

Once operational, the GWRS will effectively double the scheme capacity and Water Corporation is now licensed to recharge up to 28 billion litres each year under the conditions of recharge, providing a climate independent water source.

For the financial year to 30 June 2021, the GWRS scheme has recharged a total of 15.3 billion litres.

GWR scheme overview

The treatment systems for the GWRS include the Beenyup WWTP, the AWRPs and eight recharge bores. The scheme also includes a monitoring borefield (consisting of 8 bores) which is used to monitor the flow and quality of recycled water in the Leederville and Yarragadee aquifers. They also overlay a superficial aquifer around the recharge bores, as defined by the GWR Recharge Management Zone and monitoring requirements.

Figure 19: GWR stages 1 and 2

The GWRS takes wastewater from the Beenyup WWTP. This catchment is the northern suburbs of Perth extending from Quinns Beach through to Scarborough and inland through Dianella and Bayswater to the foothills of East Midland.

ISSN 2653-2034

The majority of wastewater collected in the Beenyup wastewater catchment is from domestic and commercial premises. Trade waste, which is process wastewater from industrial and commercial customers, represents around 2.5 per cent by volume of the wastewater flow to Beenyup WRRF.

The details of the GWR treatment system are illustrated in Figure 20.

Beenyup WRRF discharges about 0.135 billion litres a day of treated wastewater via two adjacent outlets known collectively as the Ocean Reef Ocean Outlet, at 1850 m and 1650 m offshore. The outlets discharge into 10 m of water where the treated wastewater is diluted and dispersed.

The majority of the treated wastewater will be diverted from the ocean to be utilised at the two AWRPs. Each AWRP uses a process of ultrafiltration, reverse osmosis and ultra-violet disinfection to further treat the treated wastewater before it is recharged to the Leederville and Yarragadee aquifers.

The GWRS treatment process is operated in accordance with the Hazard Analysis and Critical Control Points (HACCP) philosophy and the 12-element risk management framework. This is based on the National Water Quality Management Strategy - Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) and Australian Guidelines for Water Recycling: Augmentation of Drinking Water Supplies (Phase 2). There is a total of 20 critical CCPs maintained across the WRRF and the two AWRPs. These CCPs are continuously monitored online and assure recycled water is of drinking water quality before being recharged to the Leederville and Yarragadee aquifers. If these parameters should fall outside of specification, then an automated corrective action is implemented. The operational philosophy of the automated control system ensures that all CCPs will fail-safe. These CCPs are supported by a number of process control points.

Verification monitoring has shown that all recycled water recharged to the aquifers has met the water quality requirements specified in the Wastewater Services & GWR MoU and Department of Environmental Regulation (DWER) licence.

Groundwater quality in the recharge zone is monitored via monitoring bores for each recharge bore to determine the effect of recharged water on the Leederville, Yarragadee and superficial aquifers. All treated water and bore field water samples were 100 per cent compliant with the ADWG.

ISSN 2653-2034

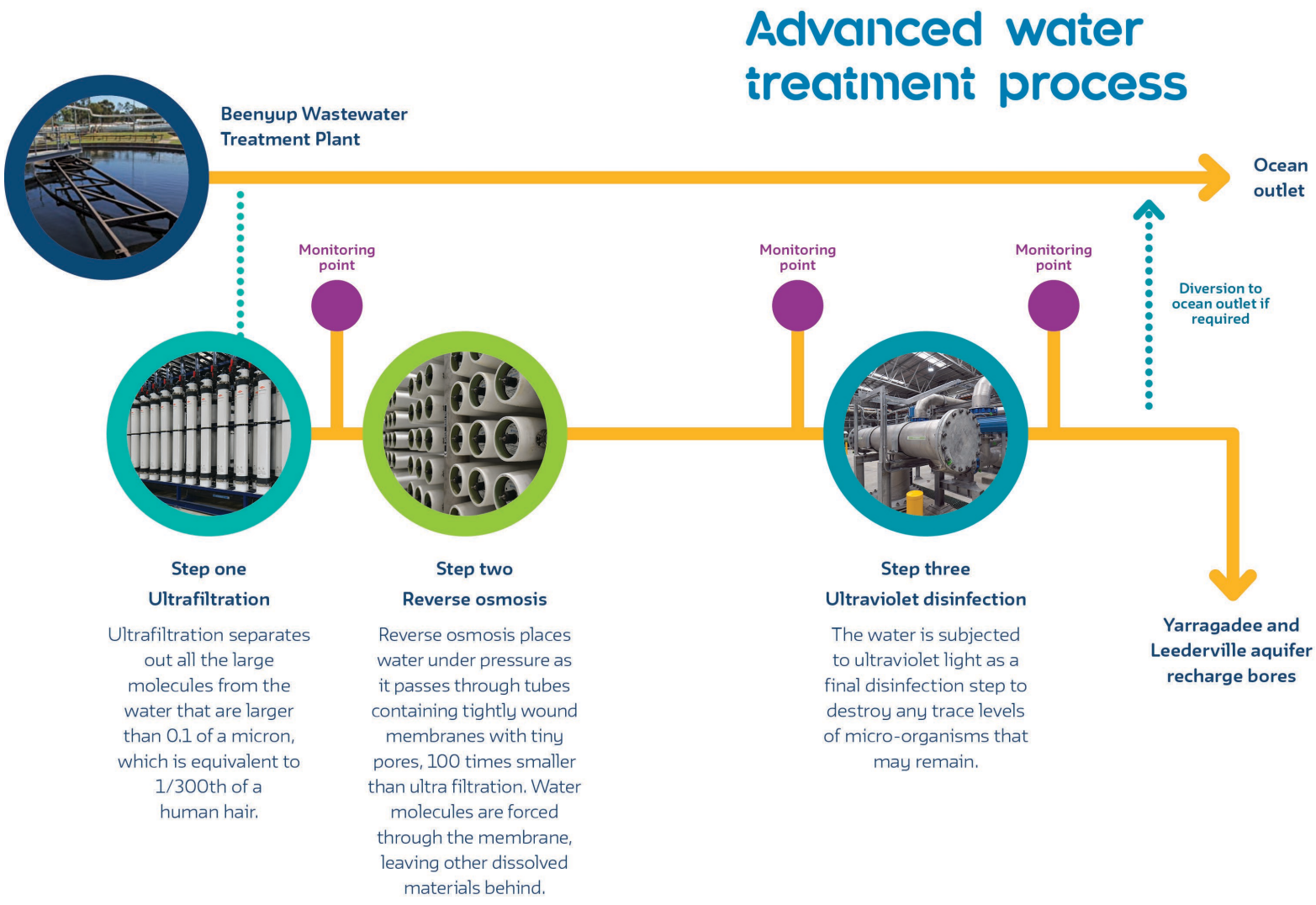


Figure 20: GWRS overview

ISSN 2653-2034

Water quality monitoring objectives

The monitoring of the Perth GWRS consists of testing/measurement of the following:

- Recycled water quality indicators (RWQI)
- Recycled water quality parameters (RWQP)
- Membrane integrity testing
- Groundwater monitoring to assess Leederville and Yarragadee response to recharge.

All sampling requirements for the RWQI and RWQP have been endorsed by DoH.

Recycled water quality indicators and parameters

An RWQI is an individual chemical or microbiological parameter that represents a class of chemicals or pathogens with similar characteristics. Choice of RWQI considers the parameter's toxicity and its source in the wastewater catchment. The purpose of the RWQI is to demonstrate safety of recycled water with respect to specific chemical and microbiological groups, and hence provide additional confidence that all chemical hazards are mitigated. Table 4 provides a summary of the RWQI monitored in the GWRS from 1 July 2020 to 30 June 2021, including the chemical or microbiological groups they represent.

RWQP refers to the water quality parameters to be achieved in the treated water, as agreed with the DoH. Compliance with the recycled water quality parameters will represent protection of human health and health-related environmental values (drinking water resource and industrial water), including protection for primary industry environmental values.

We take samples for 169 RWQP at the GWRS. All RWQP were within the guideline as set out within the MoU and represented by the RWQI. These compliant RWQP results indicate the AWRP produced water at a quality within regulatory specifications and, therefore, from a public health perspective is safe.

All RWQP results from 1 July 2020 to 30 June 2021 are given in Appendix C.

Incident and emergency management

Water Corporation manages the GWRS incidents and emergencies as defined by the Wastewater Services and GWR MoU and outlined in the GWR Incident Management Plan. The plan defines:

- alert and violation levels
- communication protocols
- response plans for dealing with GWRS incidents.

There were no reportable incidents at the GWRS from 1 July 2020 to 30 June 2021.

