

**EXAMINATION OF THE AUDITOR GENERAL'S PERFORMANCE AUDIT
REPORTS JUNE - DECEMBER 2020**

Organisation: Sydney Water

Date Received: 1 June 2022

1 June 2022

Mr Greg Piper MP
Chair
Legislative Assembly
Public Accounts Committee
Parliament House
Macquarie Street
Sydney NSW 2000

Reference: D22/20314

Auditor-General's 2020 performance audit report – *Water conservation in greater Sydney – Sydney Water*

Dear Mr Piper

I am writing in response to your letter dated 19 May 2022 in which you request further information in relation to the above performance audit. I note that the Committee acknowledges Sydney Water's response to Recommendations 5 and 6 and seeks further clarification from Sydney Water on specific information. Our response to your queries is outlined in the commentary below.

Recommendation 5:

- ***Details of Sydney Water's baseline funding for water conservation and water use ("behavioural change") programs.***

The 2020 IPART price determination for Sydney Water included the following allowances for on-going water conservation activities:

- \$10 million a year to deliver water conservation projects.
 - \$5 million a year on behavioural change programs to promote water conservation among customers.
- ***A copy of the Sydney Water's 2020-21 water conservation annual report.***

A copy of Sydney Water's 2020-21 water conservation annual report is attached to this letter.

- ***Details on how the revised Economic Level of Water Conservation (ELWC) method will ensure available funding for water conservation will increase when water storage levels decline – for example, what funds will be made available at what future storage levels and how will this be funded?***

The ELWC methodology guides Sydney Water's investment in water conservation in response to changing dam levels and the value of saving water. As dam storage levels fall, the value of saving water increases. The higher value of water justifies a greater level of water conservation activity.

This can include an expansion of Sydney Water's baseline programs and/or the use of additional programs that may have a higher cost to implement and would be uneconomic at higher dam levels. IPART's drought price provides a source of funding for this additional work.

In addition, if dam levels in Greater Sydney fall below 60%, the 2020 IPART determination requires that Sydney Water must apply a drought water usage price (currently equivalent to \$3.28 per kilolitre, 2021-22). Actions funded by the drought price include:

- Expanded water conservation activities, with funding of \$33-\$63 million per year depending on dam levels.
- Implementation of water restrictions on behalf of Government (\$15m), plus enhanced communications and advertising about restrictions and the importance of saving water (\$10m).
- Operation of the desalination plant (\$63m).

Recommendation 6:

- ***Clarify whether the issues Sydney Water raised regarding historical program data have impacted its ability to report on ongoing water savings from previous initiatives.***

Sydney Water was unable to report on benefits prior to July 2020 which has reduced our understanding of the impact our investment in water conservation programs have had over time. Sydney Water acknowledges this gap and through the recent implementation of our Enterprise Analytics program, we have been working to improve our management and water savings estimates to provide better understanding of the impact of our current and future programs. This includes filling historical data gaps where possible.

This approach does not pose a compliance issue as Sydney Water's Operating Licence and Reporting Manual do not require historical water savings or expenditure to be included in the annual Water Conservation Report.

If you have any questions regarding this information, please contact [REDACTED]

Yours sincerely

[REDACTED]

Roch Cheroux
Managing Director

Water Conservation Report

2020 – 2021



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Acknowledgement of Country

Sydney Water respectfully acknowledges the Traditional Custodians across Dharawal, Gundungurra, Darkinjung, Dharug and Eora nations where we work, live and learn. Their lore, traditions and customs nurtured and continue to nurture the waters, both saltwater and sweetwater, in our operating area, creating wellbeing for all.

We pay our deepest respect to Elders, past and present. We acknowledge their deep connections to the land and waters. We are committed to reconciliation and partnering with our Traditional Custodians, to ensure ongoing collaboration on Caring for Country now and into the future, learning from traditional and contemporary approaches, while maintaining and respecting cultural and spiritual connections.

Our families, friends and future generations depend on us to protect our water resources and our environment. In doing so, we respect the traditional 'Caring for Country' restorative approaches practiced over tens of thousands of years by our First Nations people and play our part to sustain and improve the health of the landscape by recognising and nurturing the value of water in our environment and communities.



Artwork by Dennis Gould inspired by a topographic pattern of Sydney and connects stories of both saltwater and freshwater people, and sustainability and culture.

Executive summary

Water plays an essential part of our daily lives. The way we use water helps our city thrive and supports the productivity and prosperity of our economy. By delivering world-class water services, we can create a better life for our people, our business partners and our communities.

Sydney Water recognises the critical value of this precious resource and places a high priority on water conservation as part of a range of measures to ensure a resilient and secure water supply for Greater Sydney.

Water conservation involves far more than reducing water usage, it involves in-depth research and development in order to utilise water more effectively. Sydney Water's water conservation initiatives are designed to be economically viable and environmentally sustainable, without compromising the value provided to customers and the community.

Sydney Water's water conservation program supports our ability to provide world-class water services for customers which include clean drinking water, watering for tree-lined streets, parks and green spaces, and access to safe, local waterways and beaches. Core to water conservation efforts is contributing to the following outcomes:

**Sustainable and efficient
management of our
water resources**

**Developing water
resilient and water
smart communities**

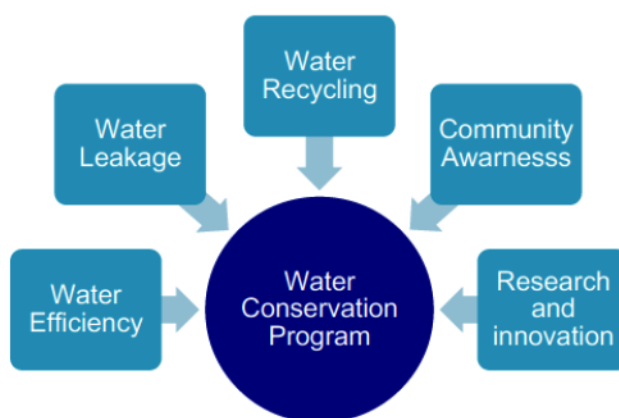
**Enabling liveability
outcomes for
the community**

The following report outlines Sydney Water's Water Conservation Plan for the next five years and details costs and water savings through water conservation programs run in 2020-21. This report also details Sydney Water's support to the delivery of the NSW Government's Metropolitan Water Plan, which recognises the critical value of water conservation in balancing supply and demand for Greater Sydney.



Highlights from 2020-21

Over 2020-21 Sydney Water has prioritised investments in sustaining established projects, while laying important foundations to build a diverse, adaptable and robust water conservation program in the coming years. There are five key focus areas that form the basis of the water conservation program.



Sydney Water has established a research and innovation portfolio, with dedicated budget, to ensure the water conservation program continues to evolve and improve. This portfolio has allowed us to explore and build knowledge of new water conservation opportunities. Over 2020-21, \$1M¹ was invested into the portfolio to support the development of 14 projects that encompass a range of water conservation initiatives from water literacy and efficiency through to robotics, analytics and recycled water.

¹ This figure is a combination of invoices paid and accrued for 2020/21

The water efficiency portfolio achieved 560 ML in annual savings, exceeding projections of 486 ML, at a cost of \$4 million. We have also explored several approaches to support a range of businesses and government agencies to become more water efficient.

A new program, WaterFix Commercial, was launched in June 2021 and included in our forward program. Additionally, the Water Savings Partnership project, an initiative in its early lifecycle that is run in collaboration with five local councils, has produced promising results.

A \$42.5 million investment was made to respond to network leaks and breaks as well as explore solutions in proactive leak detection. The resulting programs contributed to the reduction of water leakage by 12.2 ML/d to a rolling 12-month average of 112.5 ML/d, which is within the economic level of leakage band. An additional \$0.75M investment in innovation pilots, tools and analytics will deliver this program more efficiently and effectively in the future, to continue improving performance.

Existing recycled water schemes received a \$32 million investment which helped produce 37.7 GL of recycled water, contributing to a reduction in drinking water demand of 12.7 GL². A landmark agreement for a 1.2 ML/d recycled water plant to service Sydney Science Park³ was also signed. Furthermore, we are enabling supply to Western Sydney Airport growth area from Hoxton Park recycled water plant. In addition, a new memorandum of understanding (MoU) with City of Sydney was signed to foster collaboration on recycled water planning. A further \$0.51M investment in pilots, planning and tools will support the growth of recycled water offerings for customers.

Our \$3.5M investment in community awareness has contributed⁴ to a reduction in drinking water demand of 7.2%. When water restrictions were lifted in December 2020, our awareness activity quickly pivoted to promote established Water Wise Guidelines. In a commitment to continue engaging with teachers and students, we adapted the water literacy education program to support digital and remote learning. The highly successful 'Turn it off Bob' campaign was then launched in June 2021 to promote water conservation messages in the community. Since the launch of Turn it off Bob, actor Shane Jacobsen, has become a water wise ambassador for Sydney Water and will work across other activities regarding water conservation.

Water conservation and future aspirations

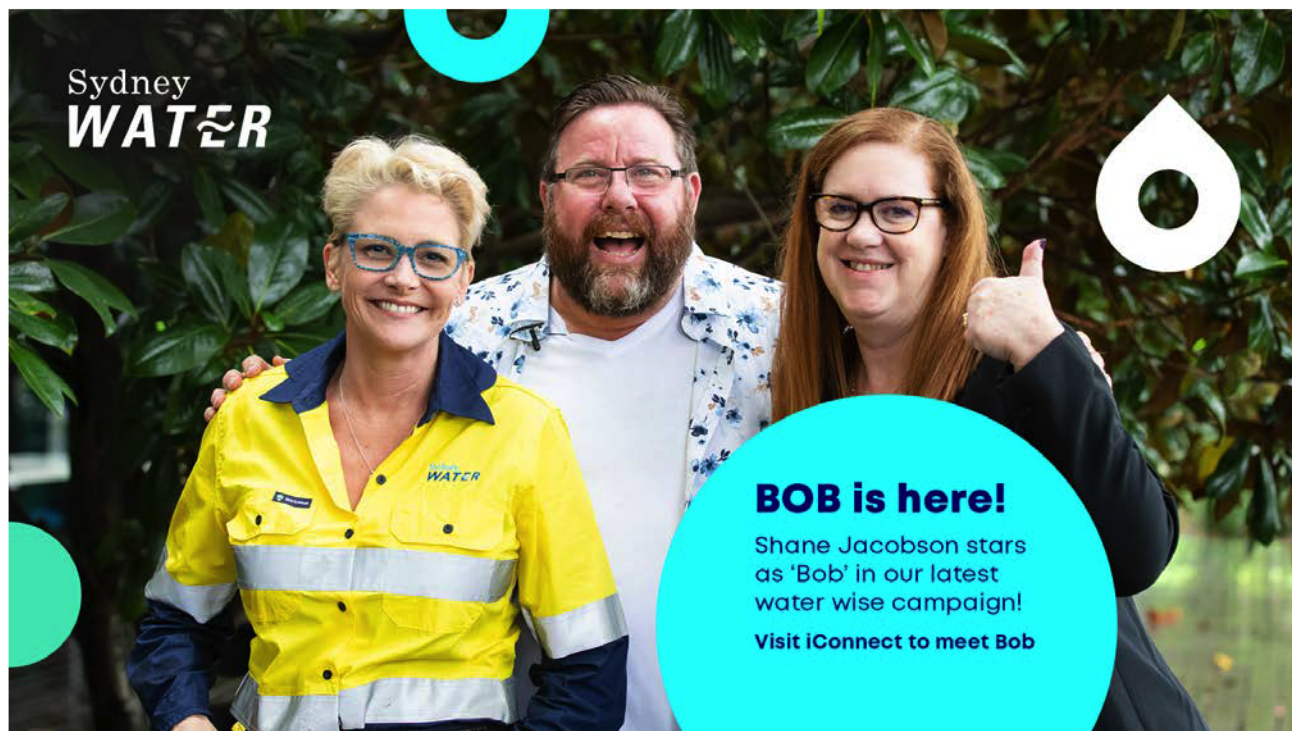
Our water conservation program works towards greater efficiency in the use of potable water through the use of the Economic Level of Water Conservation (ELWC) methodology. The methodology is designed to assess water savings along with social and environmental costs and benefits. Where projects are considered economically efficient at the current value of water, we include them in forward programs. Economic Level of Leakage (ELL) calculations are also used to inform the active leak detection programs.

² This was less than 2019/20 due to the St Marys Advanced Water Treatment Plant (AWTP) being offline for an extended period as two of the plants that source water from, Quakers Hill and St Marys, were undergoing major upgrades. Recycled water demand from irrigation customers was also lower due to high rainfall.

³ Anticipated to be in operation in 2023

⁴ Resulting from restrictions, campaigns, efficiency programs and COVID-19

In 2021-22, we will continue to build a diverse water conservation program to support a broad range of customers and drive more efficient and effective use of our water resources. This will enable our operations to respond quickly in periods of dry weather⁵.



A \$4.8M investment has been allocated to the water efficiency portfolio along with \$44M which was allocated to managing leak repair, response activities, and proactive leak detection programs. The objective of these investments is to improve water leakage management and to continue improving leakage performance. This activity has been supported with a \$5M investment to deliver a public behavioural change campaign.

An additional \$2.5M is intended for research and innovation to investigate new recycled water opportunities and improvements in data and analytics capability. The objective will be to provide data driven decisions and more effective delivery of our program. Our investments are designed to:

- Increase water savings by 800 ML per year through water efficiency activities.
- Reduce demand on drinking water by 14,000 ML through recycled water production and new opportunities for recycled water.
- Reduce leakage to below 108 ML/d (the economic level of leakage)

⁵ Sydney Water's price determination (2020-24) has an allowance for an additional \$50M a year to be spent on water conservation if Greater Sydney enters drought.

- Progress early lifecycle projects into the forward programs when economically productive to do so
- Support further collaboration with Department of Planning, Industry and Environment and Councils to support water conservation ambitions outlined in NSW Government's Metropolitan Water Plan.

Beyond 2021-22, we will adapt the program by responding to changes. The approach we take to ongoing improvement is based on the following themes:

In our knowledge: Ensure that early lifecycle and associated pilots progress into established projects and contribute to the delivery of water conservation programs that are informed by customer insights and enhanced data and analytics capability.

In the market: Cater to customers' requirements and support building market capability, as well as address market gaps.

In Government direction:

Ensure the program adapts to support the NSW State Water Strategy and Greater Sydney Water Strategy (when these initiatives are released), while continuing to support the NSW Government greening and cooling priorities.

To the value of water: Deliver effective responses to any changes in dam levels, changes to the ELWC methodology⁶ and responding quickly as drought pricing becomes available.⁷



⁶ ELWC currently under review by the Department of Planning, Industry and Environment

⁷ IPART drought pricing currently available at 60% dam levels

1. Introduction

Our relationship with water has shaped our city's growth and the lifestyle we enjoy. In the future, water will continue to play an important role to enable thriving, liveable and sustainable communities across a growing Greater Sydney.

By investing in water conservation initiatives, we can ensure that our most valuable and limited resource is used more efficiently and effectively. Our customers recognise the importance of saving water and are supportive of a continual focus on water conservation, both in and out of drought periods.

The water conservation program works towards greater efficiency in the use of potable water, in a manner that recognises its true value to society. Program initiatives are designed to be economically viable and environmentally sustainable, without compromising the value customers and the community experience from water throughout their everyday lives.

As outlined in the Executive Summary and detailed further below, our approach to water conservation is based on delivering the following outcomes.

Sustainable and efficient management of our water resources

Our water supply is **secure** and resilient to a changing climate while remaining **affordable** for customers

Our water supply is used more **efficiently** to support the Governments 2017 Metropolitan Water Plan demand forecasts.

Developing water resilient and water smart communities

Our customers know **how** to, and **why** they should, use water more efficiently and effectively.

Our customers are better **prepared** for the **changing climate**, including more extreme and frequent droughts and heatwaves.

