Sydney WATER

Research & Innovation

Creating a better life with world class water services

Annual Highlights 2019–20

Acknowledgement of Country

Sydney Water respectfully acknowledges Aboriginal people as the traditional custodians of Sydney, Illawarra and the Blue Mountains where we work, live and learn.

Their lore, traditions and customs nurtured and continue to nurture the waters (bulingang or saltwater and muulii ngadyuung or sweetwater) in our operating area, creating well-being for all. We pay our deepest respect to Elders, past, present and emerging.
We acknowledge their deep connections to land and waters. In the spirit of reconciliation, we remain committed to working in partnership with local Traditional Owners to ensure their ongoing contribution to the future of the water management landscape, learning from traditional and contemporary approaches, while maintaining and respecting their cultural and spiritual connections.

2019–20 R&I at a glance

Sydney WATER

Investing in R&I

$3.1m
2019–20 SRI budget expenditure

$338k
2018–19 R&D Tax Benefit Rebate

$3.6
leverage for every $1 invested into R&I

Industry leader

National AWA Research Innovation Award Winner

Intelligent robotics for sewer condition assessment

A culture of innovation

Measuring innovation
6.2/10 Innovation Effectiveness Index score 2019

Sydney Water Science Week event hosted 300+ attendees

300+

Wave innovation challenge
6 teams and 30 participants took on the topic 'responding to drought'. Winning idea project commenced.

OzWater 2020
11 presentations, podcasts and posters at the online OzWater conference

Patent filed
For our filtration membrane and method of production

Our R&I portfolio

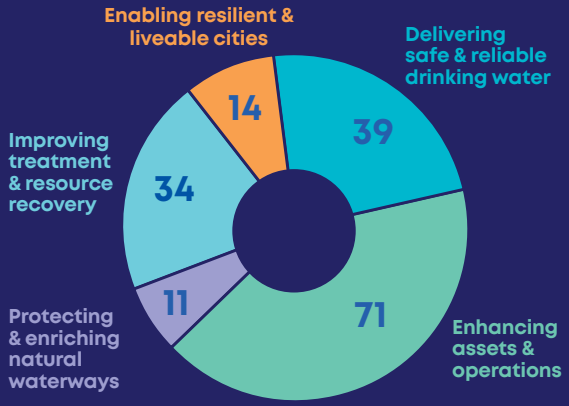
170+ projects
in progress across the business

42 % short-term projects

13 % medium-term projects

45 % long-term projects

33 concepts
ranked & prioritised



Research & Innovation 2019–20

Research & Innovation Themes

Adapting to a new future

The past year has certainly been challenging and unpredictable. From extreme drought, to unprecedented bushfires, to significant rainfall and dam inflows, and now to a global pandemic. Research and Innovation (R&I) has never been so important and will be key to driving new solutions to build our organisational resilience and become a successful and innovative business.

More than ever, we've had to come together and look at how we can do things differently for our customers.

Throughout 2019–20, we've collaborated to progress over 170 R&I projects across varying time horizons, from IoT sensors and digital metering trials to urban cooling and liveability initiatives, providing a significant pipeline of outcomes into the business.

This pack highlights our achievements over the past year. We're proud of what we've accomplished in the midst of so much change, all thanks to the enthusiasm and resilience of our people, partners and stakeholders.

Our innovative culture

Sniffer dogs join the team

Winnie and Ziggy, our wastewater sniffer dogs, joined the Resilience Programs team to help detect wastewater leaks. This innovative team collaborates with the wider business to identify and repair leaks before they become breaks, preventing impacts to our customers and the environment.

Safety is in our culture

We've been trialling wearable smart headsets to use in environmental response and training settings. A key safety feature of this device is that the operator can have both hands free, while talking to a remote expert who can see exactly what they can and talk them safely through the activity.

Riding the Wave

We held our second Wave event in October 2019: *Responding to Drought – let's bring our great ideas to life!* Over 30 employees and six teams came together to collaborate and come up with innovative solutions to the challenge of drought. We took the winning idea and turned into a viable concept – turn to Page 17 to find out more.

Our biggest Science Week yet!

Almost 300 attendees, presenters and external stakeholders came along to our 2019 Science Week event at Parramatta Head Office – with standing room only for many of the talks! It was a great opportunity to network, browse the displays and participate in technology demonstrations.

Science Week 2019

We're innovating for our customers

The wonderful Water Wizard of Oz

While working on pipes, we often turn off the water supply, which means our customers can be temporarily without water. Enter the Water Wizard!

The Sarco Stopper Water Wizard is a water bypass tool, allowing us to work on pipes while ensuring our customers receive a continuous supply of water.

The Water Wizard results in less service disruptions, helping us deliver for our customers every day.

Avoided loss of water supply to **148,000** customers

$364,000 saved by not having to pay 'water off' rebates

Reduced the times we need to attend site from 2.2 to **1.3 visits**

Helping understand community health during a pandemic

We're advancing the understanding of the new COVID-19 pathogen, SARS-CoV-2.

In response to the COVID-19 pandemic, Sydney Water acted swiftly to ensure our people were able to work safely, and we could continue to provide world-class water and wastewater services to our customers. But did you know Sydney Water is also playing a major role in tracking the spread of COVID-19 across NSW?

Since April 2020, we've been collecting and storing wastewater samples from all of our wastewater treatment plants and advanced water recycling plants to test for the presence of molecular markers of SARS-CoV-2. We've also provided samples to leading Australian researchers.

Sydney Water is a partner on WaterRA's ColoSSoS (Collaboration on Sewage Surveillance of SARS-CoV-2), a national wastewater epidemiology project using sewage to track COVID-19 in the community.