ISSN 2653-2034

Table 4: RWQI summary (1 July 2020 to 30 June 2021)

Indicator	Group Represented	Units	Guideline Value	Limit of Reporting	Total Number of Readings		Max Reported Value		Requirement Met
					Stage 1	Stage 2	Stage 1	Stage 2	
MS2 Coliphage	Microorganisms (pathogens including viruses)	pfu/100 mL	<1	1	12	12	<1	<1	✓
Boron	Inorganic compounds, metals and metalloids	mg/L	4	0.02	12	12	0.16	0.16	✓
Nitrate as nitrogen		mg/L	11	0.01	12	12	3.5	2.5	✓
N-nitrosodimethylamine	Nitrosamine disinfection by-products	ng/L	100	2	12	12	9.2	<2.0	✓
Chlorate	Inorganic disinfection by-products	mg/L	0.7	0.01	4	4	<0.01	<0.01	✓
Chloroform	Other disinfection by-products	µg/L	200	0.05	12	12	<1.0	<1.0	✓
Carbamazepine	Pharmaceuticals and personal care products	µg/L	100	0.1	12	12	<0.1	<0.1	✓
Diclofenac		µg/L	1.8	0.1	12	12	<0.1	<0.1	✓
Estrone	Hormones	ng/L	30	1	4	4	<1.0	<1.0	✓
Trifluralin	Pesticides and herbicides	µg/L	90	1	4	4	<1.0	<1.0	✓
1,4-Dioxane	Other organic chemicals	µg/L	50	0.1	12	12	<0.1	<0.1	✓
1,4-dichlorobenzene		µg/L	40	1	12	12	<1.0	<1.0	✓
Ethylenediamine tetraacetic acid (EDTA)		µg/L	250	10	12	12	<10	<10	✓
Fluorene		µg/L	140	0.001	2	2	<0.01	<0.01	✓
Octadioxin		pg/L	9,000	2	2	2	2	<2	✓
Alpha particle activity	Radioactivity	mBq/L	500	10	4	4	<35	<34	✓
Beta particle activity (-K40)		mBq/L	500	10	4	4	<71	<71	✓

All RWQI results from 1 July 2020 – 30 June 2021 were below their respective MoU guideline limit, demonstrating the safety of the recycled water produced by the AWRP while using the stringent management systems and processes adapted and developed by Water Corporation for GWRS.

ISSN 2653-2034

Stakeholder and community engagement

The GWRS has continued its community and stakeholder engagement strategy carried forward from the Groundwater Replenishment Trial. These engagement activities include: advertising, traditional media and public relations, correspondence with the Community Advisory Panel, updating groundwater recharge information on Water Corporation's Groundwater Replenishment website, use of social media channels such as YouTube, Facebook and Twitter, and conducting tours at the AWRP and visitor centre, as well as the distribution of quarterly E-newsletters.

Regular presentations and meetings with internal and external stakeholders, including regulators (DoH and DWER) and local government, are conducted to keep them informed regarding the scheme's performance.

Overall, the GWRS has been positively received and publicly supported by the community, local government and stakeholders.

Figure 21: GWR visitor centre

ISSN 2653-2034

Wastewater performance, incidents and complaints

Sewer network performance

The performance of our assets has a direct impact on our ability to deliver essential wastewater conveyance and treatment services.

Service interruptions and compliance breaches are often caused by gravity sewer blockages and wastewater overflows. Through ongoing corrective and preventive maintenance, we keep sewer blockages below the target limit of 40 blockages per 100 km of sewer main (see Figure 17). In 2020-21 there were a total of 2742 blockages in 17,397 km of main.

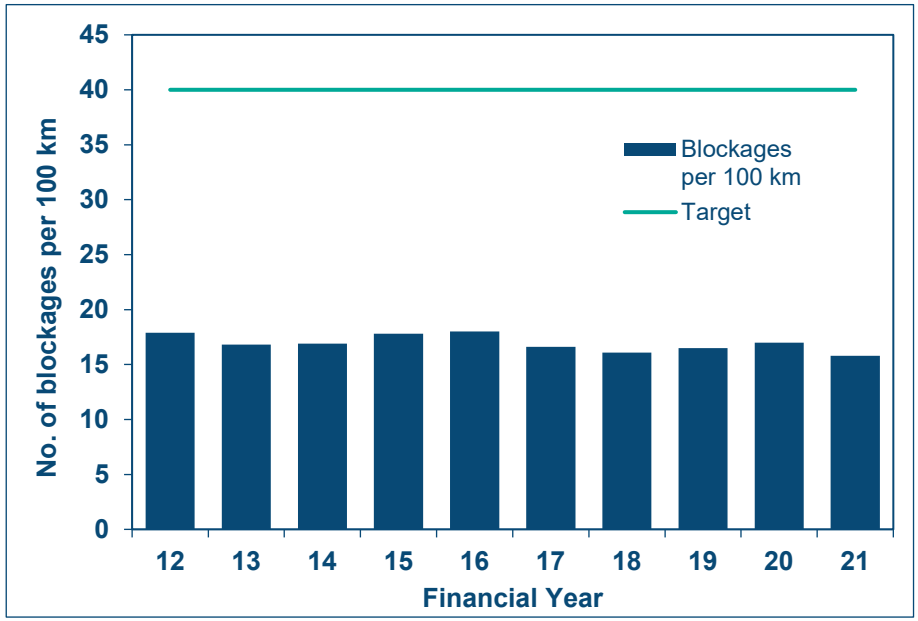


Figure 22: Sewer blockages - number per 100km (2011-12 to 2020-21) – all regions

Wastewater incidents background

WWTPs are designed to reduce biological oxygen demand (BOD) and have sufficient redundancy to ensure Water Corporation's wastewater treatment systems should always be able to reduce BOD to acceptable levels (filtered BOD of less than 20mg/L). Water Corporation regularly monitors the hydraulic and organic loading of its WWTPs to prioritise operational and capital improvements at plants reaching their capacity. Treated wastewater recycled on public open space or anywhere human contact may occur must be adequately disinfected to protect public health.

Required water quality may not be achieved as a result of a WWTP being organically or hydraulically overloaded, an algal bloom, a contaminant introduce in the sewerage system, or treatment issues. This may in turn impact directly on a scheme's ability to achieve appropriate quality for the receiving environment.

In addition, overflows from treatment plants or mains may occur due to hydraulic overloading or burst mains.

Wastewater scheme incident management

We report to the DoH, wastewater incidents with a potential public health impact. There were no incidents of public health impact in the 2020-21 financial year.

ISSN 2653-2034

Wastewater overflows

We operated with 17,397 km of gravity and pressure sewer mains and moved more than 170 billion litres of untreated wastewater through these pipes in 2020-21. Blockages and bursts within these pipes may result in overflows of wastewater into the environment or residential / commercial property. Water Corporation follows strict guidelines to manage these overflows to reduce both the public health and environmental impacts. DoH and / or Department of Water and Environmental Regulation (DWER) are alerted to these overflows and provide advice in their management as required.

Where overflows occur on residential or commercial property Water Corporation works with owners and occupiers to remediate any damage and reduce any inconvenience caused by the overflows.

Overflows can be symptomatic of underlying asset or scheme issues but are more often caused by tree roots or solid items that have been put into the sewer system though a sink or toilet. Items such as fats and cooking oils, kitchen scraps, cotton buds, hygiene products and wet wipes don't break down and can create a blockage in a sewer. Water Corporation continues working to determine root causes of overflows and provide recommendations for future work to decrease the number of overflows occurring each year. See watercorporation.com.au/blockage for more information.

The number of overflow events for 2020-21 was 954 and include volumes as low as 0.05 litres. The following graph (Figure 23) shows the numbers of overflows for the 2020-21 financial year. It is presented by volume range, wastewater type (i.e. treated or untreated wastewater) and by location of the overflow (to the environment or residential/ commercial property). Water Corporation is continuing to improve its reporting and response procedures.

Wastewater quality incidents at recycling schemes

In the period 2020-21, there were three wastewater quality incidents at WWTPs where recycling occurs that required advice or technical on-site remediation. These incidents related to Cyanobacteria (blue green algae) blooms in wastewater treatment ponds.

Additional sampling, treatment with chemicals and control barriers, such as temporary cessation of recycled water use, were used to manage these incidents.

GWR incidents

There were no reportable incidents at the GWRS from 1 July 2020 to 30 June 2021.