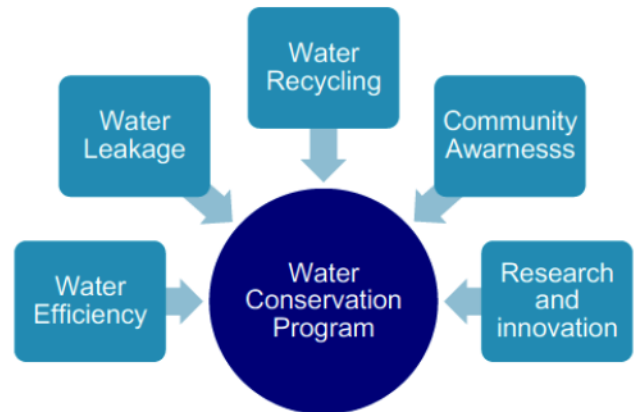
Enabling liveability outcomes for the community

Our water supply is used more effectively to enable **greening and cooling** for our customers, contributing to the NSW Government's Priorities and greening initiatives.

1.1 Focus of the report

Each year, Sydney Water reports on how we perform in conserving water, and what plans we have for future conservation. In accordance with Section 3 of our Operating Licence 2019–2023⁸. The Water conservation annual report outlines:

- Chapter 1: Introduction to the program.
- Chapter 2: Performance for 2020-21.
- Chapter 3: Five-year forward plan.
- Chapter 4: Details of the water conservation program activities undertaken in 2020-21.
- Appendices: Further analysis, methodology details and reporting requirements.



Over 2020-21, there have been five key focus areas across the water conservation program.

Water efficiency

Supporting residential customers, government and businesses to use water more efficiently and effectively. This includes more efficient technologies, education, metering, voluntary use reduction, assessment and supporting regulatory measures (e.g. BASIX)

Water leakage

Reducing water loss in our network, including leak repairs and proactive leak detection programs.

Water recycling

Reducing demand on drinking water sources. Water recycling ranges from large scale wastewater recycling to sewer mining and stormwater harvesting.

Community awareness

Increasing awareness through behavioural change campaigns, customer engagement and student education.

Research and innovation

Investigating innovation, emerging technologies and piloting customer offerings that could broaden the water conservation program and increase its effectiveness.

⁸ Appendix A outlines how this report meets specific requirements in the Operating Licence Reporting Manual

2. 2020-21 Performance

2.1 Water use in 2020-21

Across Sydney Water operations in 2020-21, 522,801 million litres of drinking water was used by residential, non-residential customers and in system operation. This equates to around 12 billion litres less than what was used in 2019-20.

Due to wetter weather, there has been a measurable reduction in water usage of around 7 billion litres, or 3 litres per person per day, when compared to what could be expected under average weather conditions⁹.

Water restrictions in place until 1 December 2020 also influenced drinking water usage. The impact of restrictions and other demand reduction activities are presented in Table 2-1.

Table 2-1 Breakdown of water use 2020-21

	2020-21	2019-20
Total water use ¹⁰	524,168 million litres	534,672 million litres
- Metered residential	67%	66%
- Metered Non-residential	21%	22%
- Leakage economic level of leakage 108 ± 16 ML/d	8% (112.5 ML/d) ¹¹	9% (124.7 ML/d)
- Non-metered water (excluding leaks) ¹²	3%	3%
Observed average water use per person	272 litres per day (99 thousand litres a year)	277 litres per day (101 thousand litres a year)
Weather corrected average per person	275 litres per day (100 thousand litres a year)	272 litres per day (100 thousand litres a year)
Observed average residential water use per person	184 litres per day (67 thousand litres a year)	182 litres per day (67 thousand litres a year)
Volume of drinking water saved by using Recycled Water	12,800 million litres	13,500 million litres

⁹ Average weather is based on the 33 years of historical data from the Bureau of Meteorology.

¹⁰ Includes drinking water and unfettered water top-up at one of our recycled water scheme.

¹¹ 12 month rolling average peak result to end of June 2021, as of 5 October 2021.

¹² Includes billed unmetered consumption, unbilled unmetered consumption, unauthorised consumption and customer meter under registration.

Although total drinking water use was lower than last year, shown in

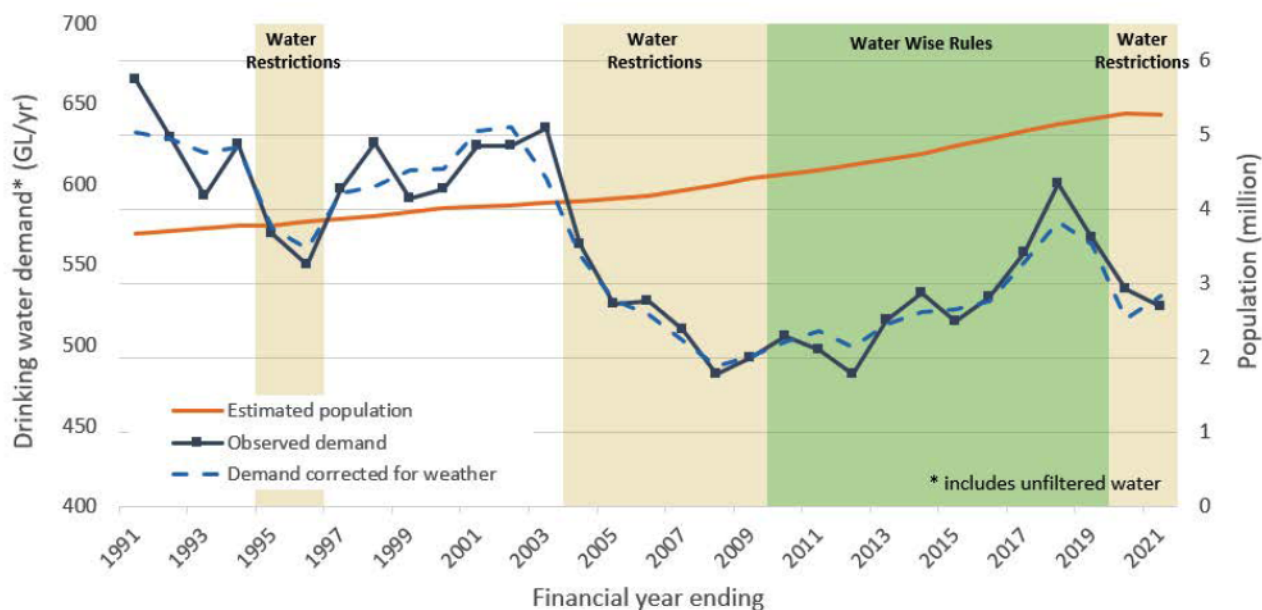


Figure 2-1, estimated residential per person use has increased by around 2 litres per person per day, also shown in Table 2-1. This has been driven by an assumed reduction in population served in 2020-21, based on the latest estimate of population for Sydney Water's area of operations. The increased usage is also assumed to be associated with the lifting of water restrictions. (see Figure 2-2).

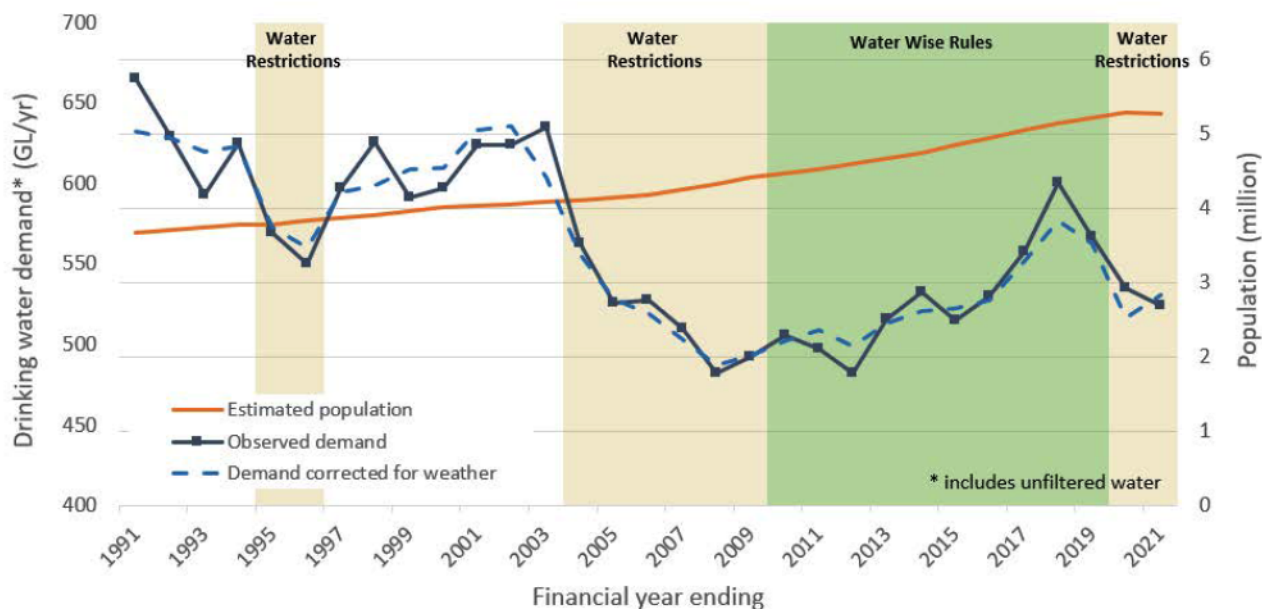


Figure 2-1 Demand for drinking water (observed and weather corrected in gegalitres) and population growth over time

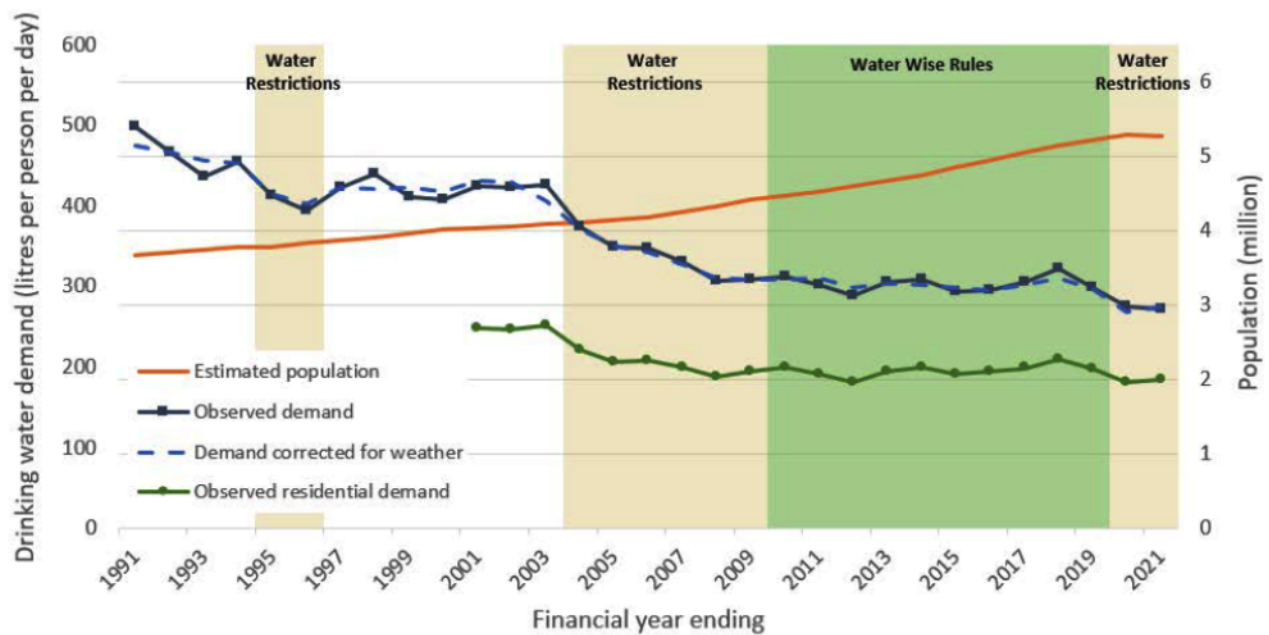


Figure 2-2 Demand for drinking water (observed and weather corrected in litres per person per day) and population growth over time

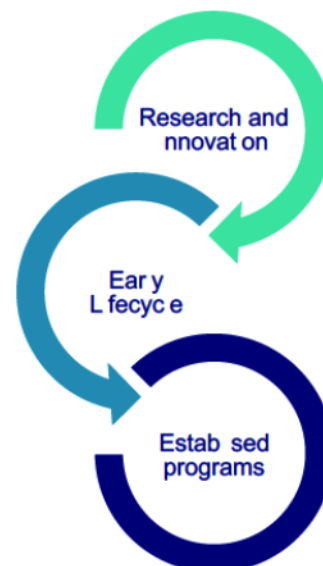
2.2 Water conservation in 2020-21

Over 2020-21, Sydney Water has focused on sustaining established programs, while also exploring new opportunities for water savings.

Our research and innovation activities are intended to build knowledge and understanding of water saving potentials by exploring new water conservation opportunities, innovations, and emerging technologies.

Once water savings potentials are understood, early lifecycle projects explore how to best integrate insights into programs of work. Integration assessment can include, testing the market and attractiveness to different types of customers, validating cost and benefit assumptions at scale, exploring different commercial offerings and where initiatives are going to be most effective (i.e. location / type of customer). Once enough data is available, early lifecycle projects are assessed and brought into the forward program if economic to do so.

Established programs are reviewed and adapted in response to the market, customer preferences and data/analytic insights.



The development of an idea into an established water conservation project

Key highlights from 2020-21 are outlined below with overall water savings and investments in water conservation captured in Table 2-2

Water Efficiency: invested \$4M to achieve 560 ML annual savings from water efficiency programs, exceeding projections of 486 ML

- WaterFix® Residential engaged 12,919 customers, exceeding the annual target of 10,000 (see Figure 2-3)
- PlumbAssist® assisted 292 customers, exceeding the target of 250
- Early lifecycle projects
 - WaterFix Commercial launched in June
 - The interventions implemented through the Water Savings Partnership are estimated to deliver 61 ML of water savings annually

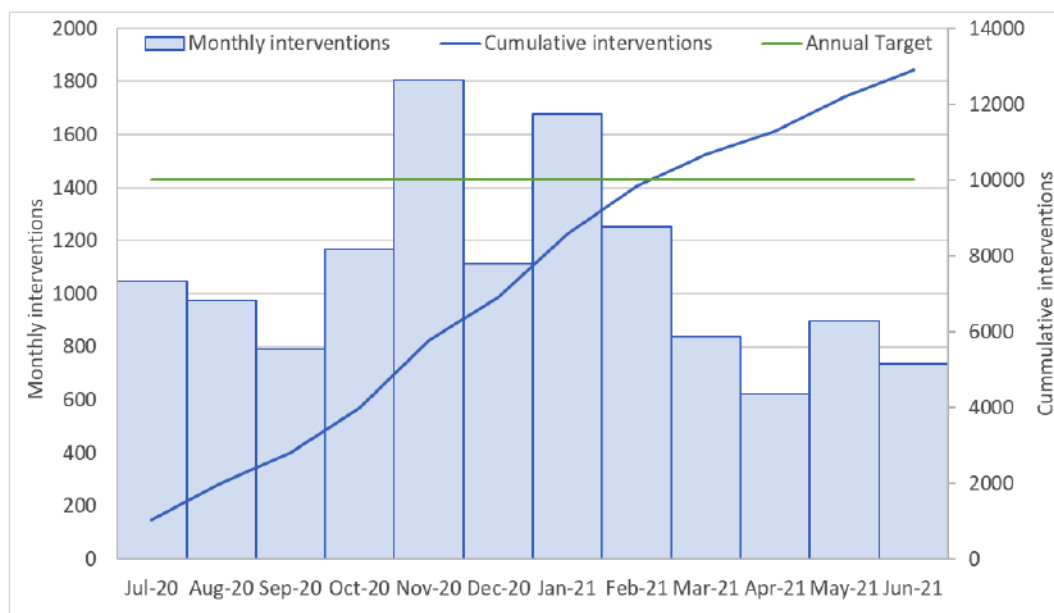


Figure 2-3 Residential participation in WaterFix® Residential over 2020-21¹³

Water Leakage: Invested \$43M in programs that contributed to the reduction of the rolling 12-month leakage result by 12.2 ML/d to 112.5 ML/d. This result is below the economic level of leakage upper band (see Figure 2-4). Core activities involved the following activities and associated investments:

- Proactively inspected over 12,000 kms of water mains through the active leak detection program which identified 5,802 leaks.
 - \$2.5M spent on proactive detection.