ISSN 2653-2034

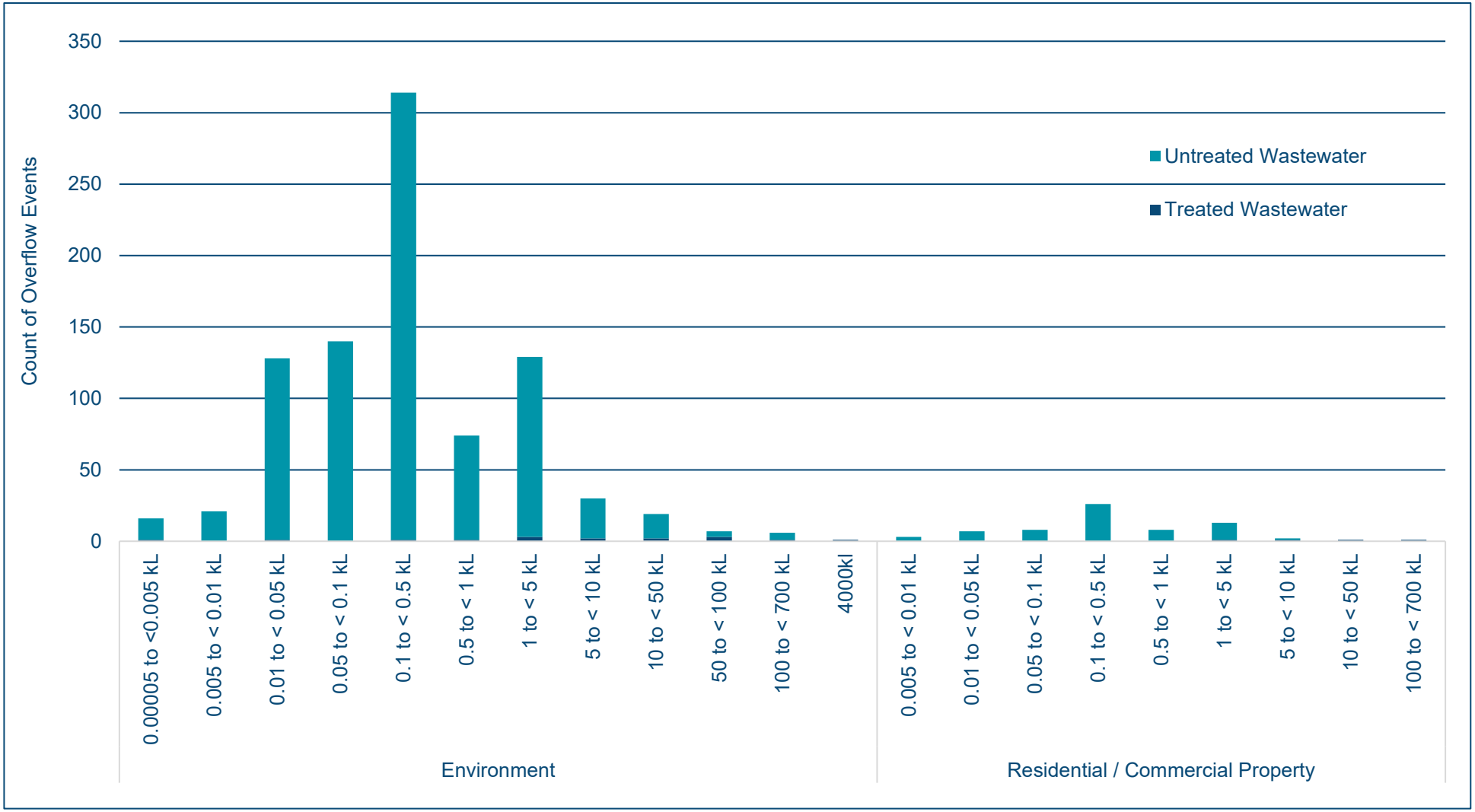


Figure 23: All overflows from Water Corporation assets 2020 - 21 by receiving environment and range

ISSN 2653-2034

Biosolids complaints and incidents

There were two incidents associated with biosolids in 2020-21. The first was a complaint regarding odour from a biosolids truck. Water corporation investigated possible causes of the odour, however apart from high ambient temperatures and high wind strength no other contributing factors were found, and the odour resolved. The second incident was due to the application of biosolids on an unapproved farm paddock following heavy rainfall, causing inundation of the approved paddock, and miscommunication between the farmer (licensee) and the machinery operator. A number of actions were put in place to ensure this is not repeated and the site was investigated for adverse effects. Both incidents were discussed with DoH.

Odour contacts

We are committed to providing high quality management of wastewater; odour buffering and treatment forms part of this management process. Odour is monitored regularly throughout the wastewater treatment process; however, due to the extensive nature of wastewater collection systems and the maintenance of wastewater treatment plants, as well as environmental factors such as high rainfall, wastewater odours can escape the sewer network or the boundaries of wastewater treatment plants.

Although wastewater odours are not a health hazard to the community, we are committed to reducing these odours to maintain the amenity and aesthetic values of surrounding land. Therefore, as part of the commitment to customers to provide wastewater services, we investigate all wastewater odour contacts.

Odours may be related to manholes, wastewater pump stations, overflows or cracked pipes in the conveyance system and, WWTP maintenance, odour scrubbers or process upsets.

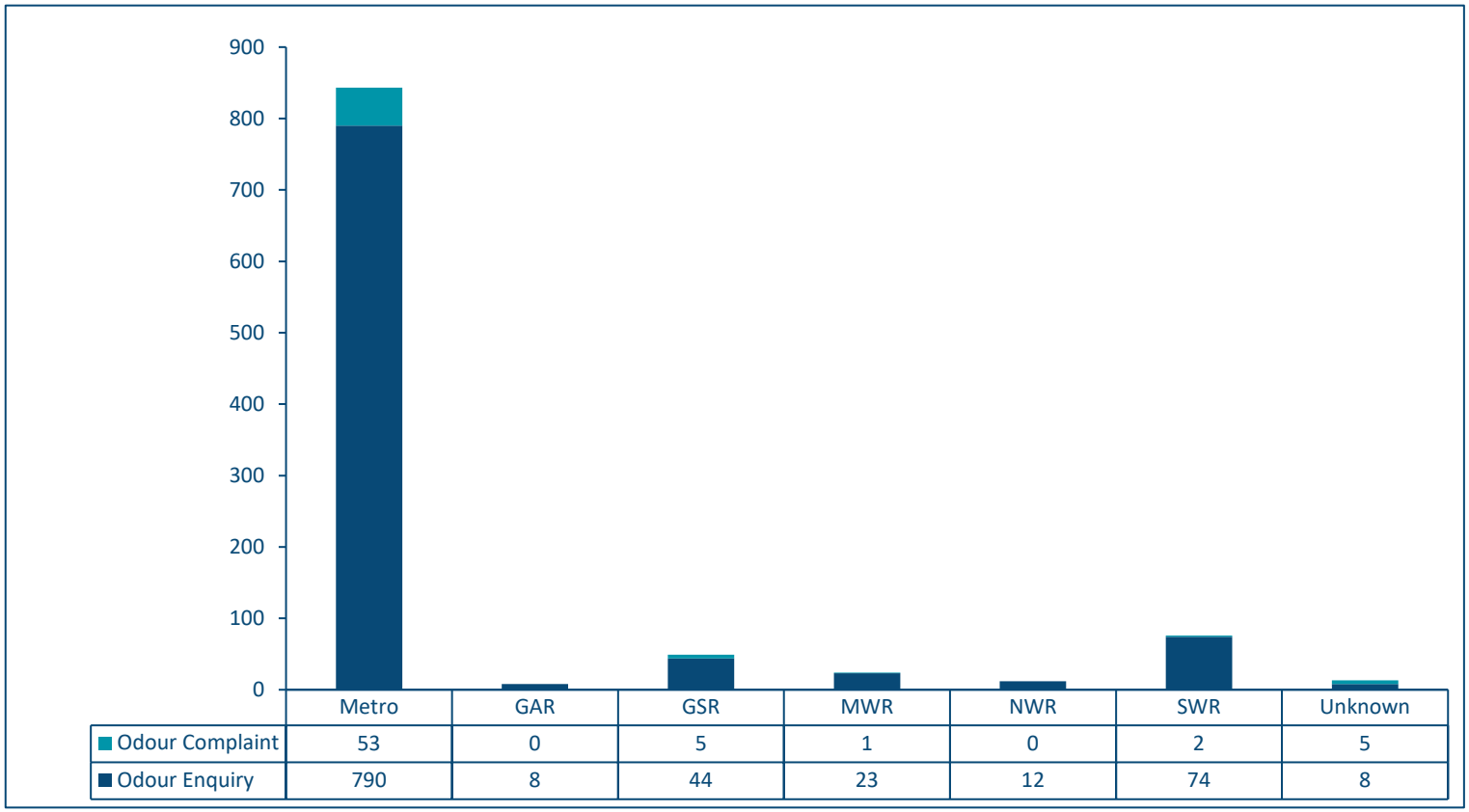
A total of 1025 customer contacts, relating to odour, were received for 2020-21. Of these contacts 959 were recorded as [1]enquiries and 66 as complaints.