¹³ The decline in participation from January to June 2021 has been reflected in the forward program

- Responded to and repaired leaks reported by our customers, prioritising and managing response times to minimise leakage.
- \$40.5M spent on repairing leaks, breaks and corresponding restoration works.
- Initiated and progressed early lifecycle projects, including enlisting and training Joey, a working Springer Spaniel dog that was trained to detect drinking water leaks and educate the public about the importance of water conservation.
- Continued working on building data and analytics capability to improve targeting of active leak detection.

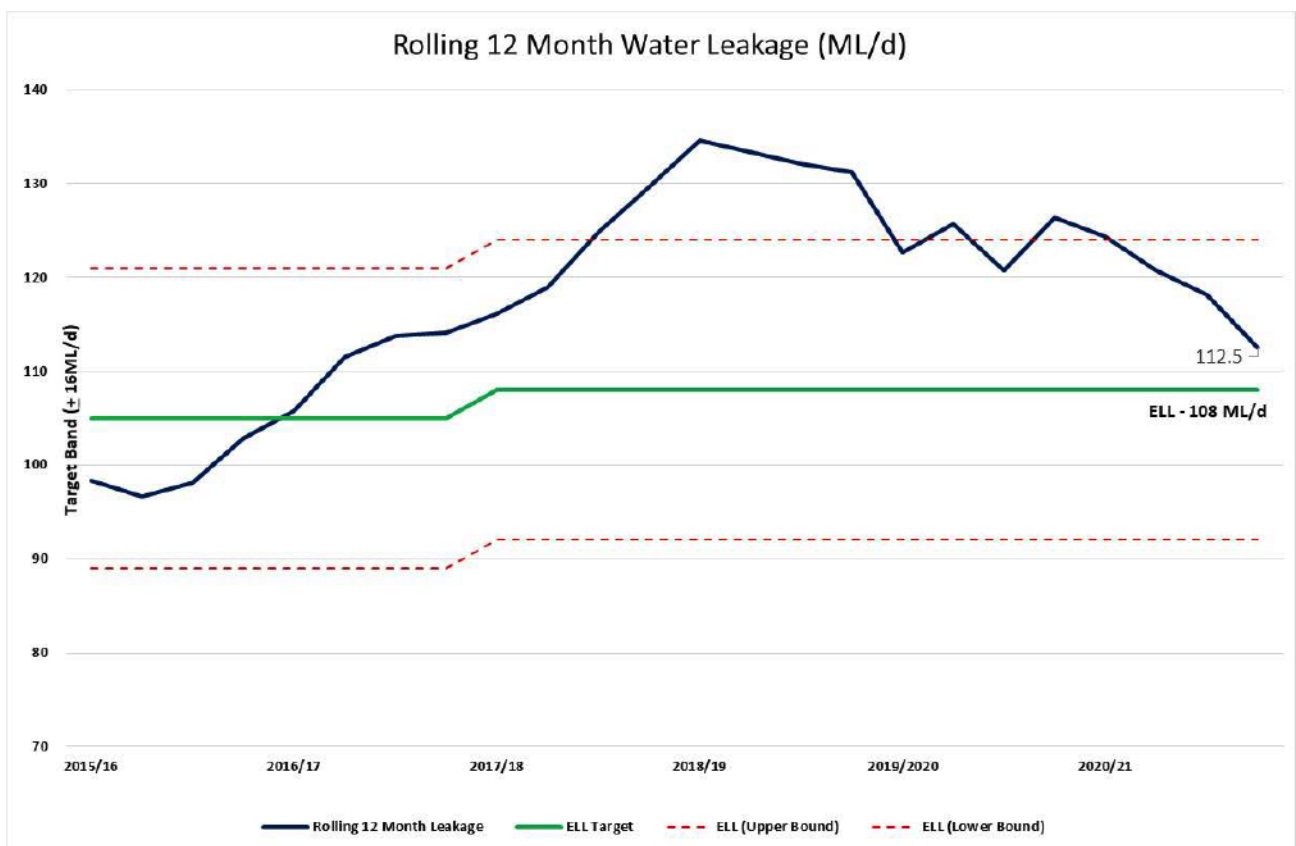


Figure 2-4: Actual leakage compared to the Economic Level of Leakage (ELL)¹⁴ in our system
 Sydney Water's water leakage program is designed to meet the economic level of leakage (see Appendix D). It is challenging to meaningfully quantify water savings from individual leak repair activities, however constant improvements are being made to measurement methods through a data and analytics program. We have also reported on leakage programs that were delivered, key leakage statistics (see Appendix D and Table 2-2), which overall have contributed to the reduction

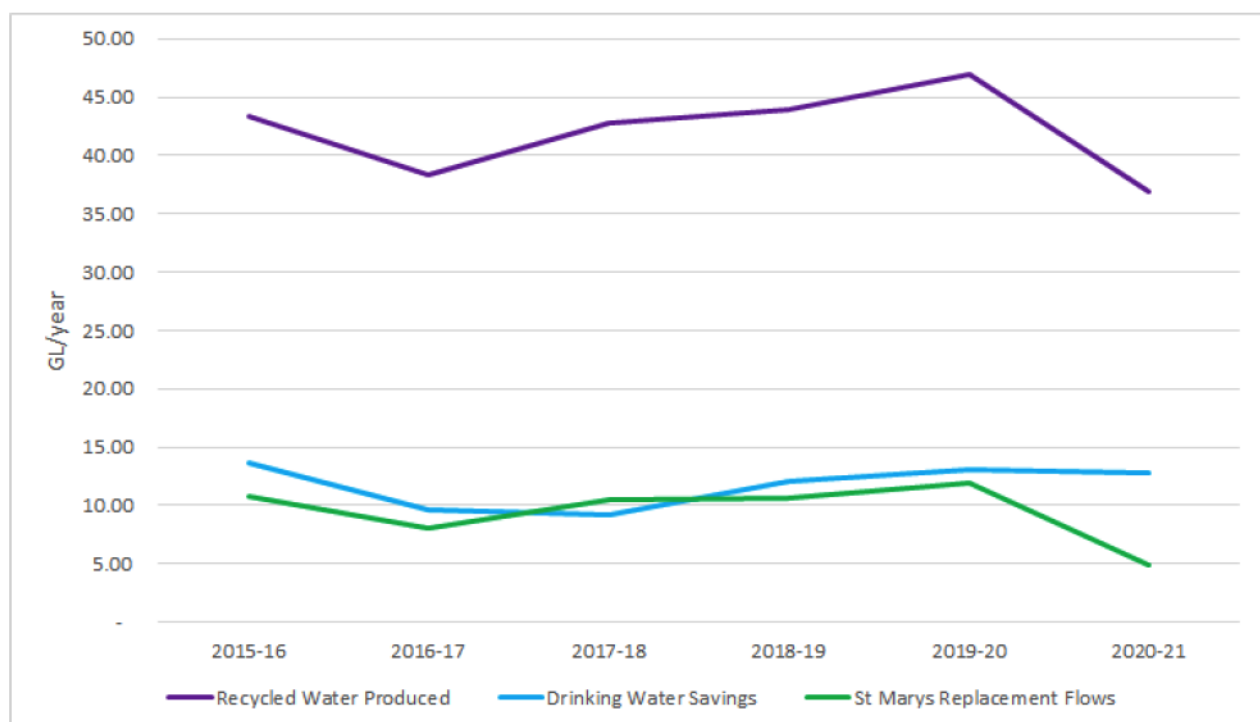
¹⁴ ELL is the point where the cost of reducing leaks equals the value of the water saved

in leakage toward the ELL. Program details and learnings from the last year are provided in chapter 3.2.

Recycled Water: Invested \$32 million to operating our recycled water schemes to produce 37.7 GL of recycled water and contribute to a reduction in drinking water demand of 12.7 GL (see Figure 2-5 and Appendix C)

- Optimised the Wollongong recycled water system to more consistently produce recycled water to meet the demand of industrial customers.
- Early lifecycle projects:
 - o Enabling supply to Western Sydney Airport growth area from Hoxton Park recycled water plant.
 - o Signed a landmark deal for a 1.2 ML/d recycled water plant to service Sydney Science Park.
 - o Established an MoU with City of Sydney to collaborate on recycled water planning.

Figure 2-5: Annual recycled water production from 2015-16 to 2020-21



Recycled Water production was impacted by the Lower South Creek Treatment Program (LSCTP), an upgrade to three of Sydney Water’s major inland wastewater treatment plants — Riverstone, St Marys and Quakers Hill. This is one of the largest wastewater programs in the country, ensuring we’re ready to meet future demand in Sydney’s North West. The St Marys Advanced Water Treatment Plant (AWTP) was offline for an extended period as two of the plants it sources water from, Quakers Hill and St Marys, were undergoing major upgrades as part of the LSCTP.

Community Awareness: A \$3.5M investment contributed to a reduction in drinking water demand of 7.2% (see Figure 2-6)

- Launched the Turn it off Bob campaign in June 2021 based on customer insights.
- Launched online digital learning resources to support classroom learning, achieving over 235,000 views.
- Early lifecycle projects included piloting a water efficiency app among staff to promote longer-term engagement and understand effectiveness in changing behaviour.

Drinking water demand is estimated to be around 7.2% lower at the end of 2020-21 from the combined effect of restrictions, water efficiency campaign activities and water efficiency programs (refer to Figure 2-6)¹⁵.

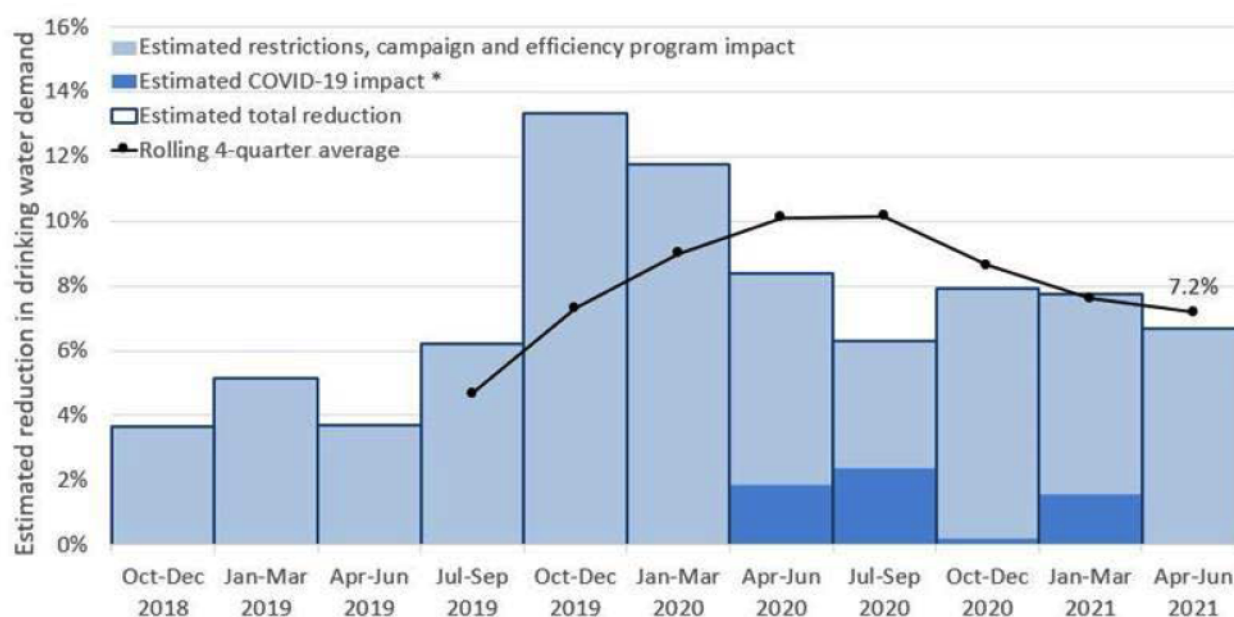


Figure 2-6 Reduction in drinking water demand resulting from restrictions, campaigns, efficiency programs and COVID-19.

Research and innovation: Established a portfolio with dedicated budget allowing Sydney Water to explore and build knowledge of new water conservation opportunities.

- Over 2020-21, \$1.04 Million¹⁶ was invested into the research and innovation portfolio which supported 14 new initiatives.

Research and innovation activities are intended to build knowledge and understanding of water saving potentials by exploring new opportunities, innovations, and emerging technologies.

¹⁵ Estimated by comparing observed demand against demand expected for the period pre-drought and pre-COVID.

¹⁶ This figure is based on invoices that have been paid and/or accrued for 20/21 projects

Water saving estimates will not be included in our forward program for 2021-22. However, benefits of this program are continually assessed and analysed in the context of short and long-term opportunities to deliver improvements to key objectives. Further program details and lessons from the last year are provided in chapter 3. Sydney Water is committed to continued investment in this portfolio.

Summary of 2020-21 water savings

Table 2-2 outlines where the savings have occurred across our water conservation program in contrast to what was forecast in the previous water conservation annual report. Project details and learnings from the last year are provided in chapter 4.

Table 2-2 Water conservation activities in 2020-21¹⁷

Project Details			Forecast 2020-21	Actuals 2020-21		
Name	Status		Average annual savings (ML)	Calculated average annual savings ¹⁸ (ML)	Investment (\$M)	Participants
WaterFix® Residential	Established		209	267	\$3.33M	12,919
WaterFix® Strata ¹⁹	Established		182	142	\$0.45M	982
PumpAssist®	Established		5	83 ²⁰	\$0.21M	292
WaterFix® Concealed Leaks	Established		-	17	\$0.11M	150
WaterFix® Business and Government ²¹	Online monitoring	Early lifecycle		6 ²²	\$0.07M	37 ²³
	Water Savings Partnership	Early lifecycle	57	61	\$0.44M	248
	WaterFix® Commercial	Early lifecycle		-	-	-
WaterFix® Small Business ²²	Early lifecycle		33	3	\$0.01M	13
Total Water efficiency	-		429	518	\$4.6M	14,641
Enhanced Leak Response ²⁴	Early lifecycle		1241	Contributes to leakage event	\$0.8M	n/a
Active leak control	Established		n/a	Contributes to leakage event	\$2.5M	n/a
Reactive leaks & breaks	Established		n/a	Contributes to leakage event	\$40.5M	n/a

¹⁷ Comparison between the forecast for the 2021-22 water conservation program with what was achieved/delivered.

¹⁸ Accumulated water savings by programs intervention for a period of 12 months.

¹⁹ Program was on hold during COVID 19 lockdown and impacted program impact over 2020-21

²⁰ Based on retrofits and leaks repaired. Water savings from repairing leaks were based on plumber's usual estimates.

²¹ Water savings for Business and Government customers have been the focus of three early lifecycle projects. Early lifecycle projects are designed to test commercial offerings with the market and understand water saving potential.

Savings from early lifecycle projects will not be included in the 2021-22 forward program.

²² 36 data loggers were installed in June 2021 and water savings are yet to be reported from these.

²³ Number of data loggers installed

²⁴ It is currently challenging to quantify water savings from individual leak activities; however, we are working to improve this through our data and analytics program.

Leakage p ots & too s	Ear y fecyc e	n/a	n/a	\$0.77M	n/a
Behav oura change campa gn	Estab shed	n/a	n/a	\$3.5M	n/a
Recyc ed Water	Estab shed	-	12,769	\$32M	n/a
Recyc ed water p ots & too s	Ear y fecyc e	n/a	n/a	\$0.51 M	n/a
P ot ng & deve opment ²⁵	Research & nnovat on	108	n/a	\$1.04M	n/a
n/a means not ava ab e					

²⁵ R&I projects are ntended to bu d know edge and understand ng of water sav ng potent a s by exp or ng new water conservat on opportun t es. Sav ngs from these projects w not be nc uded n the 2021-22 forward program.

3. Forward Plan

Towards the end of each financial year, established water efficiency projects are reassessed alongside the latest data to ensure they are still economically viable to deliver before they are progressed into the forward program.

Additionally, ideas and projects that have progressed through research and innovation phases and/or the early lifecycle phases are assessed against ELWC. If appropriate, they will also be incorporated in the forward program. This year WaterFix® Commercial has been added as a new initiative into the forward program following assessment against ELWC.

3.1 Water conservation for 2021-22

In 2021-22, \$4.2M is planned for investment for the water efficiency portfolio. Our WaterFix® Residential program appears to be less popular after prolonged periods of wet weather and high dam levels, so lower numbers are anticipated than last financial year. However, a greater emphasis will be placed to engage customers through advertising and marketing.