Any instance of odour may result in numerous customer contacts, so multiple contacts related to the same odour instance may be recorded here. Figure 25 shows the total odour contacts received per region.

Figure 24: Alkimos WWTP odour control

[1] An enquiry is a request for information or a specific action, a complaint is recorded when an expression of dissatisfaction is made related to a wastewater odour.

ISSN 2653-2034



	Metro	GAR	GSR	MWR	NWR	SWR	Unknown
Odour Complaint	53	0	5	1	0	2	5
Odour Enquiry	790	8	44	23	12	74	8

Figure 25: Odour contacts from 1 July 2020 to 30 June 2021 (total contacts = 1025)

Notes:

This includes biosolids odour contacts.

Unknown = odour contact where the region and district details have not been stored in the database

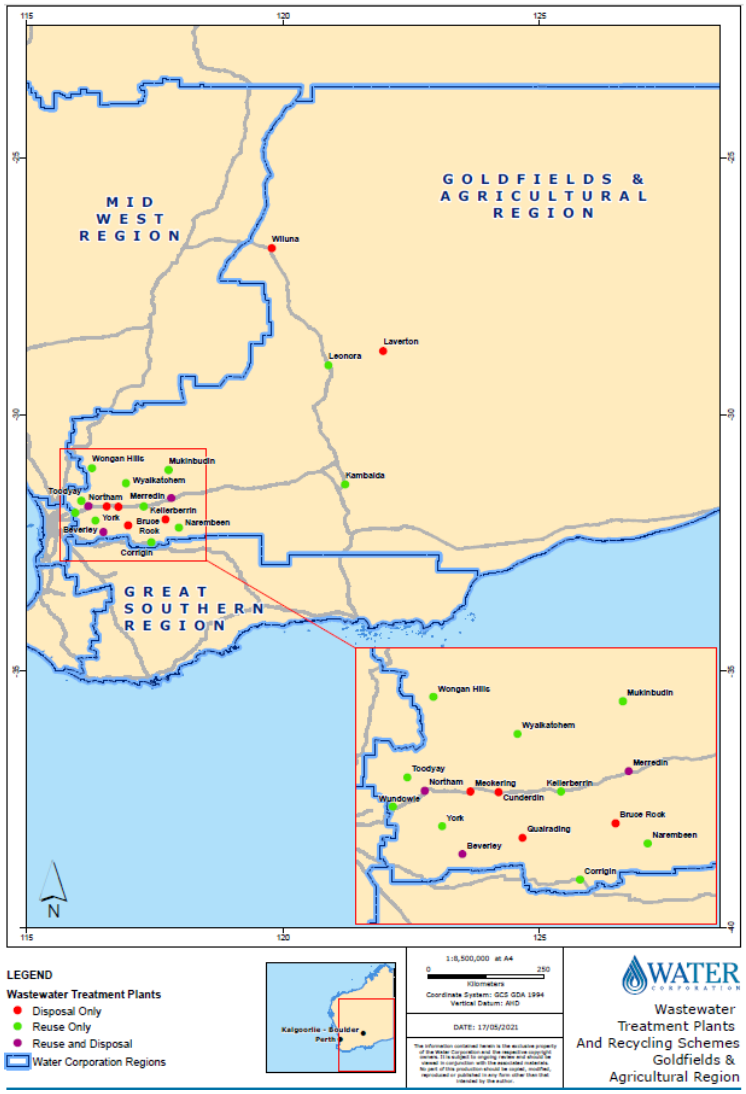
ISSN 2653-2034

Appendix A

Appendix A - Wastewater treatment plants and recycling schemes

Table 5: Goldfields and Agricultural Region

Region	Location	Treatment type	Recycling
GAR	BEVERLEY	Pond	Shire of Beverley
	BRUCE ROCK	Septic Tank Effluent Disposal	
	CORRIGIN	Pond	Shire of Corrigin
	CUNDERDIN	Pond	
	KAMBALDA	Activated sludge	Private scheme
	KELLERBERRIN	Pond	Shire of Kellerberrin
	LAVERTON	Pond	
	LEONORA	Pond	Shire of Leonora
	MECKERING	Pond	
	MERREDIN	Pond	Shire of Merredin
	MUKINBUDIN	Pond	Shire of Mukinbudin
	NAREMBEEN	Pond	Shire of Narembeen
	NORTHAM	Pond	Shire of Northam
	QUAIRADING	Pond	
	TOODYAY	Pond	Water Corporation
	WILUNA	Pond	
	WONGAN HILLS	Pond	Shire of Wongan-Ballidu
	WUNDOWIE	Pond	Shire of Northam (Wundowie and Bakers Hill Ovals)
	WYALKATCHEM	Pond	Shire of Wyalkatchem
	YORK	Pond	

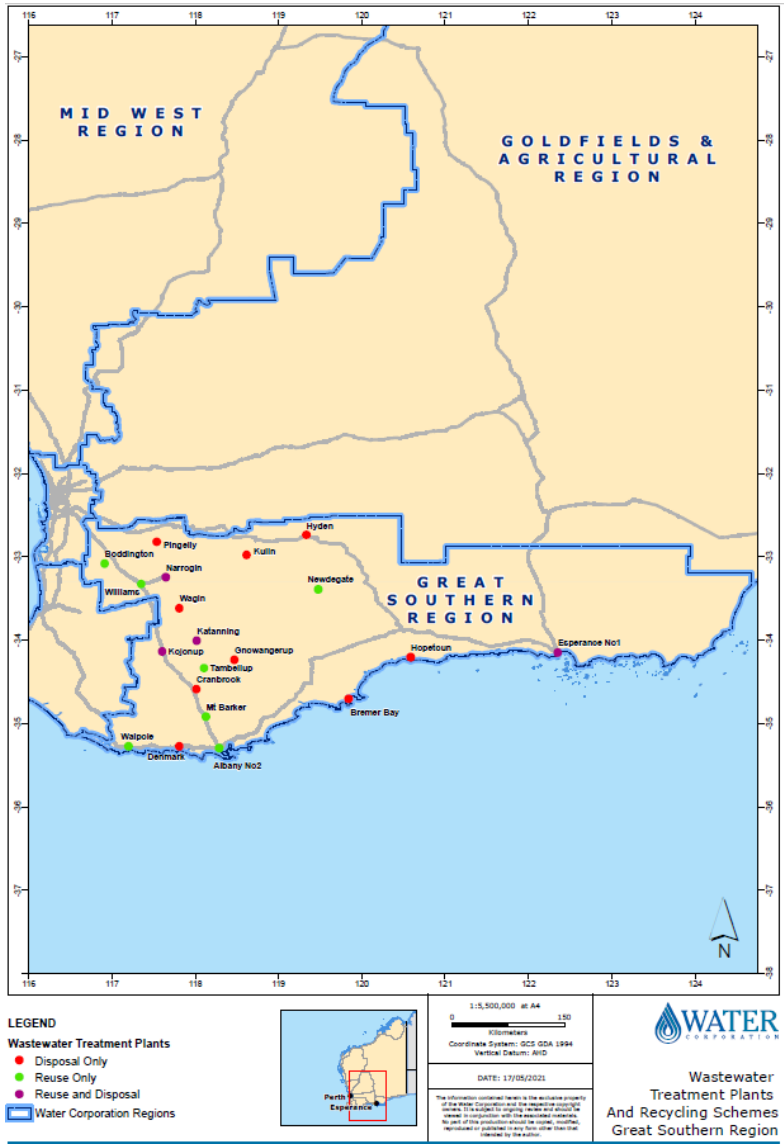


ISSN 2653-2034

Appendix A

Table 6: Great Southern Region

Region	Location	Treatment type	Recycling
GSR	ALBANY, TIMEWELL RD	Activated sludge	Water Corporation
	BODDINGTON	Pond	Private scheme
	BREMER BAY	Pond	
	CRANBROOK	Pond	
	DENMARK	Activated sludge	
	ESPERANCE	Pond	Shire of Esperance
	GNOWANGERUP	Pond	
	HOPETOUN	Pond	
	HYDEN	Septic Tank Effluent Disposal, Pond	
	KATANNING	Pond	Shire of Katanning 2 Private schemes
	KOJONUP	Pond	Shire of Kojonup
	KULIN	Pond	Shire of Kulin
	MOUNT BARKER	Pond	Water Corporation
	NARROGIN	Pond	Town of Narrogin
	NEWDEGATE	Pond	
	PINGELLY	Pond	Shire of Pingelly
	TAMBELLUP	Pond	Shire of Tambellup-Broomehill
	WAGIN	Pond	
	WALPOLE	Activated sludge	Water Corporation
	WILLIAMS	Pond	Shire of Williams