A further \$1M is planned for investment in early lifecycle projects²⁶ to support water efficiency of a diverse range of customers. Additionally, \$0.8M will be allocated to retaining water conservation field representatives who will shift focus from supporting implementation of water restrictions to aiding high water users to identify water efficiency opportunities.

Table 3-1 Water Efficiency Established projects for 2021-22

Project	Investment (\$M)	No. of interventions	Estimated annual water savings (ML/year)
WaterFix® Residential	\$2.25	9,000	186
WaterFix® Strata	\$1.20	3,000	261
PlumbAssist®	\$0.21	250	63
WaterFix® Concealed Leaks	\$0.10	180	136
WaterFix® Commercial	\$0.44	1800	157
Total	\$4.20	14,230	803

The COVID-19 pandemic and associated lockdowns and restrictions directly impact the delivery of programs and the ability to achieve targets. Programs can be placed on hold during lockdown events to reflect NSW Health guidelines. In addition, direct customer engagement also reduces

²⁶ Early lifecycle projects will not undergo ELWC assessment for inclusion in the forward program until the commercial offerings are appropriately tested with the market

during periods of lockdown as many people are less willing to engage service providers due to health and safety concerns. The targets outlined above have not been adjusted to reflect these impacts as there is uncertainty around their duration and implications for operations at this time. Targets will be adjusted pro-rata to reflect the duration of time that programs are on hold and reduction in customer uptake. In addition, investments will be made into initiatives shown in

Table 3-1, such as:

- Operating recycled water schemes and investigating new opportunities to expand recycled water services.
- Building community awareness of the importance of conserving water.
- Investigating new opportunities to save water through pilot, research and innovation portfolios.

Table 3-1 Recycled water, community awareness and research & innovation activities for 2021-22

Project Details	Net investment (\$M)	Target
Recycled water	\$32 ²⁷	14,000 ML water savings 42,000 ML recycled water production ²⁸
Behavioural change campaign	\$5	Sustaining 7% potable water demand reduction (Figure 2-6) without water restrictions
Pilots, research and innovation	\$2.5	-

3.2 Plan for 2021-22 to 2025-26

The Water Conservation Plan is a five-year program involving water saving projects that are proposed to be implemented, based on the current value of water (Table 3-3).

- Throughout the Water Conservation Plan deployment, the approach to development and improvement is based on the following themes and principles:
 - We will progress early lifecycle and pilots into established programs or new recycled water schemes as appropriate.
 - We will invest in data and analytics and incorporate customer insights into our decision making, so the delivery of programs is more efficient and effective.
- When in the market:
 - We will adapt our programs to respond to what our customers want.
 - We will structure offerings to build market capability.

²⁷ Total costs for recycled water production

²⁸ Recycled water production at St Marys AWTP may be impacted by commissions on days at Lower South Creek as a result of COVID 19 restrictions on requirements.

- We will collaborate with key stakeholders to address gaps in the market and support customers in better preparing for changes in the climate.
- Working with Government:
 - We will adapt to support the NSW State Water Strategy and Greater Sydney Water Strategy, when they are released. These strategies are supportive of the role of water efficiency in water management and may also influence investment levels required in the future.
 - We will adapt to support NSW Government greening and cooling initiatives.
- Recognising the value of water:
 - We will adapt to changes in dam levels and ensure preparation to ramp up programs when drought pricing becomes available²⁹
 - We will reassess programs if there are changes to the ELWC methodology, currently under review by the Department of Planning, Industry and Environment.

Over the next five years ELWC is forecast to be 8.1 ML/day and ELL is 108 ± 16 ML/d based on the current value of water. The projected cumulative savings from water efficiency projects are outlined in Table 3-2, estimated changes to leakage performance in Table 3-3, and recycled water production projections in Table 3-4.

Table 3-2 Water efficiency plan for 2021-22 to 2025-26 based on the current value of water

Project	Meets ELWC	Water Savings (ML/year)					Total demand reduction (ML/yr)	Cumulative savings (ML)
		2021-22	2022-23	2023-24	2024-25	2025-26		
WaterFix® Residential	Yes	186	165	145	145	145	786	2,460
WaterFix® Strata	Yes	261	261	261	261	261	1,305	3,915
PlumbAssist®	Yes	63	63	63	63	63	315	945
WaterFix® Concealed Leaks	Yes	136	136	136	136	136	680	2,040
WaterFix® Commercial	Yes	157	157	157	157	157	785	2,355
Rainwater tank repair	No	-	-	-	-	-	-	-
Love your garden	No	-	-	-	-	-	-	-
Total	-	803	782	762	762	762	3,871	11,715

²⁹ IPART drought pricing currently available at 60% dam levels

The programs listed in Table 3-4 will continue if they remain economic to deliver and will adapt to support the implementation of the Greater Sydney Water Strategy when it is finalised.

The PlumbAssist® program projections are dependent on a number of factors including customer engagement with the Customer Care team, customer eligibility and referral to the program, and the scope of work required. This program is not marketed.

Rainwater tank repair and *Love Your Garden* were not considered economically viable to deliver. However, this assessment was based on historic offerings and water savings data. We will consider further investigations to update costs, benefits and different commercial offerings in the research and innovation portfolio.

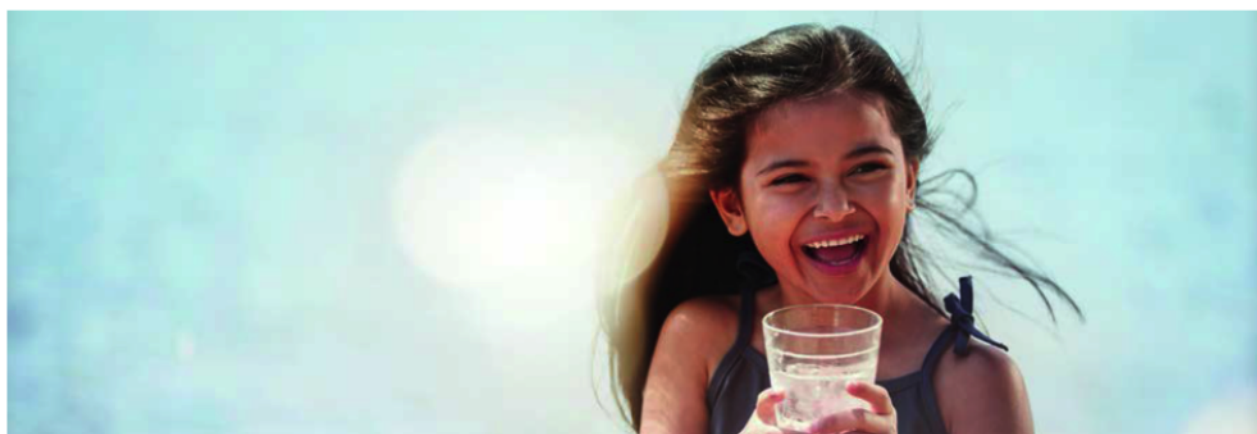


Table 3-3 Water leakage plan for 2021-22 to 2025-26 and projected impact on leakage

		Program Expenditure and targets			
		2021-22	2022-23	2023-24	2024-25
ELL Target ³⁰		108 ML/d	108 ML/d	108 ML/d	108 ML/d
Programs	Pressure Management	*	TBA	TBA	TBA
	Asset Management	\$0.07M	TBA	TBA	TBA
		15.2 ML			
	Active leakage control	21,000 km	21,000 km	21,000 km	21,000 km
		\$2.68M	\$2.60M	\$2.45M	\$3.9M
Speed and quality of repairs leak repairs		\$41.9M	TBA	TBA	TBA

* To be investigated to understand if economic to deliver

³⁰ Based on most likely scenario of dam events and cost of water. Programs for pressure management will be implemented based on economic value and cost of water, as well as ELWC.



Table 3-4 Recycled water projected savings for 2021-22 to 2025-26

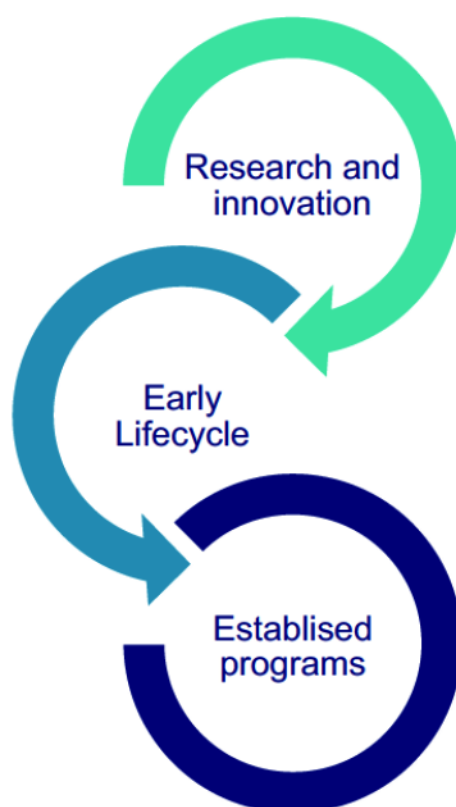
Project	Recycled Water Production (GL/year)				
	2021-22	2022-23	2023-24	2024-25	2025-26
Existing schemes (production)	42	48	50	50	50
Existing schemes (savings)	14	14.5	14.5	14.5	14.5

4. Water conservation program

In this final section of the report, we detail all activities undertaken over 2020-21 that contribute to our water conservation program. These are spilt into four key themes:

1. Water efficiency;
2. Water leakage;
3. Recycled water and;
4. Community awareness.

Early lifecycle and research and innovation activities across these themes demonstrate our commitment to building a diverse, adaptable and robust water conservation program over the coming years.



Conceptualizing the development of an idea into an established water conservation program

4.1 Water Efficiency

The residential water efficiency projects have been successful, with WaterFix® Residential and PlumbAssist®, exceeding targets and WaterFix® Strata building good momentum, despite COVID disruptions.

The combination of high rainfall, financial hardship due to COVID restrictions and other competing priorities impacted some of our programs as well as many of our business customers.

Several initiatives were adapted to target savings for businesses and government based on customer feedback and to ensure all customer interests were considered. While we had anticipated higher savings from our WaterFix® Small Business program, we have been able to report further promising results from the Water Savings Partnership early lifecycle project and have progressed the WaterFix® Commercial project into our forward program. Sydney Water is committed to further investments and exploration of new approaches to support water efficiency and the resilience of business and government customers.



Established Programs

WaterFix® Residential

Project description: Waterfix® Residential is a subsidised water efficiency focused plumbing service that helps homeowners save water each year by fixing leaks and installing water-efficient devices. We have been helping customers for more than 20 years, saving over 300 ML of water and reduce water bills through our WaterFix® Residential program.

Costs to the customer vary, depending on the type of service selected. In 2020–21, the WaterFix® service offered:

- Installation of WELS 4-star dual flush toilets.
- Installation of WELS 4-star rated basin tap aerators.
- Tap and toilet leak repairs.
- Installation of WELS 4-star rated showerheads.

Adapting the program: Uptake of the program varied throughout the year, with numbers peaking over the summer months. Introduction of a nominal call-out fee did not appear to impact uptake, but high rainfall may account for a lower uptake in mid-2021. To address this, we will focus on increasing awareness of the program through cross-promotion within our water conservation campaigns and on our website.

2020-21 achievements:

- Delivered 12,919 appointments (exceeding target of 10,000).
- Estimated to deliver 267 ML of water savings annually.
- Online customer surveys were introduced, with over a 25% response rate and the results showed an 82% satisfaction rate and 86% advocacy towards the WaterFix® Residential Program.



WaterFix® plumber repairing an indoor tap leak

Waterfix® Concealed Leaks

Project description: WaterFix® Concealed Leaks is a specialised concealed leak detection and repair service which is available to all customers, including residential, strata and non-residential customers.

Concealed or hidden leaks are often difficult to find as they are commonly underground, within walls and roof cavities, and require specialist skills and equipment. Customers pay for this service through their water bill and have the option to defer payments. The service provides customers with a guarantee, if there is a concealed leak and it cannot be found, they do not have to pay for the service. This provides customers with assurance, and a reliable and affordable leak detection and repair service.

Customers are also able to apply for a hidden leak allowance if they get a hidden leak repaired by a licenced plumber, supporting customers who may not wish to use Waterfix® Concealed Leaks.

2020-21 achievements:

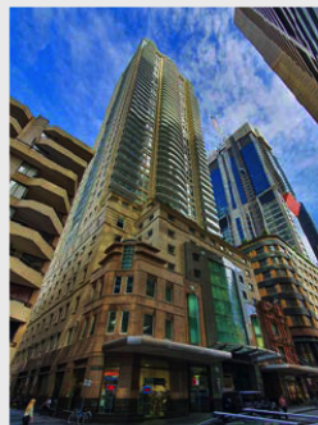
- 150 customers serviced with 64 leaks repaired
- Estimated to deliver 17 ML of water savings annually



Project description: The Waterfix® Strata program is a specialised water efficiency focused service that provides strata titled and multi-unit dwellings with a turnkey solution which can save thousands of litres of water each year. The service aims to make each residential unit and common area within the building water efficient and delivers the service over consecutive days. The service includes:

- A desktop assessment, detailed water efficiency assessment and quotation for consideration.
- All project management, appointment coordination and logistics
- datalogger installation and monitoring services.
- All plumbing works which includes minor leak repairs, concealed leak detection and repairs, and the installation of water efficient taps, toilets and showerheads.
- Various payment options are available and include a performance agreement. This is where the value of an average water bill is held, until the value of the water savings pays for the costs of the service.

The WaterFix® strata service on average achieves a 30% reduction in water use.



Century Towers WaterFix® Strata Serviced building.

Adapting the program: This year we adapted the program to service multi-unit Land and Housing Corporation (LAHC) dwellings. This has had an immediate impact on water savings and is likely to lead to additional LAHC properties being serviced in 2021-22. Additional activities undertaken this year have included:

- Onboarding and training of additional resources to increase the ability to deliver more services.
- Testing success when servicing smaller walk-up strata buildings of less than 20 units – overachieving expected water savings.

2020-21 Achievements:

- Achieved 982 units serviced (short of the 1200 target, however positive considering COVID 19 impacts)
- Estimated to deliver 142 ML of water savings annually
- Positive customer surveys results (90% satisfied and 88% would advocate for our services)

PlumbAssist®

Program description: The PlumbAssist® program is a subsidised service that provides emergency and essential plumbing repairs and maintenance to eligible customers experiencing financial hardship. The program aims to ensure that customers have access to basic services such as water, hot water and drainage, and have efficient and sustainable consumption achieved through the installation of efficient devices and minor and concealed leak repairs.

By providing this service, Sydney Water aims to prevent further financial hardship by reducing a customer's water use and related costs, while ensuring they have access to essential services.

Customers who participate in this service also receive support and case management from the Customer Care team that they are referred from.

2020-21 achievements:

1. 292 PlumbAssist® appointments were completed in the financial year, which exceeded the annual target of 250.
2. Multiple hidden major leaks were repaired resulting water savings.
3. Customer feedback was positive, receiving an overall customer experience score of 9.7/10.
4. Estimated to deliver 83 ML of water savings annually



Early lifecycle projects

WaterFix® Commercial (launched June 2021)

Project description: The Waterfix® Commercial program is a specialised water efficiency focused service that delivers large scale, cost-effective water savings to inefficient commercial buildings. The service includes:

- A desktop assessment, detailed water efficiency assessment and quotation for consideration.
- All project management, appointment coordination and logistics.
- Datalogger installation and monitoring services.
- All plumbing works which include minor leak repairs, concealed leak detection and repairs, and the installation of water efficient taps, toilets and showerheads.
- Various payment options are available and include a performance agreement.



2020-21 achievements:

- New initiative included in the forward program as it meets ELWC.

Water Savings Partnership (Sept 2019– Aug 2022)

Project description: A collaboration between Sydney Water and five local councils that aims to engage, educate and support non-residential customers in driving the adoption of behaviours, products and services that reduce their potable water demand. The program provides customers with a tailored service offering, site-specific recommendations as well as funding opportunities to support the implementation of water saving opportunities. The program takes a segmental approach to outbound customer engagement and site assessments to build knowledge of the non-residential customer landscape, and to gain insights that inform the development of pilot programs and services to support our customers in the future.