ISSN 2653-2034

Appendix A

Table 7: Mid West Region

Region	Location	Treatment type	Recycling
MWR	BOOTENAL, CAPE BURNEY	Pond	
	CARNARVON	Pond	Shire of Carnarvon Private scheme (secondary Recipient)
	CERVANTES	Pond	
	CORAL BAY	Pond	
	DENHAM	Pond	
	DONGARA	High Performance Aerated Lagoon	Shire of Irwin
	ENEABBA	Pond	
	EXMOUTH	Pond	Shire of Exmouth
	GERALDTON NORTH GLENFIELD	Pond	
	GERALDTON 2	Pond	5 Private schemes
	GREEN HEAD	Pond	
	HORROCKS	Pond	
	JURIEN BAY	Pond	
	KALBARRI	Pond	Shire of Northampton
	LANCELIN	Pond	
	LEDGE POINT	Pond	
	LEEMAN	Pond	
	NARNGULU (SOUTH GERALDTON)	High Performance Aerated Lagoon	
	THREE SPRINGS	Pond	

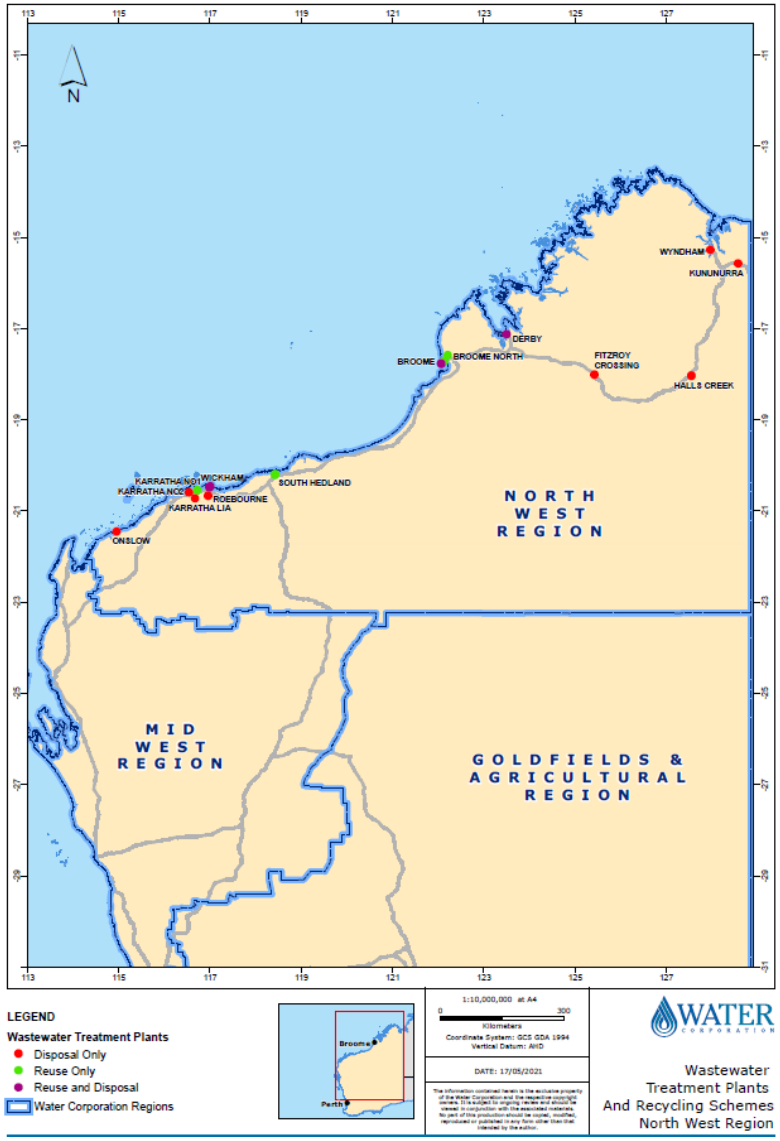
ISSN 2653-2034

Appendix A

Table 8: North West Region

Region	Location	Treatment type	Recycling
NWR	BROOME NORTH	Pond	Water Corporation Private scheme
	BROOME SOUTH	Pond	Shire of Broome 2 Private schemes
	DERBY	Pond	Private scheme
	FITZROY CROSSING	Pond	
	HALLS CREEK	Pond	
	KARRATHA 1 MILLSTREAM RD	Pond	City of Karratha
	KARRATHA 2	Pond	
	KARRATHA 3, LIA	Pond	
	KUNUNURRA	Pond	
	ONSLOW	Pond	
	ROEBOURNE	Pond	
	SOUTH HEDLAND	Pond	Town of Port Hedland Private scheme
	WICKHAM	Pond	Shire of Roebourne Private scheme
	WYNDHAM	Pond	
	CHRISTMAS ISLAND (IOT)	Activated sludge	
	COCOS HOME ISLAND (IOT)	Activated sludge	
	COCOS WEST ISLAND(IOT)	Activated sludge	

Includes Indian Ocean Territories (IOT) owned by Commonwealth, managed by Water Corporation – not shown on map.



ISSN 2653-2034

Appendix A

Table 9: Perth (Metro) Region

Region	Location	Treatment type	Recycling
Perth	ALKIMOS	Activated sludge	
	BEENYUP	Activated sludge UF, RO and UV Disinfection for GWRS	Groundwater Replenishment Scheme (refer to page 31)
	BULLSBROOK	Activated sludge	
	CADDADUP, MANDURAH 3	Activated sludge	City of Mandurah Private scheme
	EAST ROCKINGHAM	Activated sludge	
	KWINANA	Activated sludge	
	MANDURAH 1, GORDON RD	Activated sludge	City of Mandurah
	MANDURAH 2, HALLS HEAD	Activated sludge	City of Mandurah Private scheme
	MUNDARING	Activated sludge	Shire of Mundaring Private scheme
	PINJARRA	Pond	Private scheme
	POINT PERON	Primary; sludge thickening	
	SUBIACO	Activated sludge	Water Corporation 3 Private schemes
	WOODMAN POINT	Activated sludge UF and RO at KWRP for recycled water	5 Private industrial schemes

ISSN 2653-2034

Appendix A

Table 10: South West Region

Region	Location	Treatment type	Recycling
SWR	AUGUSTA	Pond	
	BINNINGUP	Pond	
	BRIDGETOWN	Activated sludge	Private scheme
	BRUNSWICK	Pond	
	BUNBURY	Activated sludge	
	BUREKUP	Pond	
	BUSSELTON (YUNDERUP)	Activated sludge	2 Private schemes
	CAPEL	Pond	
	COLLIE	Activated sludge	
	DARDANUP	Pond	
	DONNYBROOK (BOYANUP)	Pond	Water Corporation
	DUNSBOROUGH 2	Activated sludge	Water Corporation
	GNARABUP BEACH (PREVELLY)	Activated sludge	
	HARVEY	Pond	
	KEMERTON (AUSTRALIND)	Activated sludge	Water Corporation
	MANJIMUP	Pond	Water Corporation Private scheme
	MARGARET RIVER 2 (COWARAMUP)	Activated sludge	Water Corporation Shire of Augusta and Margaret River 2 Private schemes
	NANNUP	Pond	Water Corporation
	PEMBERTON	Activated sludge	Shire of Manjimup
	WAROONA	Pond	

ISSN 2653-2034

Appendix B

Appendix B - Groundwater replenishment – all recycled water quality parameters (RWQP)

Table 11: Recycled water quality parameter results 1 July 2020 to 30 June 2021

Parameter	Units	Guideline	LOR	Total Readings		Max Value Reported		Requirement Met
				Stage 1	Stage 2	Stage 1	Stage 2	
1,4-Dichlorobenzene	µg/L	40	1	1	1	<1.0	<1.0	✓
1,4-Dioxane	µg/L	50	0.1	1	1	<1.0	<1.0	✓
17alpha-estradiol	ng/L	175	1	1	1	<1.0	<1.0	✓
17beta-estradiol	ng/L	175	1	1	1	<1.0	<1.0	✓
1-methylnaphthalene	µg/L	0	1	1	1	<0.1	<0.1	✓
2,4,6-trichlorophenol	µg/L	20	1	1	1	<1.0	<1.0	✓
2,4-dichlorophenol	µg/L	200	1	1	1	<1.0	<1.0	✓
2,4-dichlorophenoxyacetic acid	µg/L	30	0.5	1	1	<0.5	<0.5	✓
2,6-dichlorophenol	µg/L	10	1	1	1	<1.0	<1.0	✓
2,6-di-tert-butylphenol	µg/L	2	0.05	1	1	<0.05	<0.05	✓
2-chlorophenol	µg/L	300	1	1	1	<1.0	<1.0	✓
2-methyl-naphthalene	µg/L	-	0.1	1	1	<0.1	<0.1	✓
2-nitrophenol	µg/L	0.7	0.5	1	1	<0.5	<0.5	✓
2-phenylphenol	µg/L	20	1	1	1	<1.0	<1.0	✓
2-propyltoluene	µg/L	0.7	0.5	1	1	<0.5	<0.5	✓
4-chloro-2-methylphenoxy acetic acid (MCPA)	µg/L	35	1	1	1	<1.0	<1.0	✓
4-chlorophenol	µg/L	10	1	1	1	<1.0	<1.0	✓
4-cumylphenol	µg/L	0.35	0.05	1	1	<0.05	<0.05	✓
4-nitrophenol	µg/L	30	1	1	1	<1.0	<1.0	✓
4-nonylphenol	µg/L	500	10	1	1	<10	<10	✓
4-tert-octylphenol	µg/L	50	10	1	1	<10	<10	✓
Acenaphthene	µg/L	-	0.001	1	1	<0.001	<0.001	✓

ISSN 2653-2034

Appendix B

Parameter	Units	Guideline	LOR	Total Readings		Max Value Reported		Requirement Met
				Stage 1	Stage 2	Stage 1	Stage 2	
Acenaphthylene	µg/L	-	0.001	1	1	<0.001	<0.001	✓
Aluminium	mg/L	0.2	0.005	1	1	<0.005	<0.005	✓
Ammonia as nitrogen	mg/L	0.5	0.01	1	1	0.64	0.58	✓
Androstenedione	ng/L	9	2	1	1	<2.0	<2.0	✓
Anthracene	µg/L	150	0.001	1	1	<0.001	<0.001	✓
Antimony	mg/L	0.003	0.0001	1	1	<0.0001	<0.0001	✓
Arsenic Unfiltered	mg/L	0.01	0.001	1	1	<0.001	<0.001	✓
Atrazine	µg/L	40	0.1	1	1	<0.1	<0.1	✓
Barium	mg/L	2	0.002	1	1	<0.002	<0.002	✓
Benzidine	ng/L	0.2	20	1	1	<20	<20	✓
Benzo(a)anthracene	µg/L	-	0.001	1	1	<0.001	<0.001	✓
Benzo(a)pyrene	µg/L	0.01	0.001	1	1	<0.001	<0.001	✓
Benzo(b)fluoranthene	µg/L	-	0.001	1	1	<0.001	<0.001	✓
Benzo(g,h,i)perylene	µg/L	-	0.001	1	1	<0.001	<0.001	✓
Benzo(k)fluoranthene	µg/L	-	0.001	1	1	<0.001	<0.001	✓
Benzotriazole	µg/L	20	1	1	1	<1.0	<1.0	✓
Beryllium	mg/L	0.004	0.0001	1	1	<0.0001	<0.0001	✓
Bisphenol A	µg/L	200	1	1	1	<10	<10	✓
Boron	mg/L	4	0.02	1	1	0.16	0.16	✓
Bromochloroacetic acid	µg/L	0.7	0.7	1	1	<0.7	<0.7	✓
Bromochloromethane (LOR - 1 µg/L)	µg/L	40	1	1	1	<0.1	<0.1	✓
Bromodichloromethane	µg/L	6	1	1	1	<0.1	<0.1	✓
Bromoform	µg/L	100	1	1	1	<0.1	<0.1	✓
Cadmium	mg/L	0.002	0.0001	1	1	<0.0001	<0.0001	✓
Carbamazepine (LOR - 0.1 µg/L)	µg/L	100	0.1	1	1	<0.1	<0.1	✓
Carbon disulfide	µg/L	700	1	1	1	<1.0	<1.0	✓

ISSN 2653-2034

Appendix B

Parameter	Units	Guideline	LOR	Total Readings		Max Value Reported		Requirement Met
				Stage 1	Stage 2	Stage 1	Stage 2	
Chlorate	mg/L	0.7	0.01	1	1	<0.01	<0.01	✓
Chloride	mg/L	250	1	1	1	5	3	✓
Chloroacetic acid	µg/L	150	2	1	1	<0.2	<0.2	✓
Chloroform	µg/L	200	1	1	1	<1.0	<1.0	✓
Chlorophene	µg/L	0.35	0.05	1	1	<0.05	<0.05	✓
Chromium	mg/L	0.05	0.0005	1	1	<0.0005	<0.0005	✓
Chrysene	µg/L	-	0.001	1	1	<0.001	<0.001	✓
Clostridium perfringens spores	cfu/100mL	<1	1	1	1	<1.0	<1.0	✓
Cobalt	mg/L	0.001	0.0001	1	1	<0.0001	<0.0001	✓
Coliphage (MS2)	pfu/100mL	<1	1	1	1	<1.0	<1.0	✓
Coliphage (somatic)	pfu/100mL	<1	1	1	1	<1.0	<1.0	✓
Copper	mg/L	2	0.0001	1	1	0.0004	<0.0001	✓
Dibenzo(a,h)anthracene	µg/L	-	0.001	1	1	<0.001	<0.001	✓
Dibromochloroacetic acid	µg/L	0.7	<0.7	1	1	<0.7	<0.7	✓
Dibromomonochloromethane	µg/L	100	1	1	1	<1.0	<1.0	✓
Dichloroacetic acid	µg/L	100	2	1	1	<2.0	<2.0	✓
Dichloromethane	µg/L	4	1	1	1	<1.0	<1.0	✓
Diclofenac (LOR - 0.1 µg/L)	µg/L	1.8	0.1	1	1	<0.1	<0.1	✓
DTPA	µg/L	20	10	1	1	<10	<10	✓
Equilenin	ng/L	30	2	1	1	<2.0	<2.0	✓
Equilin	ng/L	30	2	1	1	<2.0	<2.0	✓
Estriol	ng/L	50	1	1	1	<1.0	<1.0	✓
Estrone	ng/L	30	1	1	1	<1.0	<1.0	✓
Ethinyl Estradiol	ng/L	1.5	1	1	1	<1.0	<1.0	✓
Ethylenediamine tetraacetic acid	µg/L	250	10	1	1	<10	<10	✓
Etiocholanolone	ng/L	7	2	1	1	<2.0	<2.0	✓

ISSN 2653-2034

Appendix B

Parameter	Units	Guideline	LOR	Total Readings		Max Value Reported		Requirement Met
				Stage 1	Stage 2	Stage 1	Stage 2	
Fluoranthene	µg/L	-	0.001	1	1	<0.001	<0.001	✓
Fluorene	µg/L	140	0.001	1	1	<0.001	<0.001	✓
Fluoride	mg/L	1.5	0.05	1	1	<0.05	<0.05	✓
Flupropanate	ug/L	9	0.5	1	1	<0.5	<0.5	✓
Galaxolide	µg/L	1800	1	1	1	<1.0	<1.0	✓
Glyphosate	µg/L	1000	100	1	1	<100	<100	✓
Gross alpha activity	mBq/L	500	0.01	1	1	<35	<34	✓
Gross beta activity minus K40	mBq/L	500	0.01	1	1	<71	<71	✓
HeptaCDD (1,2,3,4,6,7,8-HpCDD)	pg/L	-	2	1	1	<1.0	<1.0	✓
HeptaCDF (1,2,3,4,6,7,8-HpCDF)	pg/L	-	1	1	1	<1.0	<1.0	✓
HeptaCDF (1,2,3,4,7,8,9-HpCDF)	pg/L	-	1	1	1	<1.0	<1.0	✓
HexaCDD (1,2,3,4,7,8-HxCDD)	pg/L	-	1	1	1	<1.0	<1.0	✓
HexaCDD (1,2,3,6,7,8-HxCDD)	pg/L	-	1	1	1	<1.0	<1.0	✓
HexaCDD (1,2,3,7,8,9-HxCDD)	pg/L	-	1	1	1	<1.0	<1.0	✓
HexaCDF (1,2,3,4,7,8-HxCDF)	pg/L	-	1	1	1	<1.0	<1.0	✓
HexaCDF (1,2,3,6,7,8-HxCDF)	pg/L	-	1	1	1	<1.0	<1.0	✓
HexaCDF (1,2,3,7,8,9-HxCDF)	pg/L	-	1	1	1	<1.0	<1.0	✓
HexaCDF (2,3,4,6,7,8-HxCDF)	pg/L	-	1	1	1	<1.0	<1.0	✓
Indeno(1,2,3-c,d)pyrene	µg/L	-	0.001	1	1	<0.001	<0.001	✓
Iodide	mg/L	0.1	0.02	1	1	<0.02	<0.02	✓
Iron	mg/L	0.3	0.005	1	1	<0.01	<0.01	✓
Iron unfiltered	mg/L	0.3	0.01	1	1	<0.0001	<0.0001	✓
Lead	mg/L	0.1	0.0001	1	1	<0.0001	<0.0001	✓
Lithium	mg/L	0.15	0.0001	1	1	<0.0003	<0.0003	✓
Magnesium	mg/L	800	0.1	1	1	<0.1	<0.1	✓
Manganese	mg/L	0.5	0.001	1	1	<0.001	<0.001	✓