Water efficiency officer, Ishita Singh
from the City of Sydney council

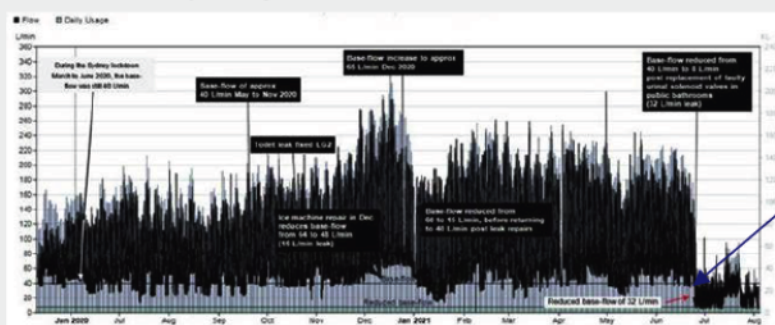
Sydney Water co-funds a water efficiency officer at each council and provides training, support and resources to assist them in delivering the pilot program within their local government area.

The program includes:

- Education delivered through webinars, workshops and customer engagement.
- Subsidised water efficiency assessments, temporary datalogging and active online monitoring services, and a case management approach in supporting customers to investigate and address faults.
- A report detailing site-specific findings, recommendations and supporting services that can improve the water efficiency for a site and reduce their environmental impact.
- Funding opportunities to assist customers in implementing work.
- Proactive engagement with customers that have high water use or increasing water use to investigate the cause.

2020-21 achievements:

- 195 water efficiency assessments were completed while officers were in training.
- The interventions implemented are estimated to deliver 61 ML of water savings annually.³¹
- Used the collation of findings from over 60 childcare centre assessments to inform the development of a pilot washing machine replacement program for childcare centres, which is currently being delivered.



A baseflow identified from online monitoring services prompted multiple leak repairs

³¹ current estimates may be subject to the impact of COVID 19

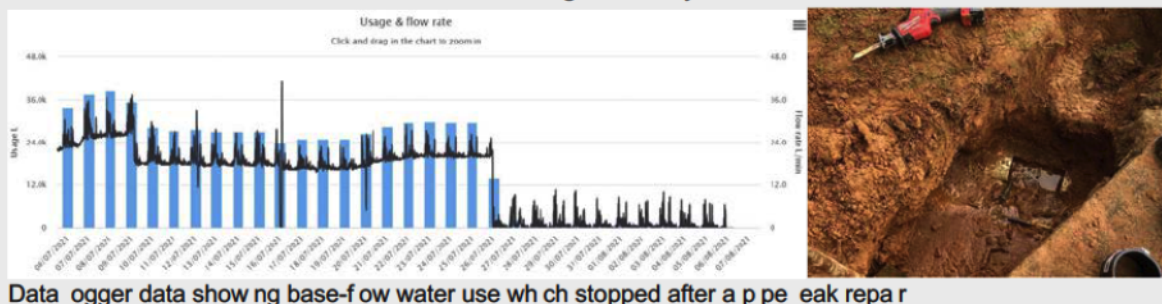
Online Monitoring (Nov 2020 – June 2022)

Water conservation challenge: Water efficiency audits conducted for businesses in the past, identified that leaks account for an average of 10-20% of total water use. Online monitoring can help businesses easily detect any unusual water usage to then save money and water.

Project description: The pilot online monitoring program is a subsidised service available to non-residential customers which includes the provision of a datalogger and access to an online monitoring platform. Online monitoring is key to early leak detection and is one of the easiest and most effective tools to monitor and manage a site's water use. It allows business to understand how, where and when they use water and establish trends. This allows a business to identify and address unusual water use from leaks and malfunctioning processes early, saving a business water and money.

Water saving benefit:

- 36 data loggers installed across 28 business and industrial sites
- 95L per minute/day of abnormal water usage detected for one site, within one day of installation
- Estimated to deliver 6 ML of water savings annually



Data logger data showing base-flow water use which stopped after a pipe leak repair

WaterFix® Small Business (Jan 2021 – June 2022)

Water conservation challenge: There is a need in the market for affordable service offerings that can help small businesses improve their water efficiency.

Project description: WaterFix® Small Business is a pilot program offering a subsidised water efficiency focused plumbing service for small business customers. This subsidy includes a call out and water efficiency assessment, as well as works completed by the WaterFix® plumber. This service can result in water savings in a range of ways, such as:

- Leak repairs.
- Installation of WELS star rated aeration devices.
- WELS 4-star rated showerhead replacements.
- WELS rated tap replacements.
- Installation of water efficient pre-rinse spray valves.
- Toilet repairs and replacements.

In 2020-21, the pilot program was offered to Sydney Water business customers who had a single 20mm to 50mm meter with a commercial Sydney Water account. We improved our promotion of the offering by working with council relationships to open services to small businesses that do not have a commercial Sydney Water account.

Water saving benefit: Completed 13 appointments and received 100% satisfaction from customer surveys.



WaterFix® plumber repairing a tap leak

Research and innovation

Smart Shower Timer (March 2021 - June 2022)

Water conservation challenge: Showers account for 26% of residential water use. Customers spend an average of six minutes in the shower. During drought restrictions, public education campaigns are the only mechanism used to encourage shorter showers.

Project description: To investigate the feasibility of developing a digital “Smart Shower Timer” as an alternative option to conventional shower timers.

The digital shower timer has the capability to provide real-time information to customers and Sydney Water, to assist their understanding of their water use and promote water saving behaviours as part of a Smart Homes, Smart Cities approach to water conservation.

Water saving benefit to customer: It will be prudent to incorporate customer insights and feedback in the development of this tool, so it can be used to support residential savings during drought (up to 60 ML per day).



Analysis of water consumption data (completed)

Water conservation challenge: Residential customers use 66% of all drinking water supplied in Greater Sydney. Understanding how households use water inside and outside their homes is fundamental to identifying usage patterns, trends and potential opportunities for future water savings³².

Project description: Sydney Water’s end use study has been collecting water use data on around 200 homes since July 2018. This data, combined with algorithms to categorise different digital signatures into individual end uses (eg. toilet flushes, showers, etc), provides insights into how people choose to use water at home and the efficiency of installed appliances, devices and fixtures.

Water saving benefit to customer: The results will continue to inform future water conservation efforts and support further investigation into using data in combination with other metering information to directly engage with customers on their water use.



³² Note image does not include estimated water lost from leakage

One stop one story Hub (OSOS) (July 2020 - June 2022)

Water conservation challenge: In some cases, financially vulnerable customers may be left in a position where they are unable to afford the cost of a plumber. As a result, they are more likely to leave leaks unrepaired, leading to water waste and higher water bills that can place financial pressure on the customer in the longer term.

Project description: The Hub is an Australian-first digital platform that will provide better support pathways for customers by allowing them to connect to support services across a range of sectors. This made it easy for customers to ask for help and get access to services to improve water efficiency.

Water saving benefit to customer: The OSOS will improve referrals to our Customer Care team, who can provide water efficiency information and make referrals to PlumbAssist® who will conduct water efficient audits and give access to emergency and essential plumbing to vulnerable customers.



Hydraloop – Innovation in urban residential water recycling (June 2021 - June 2023)

Water conservation challenge: Currently many homes have rainwater tanks and while recycled water options are available at the precinct scale, decentralised recycling water options are limited when it comes to being commercially viable at apartments, townhouses or units.

Project description: This project will trial and evaluate a new emerging technology called Hydraloop on 33 different styles of home in Sydney. Hydraloop is a small refrigerator-style water treatment system that collects, cleans and disinfects water from showers, baths, washing machines, handbasins, and air conditioning units so it can be re-used for toilet flushing, washing machines, garden irrigation and topping up swimming pools. The study will initially evaluate the costs and benefits of implementing this device for recycling water from showers and baths and re-using it for toilets, irrigation and pool top-ups.

Water saving benefit to customer: This project could provide a new way for Sydney Water to use decentralised recycled water technology at the residential dwelling level, including apartments. The application for toilets alone could potentially save up to 20% of residential indoor water consumption.



Commercial washing machine pilot (April 2021 – June 2022)

Water conservation challenge: Assessments completed by the Water Savings Partnership pilot program found over 97% of childcare washing machines were inefficient, top loading machines. Many were suffering premature failure or high maintenance costs due to the frequency of washing required in childcare centres.

Project description: Working in partnership with local councils to trial replacing inefficient top loading washing machines with highly efficient commercial grade front load washing machines. A second replacement pilot was initiated for shared machines in Land and Housing-owned multi-unit complexes.

Water saving benefit to customer: Expected reduction of 160 litres per wash to 45 litres per wash (with energy and detergent savings also anticipated). Across the 44 machines forecast to be installed, we anticipate a 1.72 ML annual demand reduction for up to 30 years.



Improving Systems and Process in Schools Water Efficiency (June 2021 – June 2022)

Water conservation challenge: Schools are among Sydney Water's biggest users of water. A recent pilot found plumbing upgrades can save on average, 26 litres of water per student, per day. However, it is difficult to extract individual school data to then identify high usage schools.

Project description: Improve analysis of water use for individual schools and create a direct line of communications with schools through the Sydney Water website in order to develop interagency data sharing that will identify high water using schools. This will support education agencies in water monitoring and management.

Water saving benefit: Enables Sydney Water to improve school water literacy at a management level. It also supports WaterFix® staff to quickly identify high water using schools and provide them plumbing upgrades. Potential annual demand reduction at high usage schools of 4.7 ML.



Smart Devices Smart Homes (July 2020 – June 2022)

Water conservation challenge: Recent advances in IoT, internet and computing power has spawned new smart home devices that could be harnessed to improve household and commercial water efficiency. This will have significant benefits in greenfield sites such as Western Sydney or in city rejuvenation projects.

Project description: The University of Technology Sydney's (UTS) Institute for Sustainable Futures will undertake independent research to assess and quantify the water saving benefits of using state-of-the-art Smart Command technology in a commercial office building.

Water saving benefit to customer: The project, due for completion in June 2022, will enable Sydney Water to identify best flow rates and water pressures to optimise water conservation in modern bathrooms, as well as ways to identify leaks with more advance data insights. It will also provide insights around human behaviour in using these new smart bathroom technologies that Sydney Water can harness to develop more innovative water conservation solutions for customers



Robotic Solutions for Urban Greening and Water Conservation (June 2021 - Oct 2021)

Water conservation challenge: Private and public irrigated spaces provide significant opportunities for water conservation and smart irrigation. However, they require commercially viable implementation pathways to be attractive for businesses.

Project description: Explore commercially viable options to reduce potable water consumption for urban greening, by harnessing assistive Artificial Intelligence technologies to enable smart irrigation, leak detection and improve soil water holding storing capacity.

Water saving benefit to customer: A roadmap of technology-readiness of new agricultural field robotic and smart sensing solutions that could assist large business users will be developed. Sydney Water can then undertake trials of technology that could be cost-effective for large business to adopt.



4.2 Water Leakage

In addition to the programs delivered in 2020-21, a detailed Water Leakage Program has been developed to ensure delivery of initiatives and tracking of the program outcomes, with a focus on continuing to improve leakage and drive leakage to the Economic Level of Leakage (ELL) target. Sydney Water's Leakage Management Program consists of four core leakage activities:

- Active leakage control
- Speed and quality of repairs
- Asset management
- Pressure management³³

The program is supported by improvement initiatives, focused on data and analytics and innovations to better identify, and locate leakage in the network. Key components of the Water Leakage Program are shown in Figure 4-1.

The target of the leakage management program is to achieve leakage to the ELL, which is calculated using the method outlined in the Leakage Management Manual (see Appendix D). A minimum level of core activity is continuously undertaken to manage water leakage, while the program is further adjusted in response to performance against ELL.

In 2020-21, our leakage program supported a 12.2 ML/d reduction to our rolling 12-month result (down to 112.5 ML/d). Currently our ELL target is 108 ML/d, with an uncertainty band of ± 16 ML/d. We are committed to continuing to improve the efficiency and effectiveness of our leakage management activities. See Appendix D for our key leakage statistics.

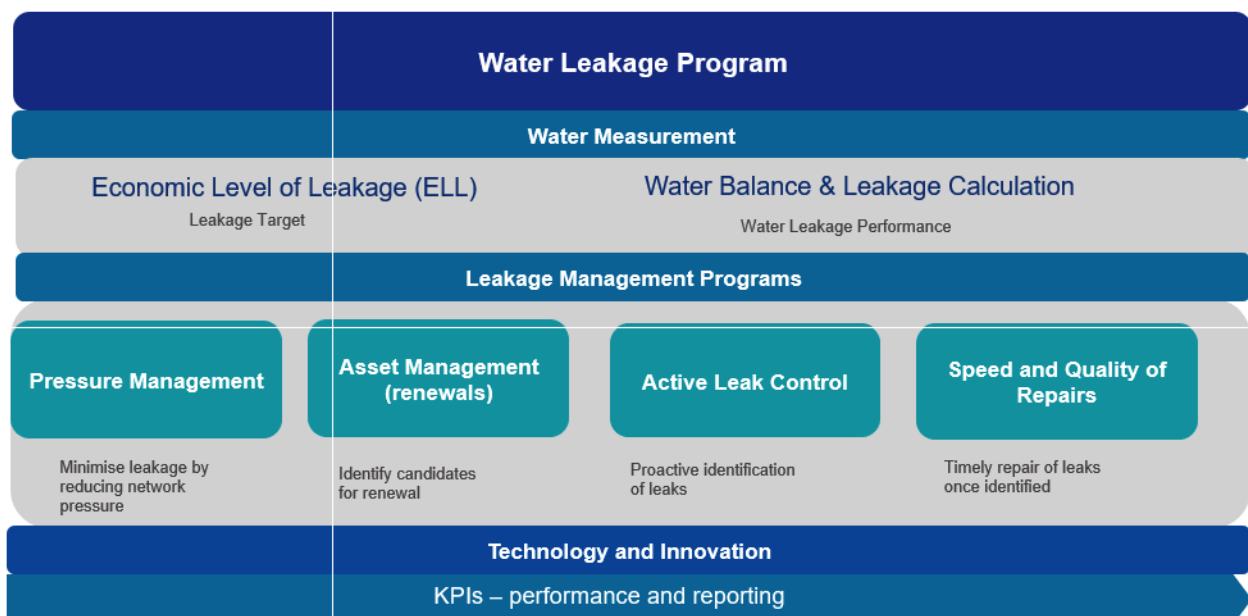
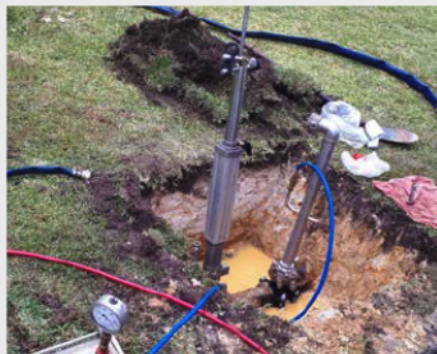


Figure 4-1 Water leakage programs

³³ Note this initiative will be investigated in 2021-22

Established Programs

Speed and quality of repairs



Program description: Sydney Water is rolling out auto scheduling which is designed to improve response time and allocation of resources to high priority network maintenance. In addition, changes to work areas are being trailed to concentrate maintenance resources in smaller geographic areas where there are areas of higher water breaks and leaks. This will reduce travel time and improve our response time, thereby reducing water lost through significant main breaks.

Sydney Water has also introduced new tools to allow repair of water mains under pressure. This avoids the need for network shutdowns and conserves significant volumes of water by removing the requirement to empty, flush/clean and recharge the network.

Adapting the program: Leakage management, backlog, response time, active leak repair and resource allocation has now been separated into one of several programs of work in the work plan for our maintenance crews. This will improve performance tracking delivery and governance.

2020-21 achievements: Key data in Appendix D

Active leak control

Program description: Active leak control is a program of work that identifies concealed leaks using a range of technology and devices. Most of this work is undertaken by specialist field survey companies, who scan watermains using acoustic leak detection equipment and identify hidden leaks.

Adapting the program:

The active leak control program continues to be improved. Examples include:

- Exploring the use of different leak detection devices in diverse locations to improve identification of leaks (see TaKaDu case study below).
- Enhancing data and analytics to better inform the location of watermain scanning, improving the program's efficiency. Including:
- Tracking unusual water usage patterns during low usage periods (ie minimum night flows) to find hidden leaks.
- Improvements in the accuracy and granularity of water balance (see case studies below)

2020-21 achievements: In 2020-21, Sydney Water undertook active leak detection activity on over 12,000kms of water mains. We identified 5,802 leaks, driving a significant part of Sydney Water's preventative maintenance program. In 2020-21, this program avoided water loss of 1,570 ML of water and contributed to improved leakage performance of 112.5 ML/d over a 12-month period.

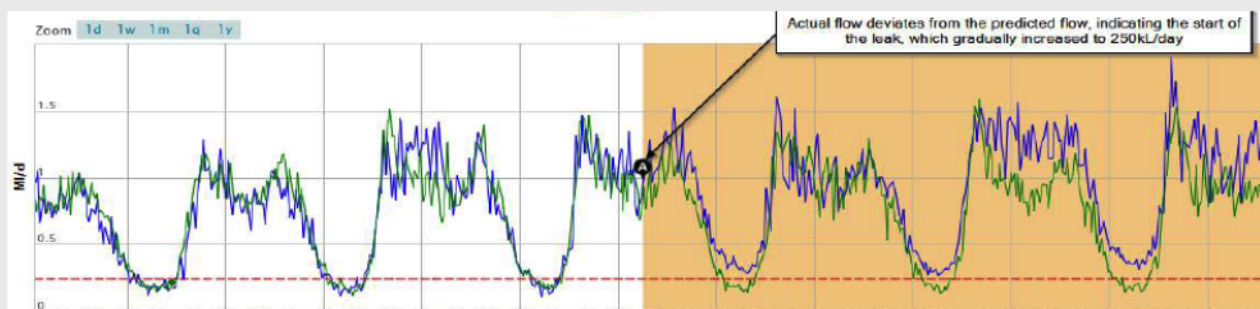
Detecting Water Leakage Using Machine Learning



Water conservation challenge: Determining water leakage in real time.

Project description: In addition to more traditional leak detection methods, Sydney Water is using sophisticated data analytics on our monitoring and control system data. Data analytics is a proven way to detect hidden water leaks by identifying flow anomalies within selected areas of the water network, which can then be located and repaired through targeted field investigations. Sydney Water's Customer Hub has been working with **TaKaDu** for several years to identify flow anomalies using machine learning algorithms.

Water saving benefit to customer: This approach is used as active leak detection in approximately 25% (or just over 5,000 km) of Sydney Water's pipe network. The TaKaDu data analytics technique led to an avoided leakage volume of 311ML and an avoided burst cost of \$250K-\$700K (depending on the value of water) in 2020-21



Actual flow deviates from predicted flow, indicating the start of the leak, which gradually increased to 250 kL/day

Asset management

Program description: Consideration of leakage issue on the asset are included in asset candidates for potential renewal. This in turn delivers a consequential impact contributing to leakage when an asset is renewed for either break history or end of life considerations.

Adapting the program: There are times when a program of work is created specifically for leakage as the prime driver and funding under the water conservation fund is considered.



2020-21 achievements: \$36,000 was invested in the repairs of Catalina and Lawson reservoirs, funded from water conservation program at an estimated water savings of 4.2 ML/year.

Early lifecycle projects

Leak detection dogs (March 2021 – ongoing)



Water conservation challenge: Efficiently reducing leakage from Sydney Water assets.

Program description: Joey is a working Springer Spaniel trained to detect drinking water leaks throughout our network. Joey's job involves scanning critical and reticulated water mains for leaks, support reactive leak detection where conventional methods have not been effective and work in collaboration with leak detection innovation projects to improve detection methods.

Water saving benefit to customer: To date, Joey has successfully found leaks on mains, service valves, hydrants, water meters and private leaks across Sydney. Additionally, Joey and his handler have been great ambassadors, spreading the word about the importance of water conservation: featuring on Channel 9 and presenting at North Sydney Council's Bark in the Park display.

Leakage Dashboard (March 2021 – July 2021)

Water conservation challenge: Lack of a more granular resolution of leakage metrics to identify hotspots and plan leak reduction interventions to reduce water loss.

Project Description: Sydney Water currently calculates and reports Leakage Performance Metrics at a total system level. This project is a Proof of Concept for setting up water balance and other secondary leakage metrics for 13 delivery system areas using advanced data analytics. The leakage dashboard will enable us to determine the leakage metrics at a greater granular resolution for quicker and better identification of leaks. The leakage performance dashboard at a better granular resolution will assist to prioritise investigations and improve decision making to target leakage efforts at the right areas for leakage reduction, water continuity and to minimise customer disruptions.

Water saving benefit to customer: The leakage performance dashboard helps us to identify leakage hotspots quickly to fix leaks or plan appropriate intervention strategies to reduce water loss.

Research and innovation

Semi-Permanent Acoustic Sensor trial in Sydney CBD (December 2019 – current)

Water conservation challenge: Potential avoidance of main breaks and real-time leak detection in high-risk CBD areas. In the cities, 90% of leaks are hidden leaks and it is challenging for the traditional leak inspections to pick up leaks due to the high environmental noise.

Project Description: To improve leak detection, Sydney Water in collaboration with the University of Technology Sydney (UTS), has deployed 229 permanent acoustic sensors across five Central Business District (CBD) areas since December 2019. The Sydney CBD, Bankstown, Penrith, Chatswood, and Liverpool have been prioritised for sensor deployment using a pipe failure prediction tool model. Since their deployment, acoustic data from all sensors has been analysed, with signal processing algorithms developed to automate the analysis and increase the reliability of leak alarms.

Water saving benefit to customer: The program has detected 100 leaks, with 72 confirmed – 31% from hydrants, 21% from valves, 19% main taps and 16% private leaks.



Lift and Shift Logger Acoustic Sensor Trial (December 2019– current)

Water conservation challenge: Concealed leak detection in Suburbs

Project Description: Lift and shift acoustic sensors are deployed on one day and collected/redeployed on the next day. They do the actual sound recording during the night when the water pressure is high, and consumption and street noise are low. The leak noise data is collected the next day and the loggers can be redeployed in another zone. This way, leaks can be easily heard and seen by our crews who can then repair them before the leaks become visible to the customers and to stop further water loss.

Water saving benefit to customer: 150 lift and shift sensors have been deployed across three small pressure zones in Bantry Bay, Wahroonga, and Holroyd. We plan to install additional sensors in small zones and use this technology to improve the effectiveness of the Active Leak Control Program.



Quantum Sensing (July 2020 – June 2021)

Water conservation challenge: Efficiently reducing leakage from Sydney Water assets.

Project Description: Sydney Water in collaboration with NSW Smart Sensing Network (NSSN), Australian National University (ANU) and University of Canberra (UC) is undertaking a study to use Quantum Sensing to detect leaks from buried pipes.

A leak before a major break will cause water to leak into the surrounding soil. The soil thus changes from dry to wet, leading to a change in its density. Measuring this change in density of the soil with the ground penetrating radar (GPR) detects leaks in pipes.

The tests conducted with simulated leaks from pipes in Potts Hill and Strathfield were successful in validating and demonstrating that GPR could pick up unidentified leak patches and moisture around the pipes. It is planned to validate the survey results in an operational environment with Sydney Water and South Australia Water in 2022. ANU with Nomad Atomics, will create a quantum sensing technology prototype to use in utilities for leak detection in water mains and further in sewer mains by 2024.

Water saving benefit to customer: Through this method there is no need to drill, dig or make connections in a pipe, which would reduce disruptions to customers, the public and motorists when detecting leaks.



iQuarius trial (March 2021 – June 2022)

Water conservation challenge: Efficiently reducing leakage from Sydney Water assets.

Project Description: The project is a trial of IQUARIUS mobile solution to verify and track the exact location of a leak and with a correlation-enabled smartphone app acoustic leak detection solution to improve the efficiency and monitoring capability of our ongoing Active Leak Control Program, undertaken by Specialist Field Service Contractors. Sydney Water internal staff will trial the mobile solution with online training and support from Israel to map the leaks on GIS maps, improving the monitoring and record-keeping in the Active Leak Control Program. The trial also involves AQS-SYS, the fixed acoustic sensors on pipe fittings which continuously monitors via daily scheduled sampling and correlation analysis of leaks. Automatic notifications are issued to the operators indicating the location of leaks on a GIS map. The Fixed Sensor trial would enable continuous detection of leaks in high-risk CBD areas with potential avoidance of main breaks.

Water saving benefit to customer: Use of IQUARIUS mobile solution would improve the monitoring capability and efficiency of the Active Leak Control Program, allowing all the concealed leaks to be picked up in turn reducing the water loss. Continuous monitoring of pipes with acoustic sensors in high-risk CBD areas will avoid main breaks, minimise customer disruptions and reduce water loss.



Smart Standpipe – Digital metering for hydrants (June 2021 – June 2022)

Water conservation challenge: Standpipes are used to allow access hydrants when a normal metered connection is not available (ie for water carting, construction sites, dust suppression, remediating environmental overflows or emergency response). Water is not measured from standpipes, so the usage patterns are unknown, and water used from standpipes is often unmetered, therefore counted as water leakage.

Project description: Trial smart standpipes by evaluating their use internally with Environmental Call Out Crews. This is a device with a digital flow meter and digital communication technology to record and transmit water use directly to Sydney Water. The data obtained will provide Sydney Water with actual potable water consumption data for remediating dry and wet weather overflows (see LEO Truck on page 47) and provide vital information to Sydney Water on unaccounted water loss not attributed to leaks and breaks.



Water saving benefit to customer: A new way for Sydney Water to prevent water theft and target inefficient water use, inform opportunities for recycled water use and account for water loss not attributed to leaks and breaks.

Digital Metering Trials (2019 – June 2022)

Water conservation challenge: Understanding where, when, and why customers use water is key to being able to target our efforts for water conservation and deliver our services more efficiently. Digital metering provides detailed data on usage, which empowers our customers and Sydney Water to make better informed decisions on how we manage our resources.

Project description: The digital metering trials will inform decisions on how digital metering can be rolled out at greater scale. The trial is investigating metrology and wireless communication technologies, business process changes, customer-facing benefits, and network management benefits. Around 8,500 digital meters that deliver hourly water usage data are being deployed in the Liverpool/Mt Pritchard supply zone. Digital metering will be rolled out to an additional 26,000 properties in a new project from 2022 to 2024. A larger scale roll-out is anticipated to commence from 2024.

Water saving benefit to customer: Digital metering data will help our customers make better, informed decisions about how they use water. By providing tailored, data-driven insights to customers into their water usage, we will enable them to improve their usage behaviours, conserve water and reduce their bills. Customers are receiving continuous flow notifications to help them identify leaks in their properties and are offered assistance to resolve them.



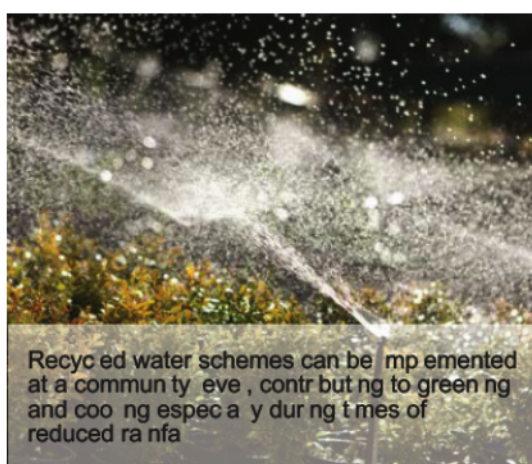
4.3 Recycled Water

Recycled water is a critical component of Sydney Water's portfolio approach to deliver a resilient and sustainable water supply that supports healthy waterways and enables a productive, liveable, and sustainable city. Recycling water reduces demand on our drinking water supplies and contributes to water security during drought or other system shocks. It makes the most of an existing resource while reducing demand on the riverine environment. Additionally, recycled water can contribute to reducing wastewater infrastructure costs including those associated with increasing standards for environmental discharge to waterways.

Recycled water can be produced from greywater, wastewater or stormwater and delivered at different scales:



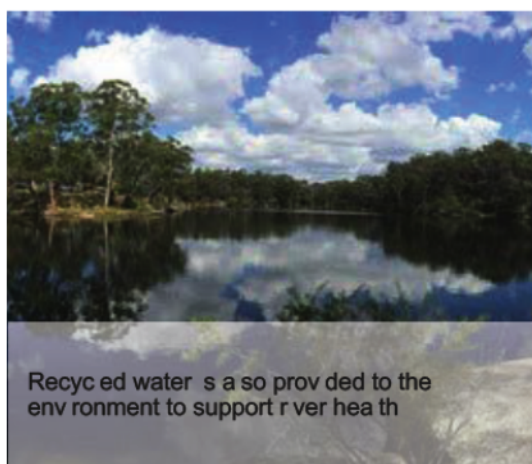
Rainwater tanks or greywater harvesting are often implemented at a household level and used for watering gardens, flushing toilets, washing laundry and cars



Recycled water schemes can be implemented at a community level, contributing to greening and cooling especially during times of reduced rainfall



Recycled water can be produced commercially, to meet industry and businesses' needs



Recycled water is also provided to the environment to support river health

In 2020-21, Sydney Water continued to provide recycled water services to our existing customers, while also actively pursuing opportunities to expand recycled water uptake and trialling several innovations in the delivery of recycled water.

Established Schemes

In 2020-21, Sydney water produced 37.7 GL of recycled water, contributing to a reduction in drinking water demand of 12.7 GL. The recycled water volume produced was less than 2019-20 due to a major infrastructure upgrade at Quakers Hill and St Marys Water Recycling Plants (see Table 4-1 and Appendix C). Recycled water production from the St Marys Advanced Water Treatment Plant (AWTP) is expected to return to normal levels from October 2021. Recycled water produced from St Marys AWTP is used as an environmental flow for the Hawkesbury Nepean River, not directly offsetting drinking water usage.

Table 4-1: Recycled water produced in 2020-21 and 2019-20

Supplied to	Run by	2020-21 annual production (GL)	2019-20 annual production (GL)
Residential, commercial and industrial use	Sydney Water	10.47	11.0
Environmental flows	Sydney Water	4.56	12.0
Use at wastewater treatment plants	Sydney Water	16.99	17.4
Irrigation of parks, sports fields and agriculture	Sydney Water	8.35	4.2
Total from Wastewater	Sydney Water	37.7 GL	47 GL
Total SW drinking water savings	Sydney Water	12.7	13
Sewer mining	Third party	Unknown	1.1
Stormwater harvesting	Council	Unknown	Unknown
Onsite reuse schemes	Third party	Unknown	Unknown

Early lifecycle projects

Sydney Water is actively pursuing opportunities to expand recycled water uptake. During the last year, we have progressed the following:

Expansion opportunities



Sydney Water executed a landmark deal with the developer, Celestino, for a recycled water plant to Sydney Science Park as a showcase for sustainable development. The plant will produce 1.2 million litres of recycled water each day – enough for around 10,000 people for toilet flushing, clothes washing, watering gardens and public open spaces. Over time, capacity is expected to grow to around 2.4 million litres a day. Operations are expected to commence in late 2023.

The Minister for Water, Property and Housing, Melissa Pavey, joined by Sydney Water's Managing Director, Roch Cheroux, Chairman, Bruce Morgan, Chairman, John Camilleri, and General Manager, Chris Gould, along with Celestino CEO Matthew Scard, to turn the first soil at Sydney Science Park.



The Western Sydney Airport area (suburb of Bradfield) has been a major focus. The Hoxton Park recycled water plant will enable recycled water supply to this new growth area. Development of a new geospatial mapping tool will also enable us to map customer demand against new supply pipelines and treatment plants.

Established a Memorandum of Understanding (MoU) with City of Sydney, which aims to collaborate on recycled water planning including investigating the supply of recycled water to the George St recycled water pipeline and urban renewal sites.



Sydney Water Managing Director Roch Cheroux and City of Sydney Mayor Clover Moore signing MoU

Research and innovation

Sydney Water is also trialling and developing several innovations in the delivery of recycled water to reduce cost and increase uptake and accessibility. These include the following pilot trials:

Recycled Water Products for customers

Water conservation challenge: Building the resilience of our customers by providing a diverse range of recycled water services that are attractive and cost-effective.