ISSN 2653-2034

Appendix B

Parameter	Units	Guideline	LOR	Total Readings		Max Value Reported		Requirement Met
				Stage 1	Stage 2	Stage 1	Stage 2	
Mercury	mg/L	0.001	0.0001	1	1	<0.0001	<0.0001	✓
Mestranol	ng/L	2.5	2	1	1	<2.0	<2.0	✓
Methyl-tert-butyl ether	µg/L	13	1	1	1	<1.0	<1.0	✓
Metolachlor	µg/L	300	0.1	1	1	<0.1	<0.1	✓
Molybdenum	mg/L	0.5	0.001	1	1	<0.001	<0.001	✓
N,N-diethyl-m-toluamide	µg/L	2500	0.1	1	1	<0.1	<0.1	✓
Nickel	mg/L	0.02	0.001	1	1	<0.001	<0.001	✓
Nitrate as nitrogen	mg/L	11	0.01	1	1	3.5	2.5	✓
Nitrite as nitrogen	mg/L	1	0.01	1	1	<0.01	<0.01	✓
N-nitrosodiethylamine (NDEA)	ng/L	10	2	1	1	9.2	<0.2	✓
N-nitrosodimethylamine (NDMA)	ng/L	100	2	1	1	4.6	3.6	✓
N-nitrosodi-n-butylamine (NDBA)	ng/L	6	2	1	1	4.8	4.8	✓
N-nitrosodi-n-propylamine (NDPA)	ng/L	5	2	1	1	<2.0	<2.0	✓
N-nitroso-diphenylamine (NDPhA)	ng/L	7000	10	1	1	<10	<10	✓
N-nitrosoethylmethylamine (NEMA)	ng/L	2	2	1	1	<0.2	<0.2	✓
N-nitrosomorpholine (NMOR)	ng/L	5	2	1	1	2.2	7.7	✓
N-nitrosopiperidine (NPIP)	ng/L	4	2	1	1	<2.0	<2.0	✓
N-nitrosopyrrolidine (NPYR)	ng/L	20	2	1	1	<2.0	<2.0	✓
Norethindrone	ng/L	250	100	1	1	<100	<100	✓
Octadioxin	pg/L	9000	2	1	1	2	<2	✓
Octafuran	pg/L	-	4	1	1	<1.0	<1.0	✓
PCB 105	pg/L	-	20	1	1	<41	<20	✓
PCB 114	pg/L	-	4	1	1	<4	<4	✓
PCB 118	pg/L	-	100	1	1	<100	<100	✓
PCB 123	pg/L	-	2	1	1	<2	<2	✓
PCB 126	pg/L	-	1	1	1	<2	<1	✓

ISSN 2653-2034

Appendix B

Parameter	Units	Guideline	LOR	Total Readings		Max Value Reported		Requirement Met
				Stage 1	Stage 2	Stage 1	Stage 2	
PCB 156	pg/L	-	10	1	1	<10	<10	✓
PCB 157	pg/L	-	1	1	1	<1.0	<1.0	✓
PCB 167	pg/L	-	10	1	1	<10	<10	✓
PCB 169	pg/L	-	1	1	1	<1.0	<1.0	✓
PCB 189	pg/L	-	2	1	1	<2	<2	✓
PCB 77	pg/L	-	2	1	1	<2	<1.0	✓
PCB 81	pg/L	-	1	1	1	<2	<1	✓
PentaCDD (1,2,3,7,8-PeCDD)	pg/L	-	1	1	1	<1	<1	✓
PentaCDF (1,2,3,7,8-PeCDF)	pg/L	-	1	1	1	<1	<1	✓
PentaCDF (2,3,4,7,8-PeCDF)	pg/L	-	1	1	1	<1	<1	✓
Pentachlorophenol	µg/L	10	1	1	1	<1.0	<1.0	✓
Perchlorate	µg/L	6	0.5	1	1	<0.5	<0.5	✓
Perfluorooctane sulfonate (PFOS)	µg/L	0.07	0.05	1	1	<0.05	<0.05	✓
Perfluorooctanoic acid (PFOA)	µg/L	0.56	0.05	1	1	<0.05	<0.05	✓
pH measured in laboratory	No unit	6.0-8.5	0.1	1	1	7.4	7.3	✓
Phenanthrene	µg/L	150	0.001	1	1	<0.001	<0.001	✓
Progesterone	ng/L	105	100	1	1	<100	<100	✓
Propiconazole	µg/L	100	0.1	1	1	<0.05	<0.05	✓
Pyrene	µg/L	150	0.001	1	1	<0.001	<0.001	✓
Selenium	mg/L	0.01	0.001	1	1	<0.001	<0.001	✓
Silver	mg/L	0.1	0.0001	1	1	<0.0001	<0.0001	✓
Simazine	µg/L	20	0.1	1	1	<0.1	<0.1	✓
Sodium	mg/L	180	0.1	1	1	8.8	5.3	✓
Strontium	mg/L	4	0.0001	1	1	<0.002	<0.002	✓
Sulphate	mg/L	500	0.01	1	1	<0.1	<0.1	✓
Testosterone	ng/L	7	2	1	1	<2.0	<2.0	✓

ISSN 2653-2034

WATER CORPORATION

Appendix B

Parameter	Units	Guideline	LOR	Total Readings		Max Value Reported		Requirement Met
				Stage 1	Stage 2	Stage 1	Stage 2	
TetraCDD(2,3,7,8-TCDD)	pg/L	-	1	1	1	<1.0	<1.0	✓
TetraCDF (2,3,7,8-tetraCDF)	pg/L	-	1	1	1	<1.0	<1.0	✓
Thallium	mg/L	0.002	0.0001	1	1	<0.0001	<0.0001	✓
Thermotolerant coliforms	cfu/100 mL	<1	1	1	1	<1.0	<1.0	✓
Tin	mg/L	14	0.0001	1	1	<0.0001	<0.0001	✓
Tolyltriazole	µg/L	20	1	1	1	<1.0	<1.0	✓
Total cyanide	mg/L	0.08	0.01	1	1	<0.01	<0.01	✓
Total dissolved solids by evaporation	mg/L	500	10	1	1	42	30	✓
Total trihalomethanes	µg/L	250	4	1	1	<4.0	<4.0	✓
Tribromoacetic acid	µg/L	0.7	0.7	1	1	<0.7	<0.7	✓
Trichloroacetic acid	µg/L	100	1	1	1	<1.0	<1.0	✓
Trifluralin	µg/L	90	1	1	1	<1.0	<1.0	✓
Turbidity	NTU	5	0.5	1	1	<0.5	<0.5	✓
Uranium	mg/L	0.02	0.0001	1	1	<0.0001	<0.0001	✓
Vanadium	mg/L	0.015	0.005	1	1	<0.0001	<0.0001	✓
Zinc	mg/L	3	0.005	1	1	0.007	<0.005	✓

Note: All data statistics are calculated assuming <limit of reporting (LOR) data are equal to LOR (e.g. <0.1 µg/L is 0.1 µg/L for calculation purposes).