- **New development areas:** Development of a decentralised modular packaged plant for interim servicing at small scales.
- **Residential customers:** Hydraloop urban residential water recycling (see 4.1.3 for details).
- **High water users:** Investigating recycled water supply for high water using customers e.g. data Centres.
- **Construction sites:** Piloting the tankering of recycled water to be used by customers for construction and dust suppression, replacing potable water usage. Allowing for mobility in recycled water supply.

We engaged with representatives from Central Coast Council and Hunter Water to discuss their experiences with tankering. They shared learnings from their projects and advice for our pilot.

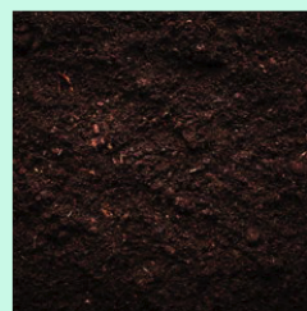


Recycled Water and Soil Interactions (July 2020 – June 2022)

Water conservation challenge: Population growth and greening/cooling requirements in Western Sydney will put pressure on available potable water supply.

Project description: To understand optimum recycled water quality to improve soil water storage capacity of soils in Western Sydney.

Water saving benefit to customer: The insights from this project will assist customers to reduce potable water consumption and provide alternative water options for urban greening. The outcomes of this project will also support the development of new irrigation best practice guidelines for customers, so they can use less water for urban greening.

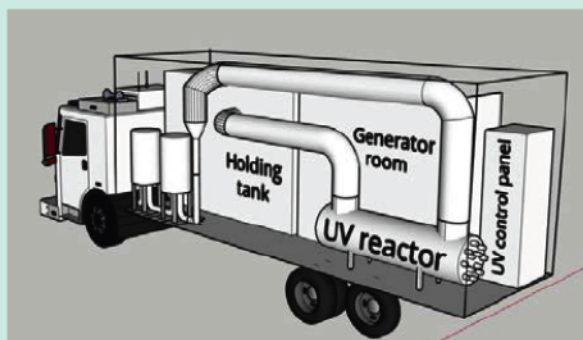


LEO TRUCK –water conservation for overflows (June 2021 – June 2022)

Water conservation challenge: The unprecedented drought of 2017 meant both Sydney Water and its customers had to find innovative ways to reduce potable water consumption through water efficiency. Wet and Dry Weather overflows require up to 960,000 litres of potable water to restore a significant incident to its pre-overflow conditions.

Project description: The aim of the project is to design a mobile treatment method to mitigate the need for potable water flushing, by harnessing recycled water that is re-circulated through the LEO Truck (A closed loop mobile recycled system) to restore the site to its pre-overflow conditions. The outcomes of this project phase are to undertake a detailed design concept overview of the LEO Truck. The results of this project phase will enable the LEO Truck to move into manufacturing phase to have new mobile water efficient treatment technology for trialling and treating environmental overflows.

Water saving benefit to customer: This project could reduce significant volumes of potable water and allows Sydney Water to manage environmental overflows in a more water efficient way.



4.4 Community awareness

Established programs

Behavioural

Program details: Our water conservation campaign aims to encourage and educate our community about the need to use water wisely and helps build resilience in our water supply. We use data and customer research to inform our approach and through this we learnt the following:

- 1 we need ongoing messaging about the ways to save water to achieve ongoing behaviour change
- 2 customers believe it is unreasonable for water savings campaigns to occur during high rainfall events/floods

Along with our campaign, we promote PR stories throughout the year to highlight key moments, stories and our water saving efforts.

We reach our diverse audience across Greater Sydney through a combination of different media channels including TV, out of home, digital, social and radio. The campaign is also translated into our key languages to engage with our culturally diverse audiences, which represent 36% of our population.

During 2020-21, we were no longer in drought, rainfall was refilling dams and research showed that our community didn't want to be told what to do with water while also living through COVID-19 restrictions. This meant we needed to take a different approach to our campaign. As a result, the Turn it off Bob creative aims to address the public in a less confrontational way by communicating with humour via a fictional and relatable Sydney family.

Partnering with Shane Jacobson, a recognisable, well-respected public figure and using humour increases the reach, engagement and 'talkability' of the campaign. 'Talkability' prompts people to talk about the issues with friends and family, which helps us spread our water wise messaging.



Adapting the program: Rainfall in August 2020 brought dam levels to over 98%, so we focused on promoting Sydney Water's improvements in leak detection technology. Water restrictions eased in December 2020, at the start of summer, which was communicated through a large PR campaign, also advising of the importance of continuing to save water and the details of Water Wise Guidelines. The launch of the "Turn it off Bob" campaign was delayed again as we responded to a 1 in 50-year flood, which led to the spilling of Warragamba Dam.

2020-21 achievements:

- August 2020 - secured innovation stories on quantum sensing to detect leaks
- December 2020 - Water Wise Guidelines introduced + PR on best water saving suburbs.
 - 31 million accumulated views (Channel 7, ABC Radio, 2GB and Daily Telegraph)
- April 2021 – leak detection dogs
- June 2021 – launch the "Turn it off Bob" campaign
 - PR launch resulted in a reach of 2.6 million people (50% of our total audience) through TV and Radio and 744,200 through online articles



Water literacy education and engagement

Program details: Our aim is to build water literacy and align with the community to promote key messages within the broader context of the urban water cycle. Our approach is to leverage the formal education sector to help deliver water literacy understanding among young people. In 2021-22, this will be expanded to build further foundational knowledge more broadly across our communities.

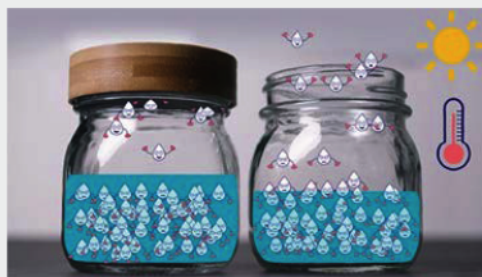
Adapting the program: Face to face engagement, including the long-standing Tours and Excursion programs, were limited during 2020-21 due to COVID-19 restrictions. To continue to engage with teachers and students, we adapted many of our programs to support digital learning. Insights gained over the course of the year indicated that video conferencing was not a preferred educational tool. Rather, short videos, animations and classroom worksheets were preferred in advance of returning to face-to face engagement.

2020-21 achievements:

Digital learning resources

New and revised lessons, activities and worksheets were launched on Sydney Water's dedicated Education webpages, attracting over 120,000 views, and 2,000 Google classrooms views reached an estimated 60,000 students.

Eleven new educational videos were launched on the Sydney Water YouTube channel for school and community audiences with a reach of over 115,600 views, including Water in your home launched in late May, three Water cycle experiments and Water on Earth animation.



Primary school resource packs

Sydney Water has invested in 1,800 primary school water conservation resource packs, which have been developed and are planned for distribution in late 2021 and early 2022, with an expected reach of 90,000 students. The resource packs include card games, books, lessons, and activity worksheets with a focus on building value for water and water saving behaviours.



Direct engagement

Over 1,670 visitors participated in an educational tour on our operational sites. Almost 800 people participated in an educational conference, workshop, or guest presentation.

Water literacy framework

A water literacy framework was developed to better understand community levels of water awareness and understanding. Insights gained will inform a three-year engagement period to enable an equitable, two-way dialogue with our community. The aim is to equip our community with the information needed to make well-informed, meaningful decisions about water and planning for the future.

Research and innovation

Water efficiency app with real time data

Water conservation challenge: Behavioural change campaign efficacy has been shown to be dependent on our ability to provide households with their water pattern, compare them to similar households and proactively inform them when there's a leak. With 95% of our current meters mechanical and most read monthly, we're unable to deliver usage at the cadence and resolution expected by the customer. Our challenge is to test customer interactions that can be enabled through the digitisation of the meter network and identify the benefits that will support the business case.

Project description / outcome: A Proof of Concept to gain insight into an identified customer need to understand water usage with greater cadence and via digital channels. The IoT project team have been working on testing digital meters, enabling the ability to capture and send more frequent usage data to Sydney Water. To take advantage of this richer data, we're building an inhouse Beta Usage App displaying usage, benchmark and household leaks daily, weekly and monthly.

We had 175 staff participants in the app trial which led to the following insights:

- A benchmark alone doesn't drive behavioural change.
- Change needs ongoing engagement to stick with the audience.
- Personalised information matters - information needs to be relevant to the customer.
- Leak alerts were an effective mechanism to influence action by customers (7% of participants triggered a leak alert between March and October 2020)
- We're expected to be the experts in educating our customers to be more efficient.
- Engaging staff in the new service/product design process drives employee advocacy.



Water saving benefit to customer:

The insights gathered from this small-scale trial will provide input into the design of the Digital Customer Experience and future products and services that deliver water efficiency outcomes and cost savings to our customers.



Project Time Frame: Commenced February 2020 with continued analysis of water usage pattern across different seasons and interactions of participants to understand the longer-term engagement and effectiveness of the Water Usage app.

4.5 Sector collaboration and regulator measures

Sector collaboration

Sydney Water participates in several industry associations and works in collaboration with Government and standards committees in order to learn, share and combine efforts to create greater impact. This ensures we are aware of new opportunities and emerging technologies both in the region, nationally and globally. Details of groups we work with are outlined in Table 4-2.

Table 4-2: Organisations we collaborate with on Water Conservation and highlights from 2020-21

Organisation	Committees	Highlights from 2020-21
WSAA	Water Efficiency Network Leakage Management Community of Practice	Funding proposal for online national water efficiency benchmark facility negotiated and developed. Presented ELL methodology to WSAA members. Shared the outcomes of leak sensor technology trials in proactive leak detection
Australian Water Association	Water Efficiency Committee	Position Paper on Water Efficiency approved by AWA Board. Members circulate / webinar focusing on regulatory models for water efficiency Paper on <i>Enhancing Sydney Water's leak prevention through acoustic monitoring</i> published in Water e-Journal Vol 5 No 2 2020. Participated in the Ozwater Conference in May 2021 (<i>Presentations: How to drive customer advocacy engagement and behavioural change; Advances in leak prevention to minimise unaccounted water</i>)
International Water Association	Water Leakage Management Committee	Participated in the IWA virtual Water Loss Conference in November 2020 (<i>Presentation: Creating a Better Life for Sydney - New Integrated and Proactive Approaches by Sydney Water</i>)
The Department of Planning, Industry and Environment	Metropolitan Water Strategy / State Water Strategy technical and strategy working groups	Worked closely with DPIE, ISF, WSAA, and regional water authorities to contribute to the development of a water efficiency program framework and an extensive program options list with expected costs and water savings. Also work collaboratively to support the NABERS national sustainability initiative.
Standards Australia / WELS	WS032 / AS6400	Worked with the ISO / PC316 committee to integrate the core elements of AS6400 into the international water efficiency labelling standard.
International Standards Organisation	ISO / PC 316	Worked with in the committee to harmonise the requirements of the various labelling standards to a common, agreed model for the future ISO Water Efficiency Labelling Standard.
ISLE Utilities	Leakage Management Benchmarking	Shared and learnt leakage management best practices with industry experts led by ISLE Utilities, Australia. Four Leading Practices by Sydney Water such as Digital Metering, Acoustic sensor trials, Customer Hub and Estimation of free service volumes in leakage calculations were identified and shared with international utilities.

Regulatory measures

There are two external regulatory measures: The Water Efficient Labelling and Standards (WELS) scheme and the Building Sustainability Index (BASIX). Both measures continue to improve the water efficiency of homes. BASIX is a state-wide planning policy that sets water use and greenhouse emission targets for residential dwellings. BASIX aims to reduce the volume of drinking water used and greenhouse gas emissions produced by new dwellings and existing dwellings with extensions and alterations. WELS is a national scheme that involves mandatory water efficiency rating and labelling for a range of appliances and fittings. It also sets minimum water efficiency standards for some appliances, such as washing machines.

Appendix A Reporting Requirements

Summary of requirement	Location
Clause 2.1 Water Conservation Report	
<p>Include information of Sydney Water's water conservation program for the previous financial year and for at least the next five financial years, including where relevant (but not limited to):</p> <ul style="list-style-type: none"> • Sydney Water's strategies, programs and projects relating (at a minimum) to water leakage, recycled water and water efficiency (Water Conservation Measures); • Whether the Water Conservation Measures are economic; • How and when the Water Conservation Measures will be implemented; • The targeted water users; • The expected water savings; • Cost of the measure per kilolitre of water saved; • The method to assess the effectiveness of the Water Conservation Measures; and • The extent to which these Water Conservation Measures accord with the with the economic level of water conservation (ELWC) and the Current Economic Method; 	<p>Chapter 2.2 Chapter 3 Chapter 4</p>
<p>Include details of all of the Water Conservation Measures relating (at a minimum) to water leakage, recycled water and water efficiency that were considered by Sydney Water in developing its water conservation program, and clearly identify those Water Conservation Measures that:</p> <ul style="list-style-type: none"> • Are economic when assessed by the Current Economic Method; • May become economically efficient at a later date; • Sydney Water is required to implement under Licence clause 3.1.2; • Sydney Water has implemented; • Sydney Water is proposing to implement at a later date (or under specific circumstances); and • Sydney Water is proposing not to implement and the reasons for not implementing; 	Chapter 3
Describe and explain Sydney Water's progress against each of the Water Conservation Measures of its water conservation program for the previous financial year, including any deviations from the program	Chapter 2.2 Chapter 4
Describe and explain any changes to Sydney Water's water conservation program relative to the previous annual Water Conservation Report (where applicable);	Chapter 2.2 Chapter 4
Outline how Sydney Water's water conservation program relates to the Metropolitan Water Plan and its progress against the Metropolitan Water Plan;	Chapter 1 Chapter 4.5 Appendix H
Include information on any Water Conservation Measures researched, piloted or developed for the previous financial year (including the funds spent on these activities);	Chapter 2 Chapter 4

Include information on the water conservation performance indicators (in Appendix C) for the previous financial year;	Chapter 2.1
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- | | |
|---|--|
| <ul style="list-style-type: none"> • Quantity of Drinking Water drawn by the water utility from all sources during the financial year, expressed in litres per person per day (observed) • Quantity of Drinking Water drawn by the water utility from all sources during the financial year, expressed in litres per person per day (weather corrected) | |
|---|--|

Include the following water conservation information for the previous financial year:	Chapter 2.1
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|--|--|
| <ul style="list-style-type: none"> • Quantity of Drinking Water drawn by Sydney Water from all sources, expressed in gigalitres per year (aggregate); • Level of water leakage from Sydney Water's Drinking Water supply system against the economic level of leakage for that financial year (in megalitres per day); and • Volume of water sourced from Recycled Water (in megalitres). | |
|--|--|

2019/20 IPART Audit recommendations

Sydney Water must update the Water Conservation Report to include more information on the development, delivery and monitoring of the program. This should include more information on how projects are first identified from the wide range of potential options, assessment of project effectiveness and monitoring of benefits. Sydney Water must develop the structure of this report and content to be included in time for the next water conservation report for the 2020-21 year.	Chapter 3.2 Appendix E
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By 30 June 2021, Sydney Water must demonstrate measures that have been taken in the 2020-21 financial year to improve its systems and processes used to deliver the water conservation program, including program monitoring and corrective action processes.	Chapter 2.2 Appendix B Appendix E
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Sydney Water must identify, assess, and include where appropriate measures for reducing leakage to below the economic level within its water conservation program. This should be completed for inclusion in the 2021-22 water conservation program.	Chapter 3 Chapter 4.2
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Appendix B Method Overview