Table 12: Description of units

Abbreviation	Full name	Relative to grams per litre (g/L)
mg/L	Milligrams per litre	10^{-3} or 0.001
µg/L	Micrograms per litre	10^{-6} or 0.000001
ng/L	Nanograms per litre	10^{-9} or 0.000000001
pg/L	Picograms per litre	10^{-12} or 0.000000000001
cfu/100 mL	Colony forming units per 100ml	Not applicable
NTU	Nephelometric Turbidity Units	Not applicable

ISSN 2653-2034

Appendix C

Appendix C – Recycled Water Quality Data - sampling undertaken by Water Corporation as per MoU

Table 13: Low and medium exposure risk recycling schemes

Region	WWTP	Primary Recipient	Residual (1)TCl mnthly compliance (# samples)	Samples <0.2 mg/L	Requirement met	Residual (1)TCl wkly check (# samples)	Samples <0.2 mg residual	Requirement met	Suspended Solids (# samples)	Samples >30 mg/L	Requirement met	pH (# samples)	samples outside 6.5-8.5	Requirement met	*E.coli* (# samples)	samples >1000cfu/ 100mL (for low risk)	Requirement met
GAR	Beverley	Shire of Beverley	-	-	(2)	58	24	(6)	-	-	(3)	-	-	(2)	-	-	(2)
GAR	Kambalda	Private Scheme	-	-	(2)	10	0	✓	-	-	(3)	-	-	(2)	-	-	(2)
GAR	Leonora	Shire of Leonora	-	-	(2)	45	6	(6)	-	-	(3)	-	-	(2)	-	-	(2)
GAR	Mukinbudin	Shire of Mukinbudin	-	-	(2)	42	10	(6)	-	-	(3)	-	-	(2)	-	-	(2)
GSR	Boddington	Private Scheme	-	-	(2)	46	0	✓	-	-	(3)	-	-	(2)	-	-	(2)
GSR	Esperance 1	Shire of Esperance	-	-	(2)	-	-	(2)	-	-	(3)	-	-	(2)	-	-	(2)
GSR	Katanning	Private Scheme 1	-	-	(2)	37	21	(6)	-	-	(3)	12	0	✓	-	-	(2)
GSR	Katanning	Private Scheme 2	-	-	(2)	54	21	(6)	-	-	(3)	-	-	(2)	-	-	(2)
GSR	Katanning	Shire of Katanning	-	-	(2)	54	21	(6)	-	-	(3)	-	-	(2)	-	-	(2)
GSR	Kojonup	Shire of Kojonup	-	-	(2)	37	0	✓	-	-	(3)	-	-	(2)	-	-	(2)
GSR	Kulin	Shire of Kulin	-	-	(2)	17	0	✓	-	-	(3)	-	-	(2)	-	-	(2)
GSR	Narrogin	Shire of Narrogin			(2)	45	0	✓	-	-	(3)	-	-	(2)	-	-	(2)
GSR	Tambellup	Shire of Tambellup-Broomehill	-	-	(2)	34	0	✓	-	-	(3)	-	-	(2)	-	-	(2)
GSR	Williams	Shire of Williams	-	-	(2)	46	0	✓	-	-	(3)	-	-	(2)	-	-	(2)
MWR	Dongara	Shire of Irwin	-	-	(2)	44	0	✓	-	-	(3)	-	-	(2)	-	-	(2)
MWR	Kalbarri	Shire of Northampton	-	-	(2)	44	7	(6)	-	-	(3)	-	-	(2)	-	-	(2)
NWR	Broome North	Water Corporation	10	0	✓	55	0	✓	-	-	(3)	12	0	✓	12	0	✓
NWR	Broome South	Shire of Broome	17	0	✓	57	0	✓	-	-	(3)	31	0	✓	18	3	(8)
NWR	Broome South	Private scheme 1	17	0	✓	57	0	✓	-	-	(3)	31	0	✓	18	3	(8)
NWR	Broome South	Private scheme 2	17	0	✓	57	0	✓	-	-	(3)	31	0	✓	18	3	(8)
NWR	Derby	Private Scheme.	14	2	(7)	49	3	(6)	-	-	(3)	12	1	(6)	14	2	(8)
Perth	Mundaring	Shire of Mundaring	12	0	✓	51	2	(6)	12	0	✓	12	0	✓	12	0	✓
Perth	Mundaring	Private scheme	9	1	(6)	51	2	(6)	12	0	✓	12	0	✓	9	0	✓
SWR	Bridgetown	Private Scheme	8	0	✓	24	0	✓	-	-	(3)	7	1	(6)	8	1	(4)
SWR	Manjimup	Private Scheme	-	-	(2)	17	1	(6)	-	-	(3)	-	-	(2)	-	-	(2)
SWR	Margaret River	Shire of Margaret River	-	-	(2)	39	0	✓	12	0	✓	-	-	(2)	-	-	(2)
SWR	Margaret River	Private Scheme	-	-	(2)	39	0	✓	12	0	✓	-	-	(2)	-	-	(2)
SWR	Margaret River	Water Corporation	12	0	✓	-	-	(5)	-	-	(5)	-	-	(5)	-	-	(5)

Notes:

(1) TCl = total chlorine
(2) This sampling is not the responsibility of Water Corporation
(3) Suspended Solids not applicable to these schemes
(4) Resample taken and within Guideline and approval limits
(5) This sampling is not required in the DoH approval
(6) Operational exception – health compliance still achieved
(7) Corresponding to 2 *E. coli* exceedances. Adjustments made to system and next sample back in spec
(8) Review of asset and adjustment of disinfection setpoint, follow up resample in spec

ISSN 2653-203

Appendix C

Table 14: Low and medium exposure risk recycling schemes with continuous online analysis of chlorine residual.

Region	WWTP	Primary Recipient	Residual TCl mnthly compliance (#samples)	Samples <0.2 mg/L	Requirement met	Residual TCl wkly check (# samples)	Samples <0.2 mg residual	Requirement met	Suspended Solids (#samples)	Samples >30 mg/L	Requirement met	pH (samples taken)	samples outside 6.5-8.5	Requirement met	*E.coli* (#samples)	samples >1000cfu/ 100mL (for low risk)	Requirement met
NWR	Karratha 1	City of Karratha	-	-	(6)	-	-	(6)	12	0	✓	12	0	✓	60	0	✓
NWR	South Hedland	Private Scheme	-	-	(6)	-	-	(6)	7	0	✓	7	0	✓	7	0	✓
NWR	South Hedland	Town of Port Hedland	Scheme non-operational in 2020-21														
NWR	Wickham	Private Scheme	-	-	(6)	-	-	(6)	-	-	(2)	-	-	(2)	-	-	(2)
Perth	Subiaco	Water Corporation	-	-	(6)	-	-	(6)	2	0	✓	12	0	✓	9	0	✓
Perth		Private Scheme															
Perth		Private Scheme															
Perth		Private Scheme															
SWR	Pemberton	Shire of Manjimup	-	-	(6)	-	-	(6)	8	1	(10)	8	0	✓	8	0	✓

Table 15: Extra low exposure risk recycling schemes (all schemes wholly operated and maintained by the Water Corporation)

Region	WWTP	Primary Recipient	Residual TCl mnthly compliance (#samples)	Samples <0.2 mg/L	Requirement met	Residual TCl wkly check (# samples)	Samples <0.2 mg residual	Requirement met	Suspended Solids (#samples)	Samples >30 mg/L	Requirement met	pH (samples taken)	samples outside 6.5-8.5	Requirement met	*E.coli* (#samples)	samples >10000cfu/100mL (for low risk)	Requirement met
GAR	Toodyay	Water Corporation	Scheme non-operational in 2020-21														
GSR	Albany 2	Water Corporation	-	-	(5)	-	-	(5)		-	(5)	12	1	✓	12	0	✓
GSR	Mt Barker	Water Corporation	-	-	(5)	-	-	(5)		-	(5)	12	2	✓	12	0	✓
GSR	Walpole	Water Corporation	-	-	(5)	-	-	(5)		-	(5)	6	1	✓	6	0	✓
SWR	Donnybrook	Water Corporation	12	0	✓	-	-	(5)		-	(5)	-	-	(5)	12	0	✓
SWR	Dunsborough	Water Corporation	8	0	✓	-	-	(5)		-	(5)	-	-	(5)	11	0	✓
SWR	Kemerton	Water Corporation	-	-	(5)	-	-	(5)		-	(5)	36	0	✓	36	0	✓
SWR	Manjimup	Water Corporation	-	-	(5)	-	-	(5)		-	(5)	24	0	✓	24	1	(11)
SWR	Nannup	Water Corporation	-	-	(5)	-	-	(5)		-	(5)	23	17	(9)	11	0	✓

Notes:

(2) This sampling is not the responsibility of Water Corporation

(5) This sampling is not required in the DoH approval

(6) Continuous online sampling of chlorine residual, therefore no requirement to undertake monthly compliance or weekly check samples

(9) Sample exceedance; review of barriers showed no elevated public health risk.

(10) Operational exception; health compliance still achieved

(11) Sample exceedance; response sample taken and in spec

There are 24 recycling schemes where the responsibility to sample lies with the third party – these schemes are not included in these tables.

ISSN 2653-203