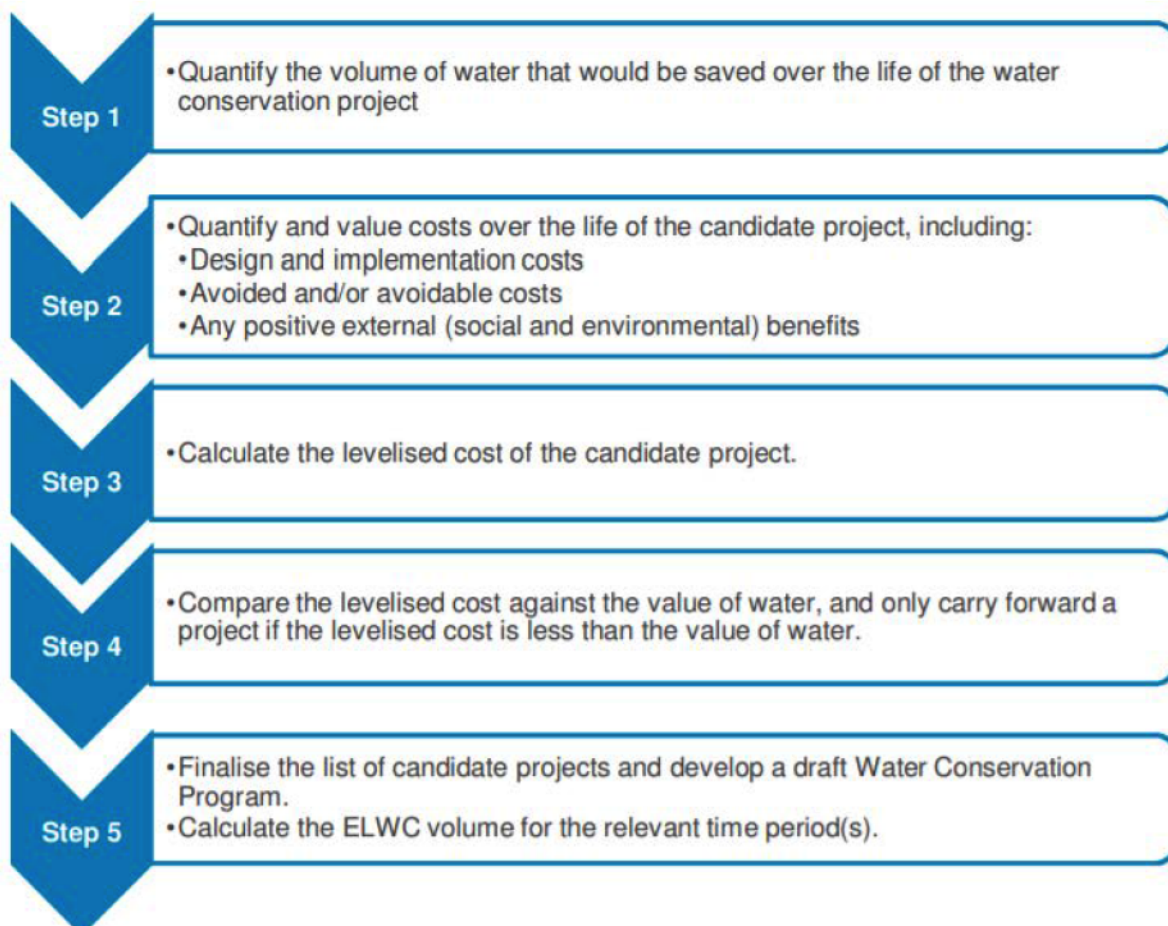
Estimating Economic Level of Water Conservation

Under our Operating Licence 2019-23, Sydney Water is required to maintain a water conservation program consistent with the Current Economic Method and to implement water conservation measures that have been assessed as economic as determined by the Current Economic Method.

The Economic Level of Water Conservation (ELWC) methodology is our Current Economic Method for assessing whether our water conservation measures are economic. The ELWC methodology should be conducted on any of the following types of water conservation activities:

- Water leakage;
- Water recycling; and
- Water efficiency (including demand management).

Essentially, a water conservation project is assessed as economically viable under ELWC where the levelised cost is less than or equal to the value of water. The process for applying the ELWC methodology is summarised in the diagram below.



Levelised cost estimates for several customer programs have been reduced as a result of incorporating additional social and environmental benefits, these include a reduction in energy, carbon, and wastewater treatment demands.

Estimating Economic Level of Leakage

Sydney Water aims to achieve an economic level of leakage (ELL) that balances the cost of water, system performance, customer expectations and programs. Ultimately, the approach is designed to identify and repair leaks while providing value for customers.

The ELL is the point where the cost of reducing leaks equals the value of the water saved. It is based on a least-cost model to determine the best rate of expenditure to manage leaks and this approach is based on International Water Association best practice, customised for Australian use.

The ELL target is established at the start of each year based on a mix of default values derived from statistical analysis across international water agencies, as well as current and historical asset and performance data such as length of main, increasing number of connections, water pressure, response times, leak detection costs, and the marginal cost of water.

Where possible, the forecasted prevailing climate conditions are considered in the determination of the ELL Target to gauge the changes in soil moisture and impacts on asset movement, that may increase or reduce weeping joints, emerging cracks. For example, the number of forecasted breaks would be less in non-drought related years.

Forecasting and monitoring water savings

The volume of water savings achieved from our water conservation programs are reviewed to support an adaptive planning approach for water conservation. It also provides evidence to inform the ELWC assessment process.

The table below summarises the status of these review.

Program	Status
WaterFix® Residential	Water savings are estimated using a bottom-up calculation of water savings per intervention, which achieves on average, a saving of 20.9 kL/yr per appointment. This assumption was last reviewed in 2021 which compared the consumption of a control group with those that had an appointment during 2018-19, and resulted in an average savings of 22 kL/yr per appointment. A further review of how the water savings are calculated based on actual water consumption, is underway.
PlumbAssist®	Planned for 2021-22. Course bottom-up estimates based on estimates of savings from device swaps and visual observations of leaks have been used to estimate water savings from this program.
WaterFix® Strata	Water savings estimated from actual consumption changes measured by online loggers.

WaterFix® Concealed Leaks	Water savings are estimated using site-specific fault information provided by a specialist service provider, and a bottom-up estimation for the program impact and forward potential
WaterFix® Small Business	Insufficient data available to assess savings. Review expected in 2022-23
Online Monitoring	Insufficient data available to assess savings. Review expected in 2022-23
Water Savings Partnership	Water savings are estimated using site-specific findings, and a bottom-up estimation for the program impact and forward potential

Appendix C Recycled Water

Over 2020-21, Sydney Water produced 37.7 GL of recycled water, contributing to a reduction in drinking water demand of 12.7 GL. The table below summarises the total recycled water supplied, and volume of drinking water replaced by recycled water initiatives³⁴ in 2020-21.

Recycled Water Scheme	Source of recycled water	Recycled Water (ML/yr)	Drinking Water Savings (ML/yr)	Type of use
Sydney Water Reuse	All STP	16,988	2,170.7	Industrial
Kiama Golf Club	Bombo	41.4	0.0	Irrigation
Castle Hill Country Club	Castle Hill	120.6	0.0	Irrigation
Aorangi Farm	Gerringong	126.0	0.0	Irrigation
Liverpool Golf Club	Liverpool	55.8	41.8	Irrigation
Warwick Farm Racecourse	Liverpool	97.5	73.2	Irrigation
Hickey's Lane Reserve	Penrith	1.2	1.2	Irrigation
Penrith Council Parks	Penrith	1.2	1.2	Irrigation
Picton Farm	Picton	286.5	0.0	Irrigation
Stonecutters Ridge Golf Course	Quakers Hill	69.1	0.0	Irrigation
Agricultural release	Quakers Hill	365.0	0.0	Agricultural release
University of Western Sydney, Hawksbury Campus	Richmond	115.2	0.0	Irrigation

³⁴ Drinking (potable) water savings are where drinking water would be used if recycled water was not supplied. Environmental, agricultural and some irrigation schemes do not save drinking water.

Recycled Water Scheme	Source of recycled water	Recycled Water (ML/yr)	Drinking Water Savings (ML/yr)	Type of use
Richmond Golf Club	Richmond	28.7	0.0	Irrigation
Rouse Hill Recycled Water Scheme	Rouse Hill	2,516.2	2,516.2	Residential
Dunheved Golf Club	St Marys	62.4	3.5	Irrigation
Agricultural Release	St Marys	2,428.0	0	Agricultural Release
Hawkesbury Nepean Replacement Flows	St Marys	4,555.5	0	Environmental flows
Elizabeth Macarthur Agricultural Institute	West Camden	18.9	0.0	Irrigation
Agricultural release	West Camden	1,825.0	0.0	Irrigation
Bluescope Steel	Wollongong (Stage 1)	6,699.5	6,699.1	Industrial
Port Kembla Coal Terminal	Wollongong (Stage 2)	21.1	21.1	Industrial
Wollongong Golf Course	Wollongong (Stage 2)	0.0	0.0	Irrigation
Wollongong Council	Wollongong (Stage 2)	0.4	0.4	Irrigation
Industrial Foundation and Rosehill Racecourse	Rosehill	1,242.1	1,242.1	
Total		37.7 GL	12.7 GL	

Appendix D Leak Management

Leak management statistics

Key statistics	2018-19	2019-20	2020-21
Actual Leakage (refer Water balance)	131 ML/day	124.7 ML/day ³⁵	112.5 ML/day ³⁶
Economic Level of Leakage (ELL) Target ³⁷	108 ML/day	108 ML/day	108 ML/day
Number of water main breaks, bursts and leaks	5,702	6,797	4,872
Number of water main breaks, bursts and leaks, per 100 km of water main	25	29	21
Average duration of an unplanned water interruption (minutes)	143	187	200
Length of mains inspected	15,000 km	18,001 km	12,000 km
Infrastructure Leakage Index ³⁸ (ILI)	1.63	1.50	1.31
Prevailing climate and weather conditions	Extended dry conditions Drought	Extended dry conditions Drought until February 2020	Normal to wet conditions

³⁵ These reported figures are subject to adjustment once final meter readings are collected. The reported numbers include a calculated estimated usage for the period (Accrued) when a final meter reading has not been received. These numbers are updated monthly.

³⁶ 12 month rolling average leak result to end of June 2021, as of 5 October 2021..

³⁷ An uncertainty band of ± 16 ML/day exists around the forecast ELL, as leakage is determined by deduction, total system supply minus usages, and uncertainty in input figures, including meter read adjustments, result in much larger uncertainty of the final leakage volumes over the year.

³⁸ The ILI is a standard introduced by World Bank includes bands from A (reflecting best practice) to D, with recommendations for both developed and developing countries. Sydney Water's ILI of 1.31 is in the top band (Band A [less than 2]) and compares well against other developed countries. By world standards Sydney Water rates in the top 10% of water utilities for minimum leaks

Several factors have impacted the average duration of unplanned water interruptions, over 2020-21. This includes changes in work practices to mitigate COVID-19 risks, changes in priorities while responding to the March 2021 flooding event, and improved capture of incident data.

In response, we have begun trials of automated dispatching, improved planning and bundling of work activities to optimise field resources and have focused on improved work scheduling to support our response to leaks and breaks in balance with minimising customer impact and maintain water continuity. We will continue to monitor and review our performance in relation to our leakage performance, balanced with water continuity and environmental outcomes and adjust our workplan priorities and resources accordingly.

Water balance

Sydney Water uses the water balance method to estimate average losses (leakage) from our water supply systems. The water balance is a reconciliation of the volume of water we produce with all known and estimated end uses subtracted. The remaining volume is estimated to be leakage. Sydney Water follows the methods, definition and terminology recommended by the International Water Association (IWA). The Water Services Association of Australia (WSAA) also supports this Approach. The table below shows the water balance results for 12 months from 1 July 2020 to 30 June 2021 in ML.

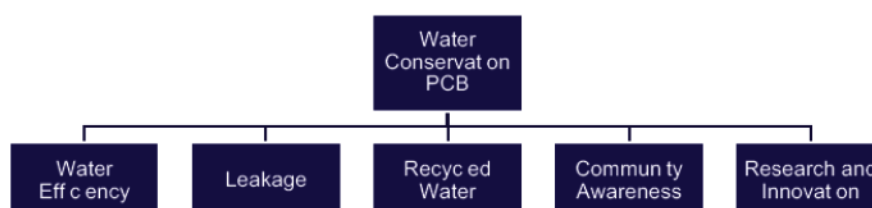
Water Supplied 524,168 ML ³⁹						
Non-revenue Water 55,751				Revenue Water 467,573		
Water Losses 51,076			Authorised consumption 472,248			
Real Losses 41,069	Apparent Losses 10,006		Unbilled Authorised 4,675		Billed Authorised 467,573	
Leakage on Mains 41,069 (112.5 ML/day)	Meter Inaccuracy 9,483	Unauthorised consumption 523	Unbilled Unmetered 4,515	Unbilled Metered 159	Billed Unmetered 2,903	Billed Metered 464,670

³⁹ Water supplied does not include system export volumes of 845ML for 2020/21

Appendix E Program governance and decision making

Water conservation is a broad program of work: from the operation of our assets, to engaging with and providing services for our customers as well as improving data and digital capability. The program is delivered by several teams, with a diverse range of skills. These teams are represented on the Water Conservation Portfolio Control Board (PCB), a group responsible for ensuring Sydney Water delivers the on the water conservation program. This includes:

- Monitoring performance;
- Providing holistic strategic advice and direction;
- Resolving issues and;
- Ensuring appropriate reporting of outcomes



The water conservation program needs to adapt to opportunities and challenges, as the value of water changes and as we improve our understanding of the effectiveness of water saving projects. This allows us to start, stop or adjust the scale of projects and introduce new ones.

To improve the way we do this, a research and innovation portfolio was established in 2020-21. This allows Sydney Water to assess and explore new water conservation opportunities, innovations, and emerging technologies.

Throughout this first financial year, opportunities have been prioritised and funded based on potential water savings and deliverability confidence, with the intention of developing a diverse portfolio of water efficiency and recycle water projects that support different types of customers to save water, harnessing data analytics to enable better targeting and delivery of water conservation programs, and initiatives that target internal water saving (ie reducing system leakage and losses).

New ideas are typically generated from staff and the stakeholders they work with. These ideas can be captured at any time through the Sydney Water innovation platform, a newly developed expression of interest form and through targeted workshops led by the research and innovation team.



Appendix H Glossary

Building and Sustainability Index (BASIX)	State-wide planning policy that ensures new residential dwellings are designed to use less drinking water and produce fewer greenhouse gas emissions by setting energy and waste reduction targets. BASIX also applies to extensions and alternations of existing residential properties.
Economic level of leakage	Represents the total level of leakage from the system at the point where the cost of leak reduction activities equals the savings from reduced water demand.
Levelised cost	The present value of net project costs divided by the present value of water saved, measured over the life of the project
Recycled water	Recycled water is water that has been used before and is then cleaned to remove impurities. Recycled water (sometimes called reclaimed water) comes from wastewater, which includes greywater and stormwater. Sydney Water treats recycled water to Australian Recycled Water Guidelines and NSW Health standards so that it is suitable and safe for its intended use.
Sewer mining	The extraction of wastewater upstream and/or downstream of a wastewater treatment plant for treatment and reuse as recycled water.
Stormwater Harvesting	The collection, treatment, storage and use of stormwater runoff.
Water Efficiency Labelling Scheme (WELS)	National scheme that involves mandatory water efficiency rating and labelling for a range of appliances and fittings.
Water Wise Rules	Long-term water saving rules introduced by the NSW government in June 2009. The rule focus on simple, common-sense behaviours, such as watering in the cool parts of the day, no hosing of hard surfaces and fitting hand-held hoses with trigger nozzles.
Weather Correction	The removal of year-to-year variation in water use relating to changes in weather conditions.
2017 Metropolitan Water Plan (NSW)	The 2017 Metropolitan Water Plan overarching goal is to secure water for a liveable, growing and resilient Greater Sydney. It establishes key strategies to be implemented over the life of the plan which includes, optimising the way we manage the water supply system, investing in water conservation, preparing for drought, delivering WaterSmart cities and improving river health

Appendix I Acronyms

AWA	Australian Water Association
BASIX	Building Sustainability Index
DPIE	Department of Planning, Industry and Environment
ELWC	Economic level of water conservation
ELL	Economic level of leakage
ILI	Infrastructure Leakage Index
IPART	Independent Pricing and Regulatory Tribunal NSW
ISF	Institute of Sustainable Futures
IWA	International Water Association
LPD	Litres per person per day
NSW	New South Wales
WELS	Water Efficiency Labelling and Standards
WRP	Water Recycling Plant
WSAA	Water Services Association of Australia
m	metres
l	litres
kL	kilolitres
km	Kilometres
ML	megalitres
GL	gigalitres