We've developed a method of using molecular markers to detect virus particles in sewage, and our West Ryde Laboratory is the only lab in NSW able to undertake this analysis.

In collaboration with NSW Health, we're analysing samples from targeted locations in regional NSW, helping to inform public health measures for the control of COVID-19 in NSW.

Our incredible laboratory team plays a major role in tracking the spread of COVID-19

Collaborating with our industry partners...

WaterRA

In 2019, Sydney Water became a member of Australia's leading national research organisation for the water industry, Water Research Australia (WaterRA). One of the major projects we have been working on with WaterRA is the ColoSSoS project – Collaboration on Sewage Surveillance of SARS-CoV-2. See Page 9 for more information.

W-Lab

In early 2020, the Water Services Association of Australia (WSAA) launched W-Lab, an industry-leading innovative technologies program with partners Isle Utilities and ThinkPlace. Sydney Water is proud to be one of over 20 members from the Australian and New Zealand water industry.

"By leveraging this technology innovation across different sectors, we can find new ways to optimise our own operations, which will enable Sydney Water and other utilities to deliver world class water solutions to our customers."

Dr Nicola Nelson
Manager Research and Innovation

...and our university partners

Almost 50% of Sydney Water's research projects are delivered by universities, and we generally employ around 10 undergraduate students and 15 university graduates each year.

To better streamline, promote and enable collaboration with universities, Sydney Water has developed a collaborative framework agreement between our major local university partners. We're initially piloting with four local partners; University of Sydney, University of Technology Sydney (UTS), University of NSW (UNSW), and Western Sydney University (WSU), with a view to expanding this to more university partners in the future.

This agreement will remove the need to go through complex and time-consuming contract negotiations for each new university collaboration – saving time, ensuring it is simpler for universities to work with us, and making it easier to implement research.

Delivering safe and reliable drinking water

We are constantly improving our water quality management and monitoring systems to ensure we continue to provide high quality, safe and reliable water to our 4.9 million customers – now and in the future.

Mobile water quality van – 'lifting the lid' during COVID-19

What would happen if our Water Filtration Plants (WFP) had to quarantine and close for cleaning due to COVID-19? This scenario could put our water quality testing at risk.

The Water Production and Optimisation team came up with an innovative solution – the mobile water quality laboratory van.

The van replicates the functionality of an on-site water quality laboratory, and can go to any WFP, operate online and carry out water quality testing – without needing to set foot inside the WFP site!

Case Study

Innovative ways to treat our drinking water

Natural Organic Matter (NOM) deteriorates raw water quality, increases the formation of disinfection by-products and reduces the capacity of water filtration plants to produce high-quality drinking water for our customers.

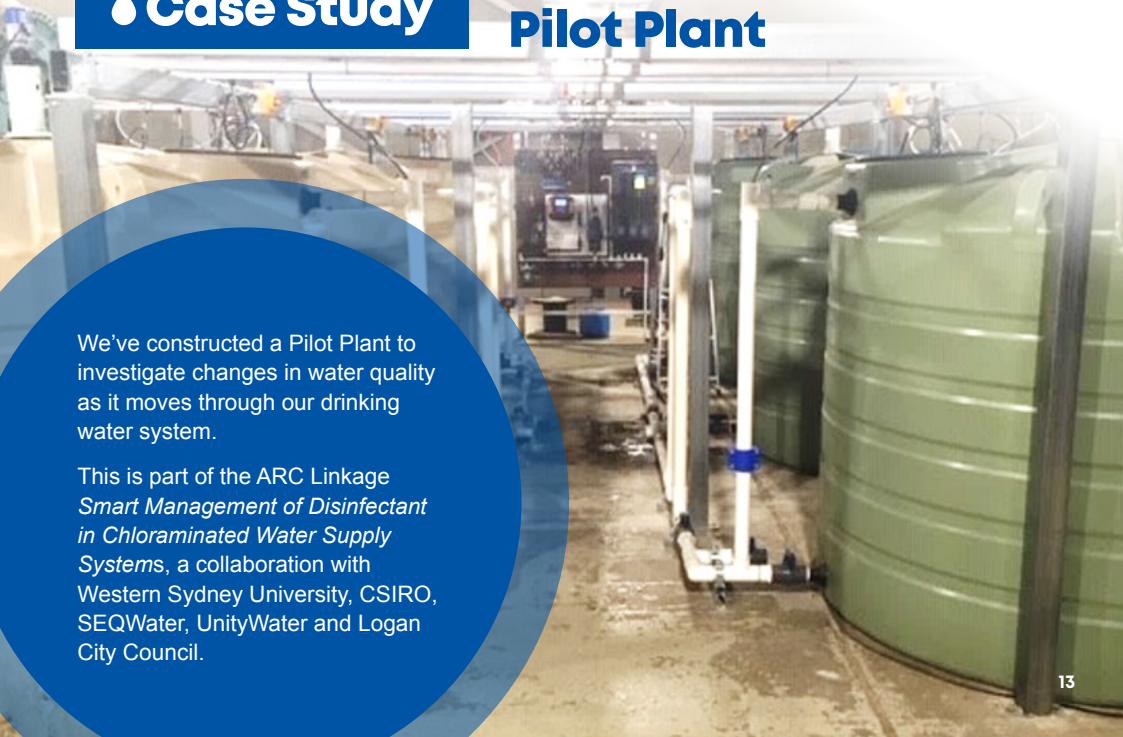
We've partnered with the University of Technology Sydney (UTS) and the Technical University of Berlin to research how to improve NOM removal and achieve stronger flocs using tailor-made **polyelectrolytes**.

Our objective is to achieve a viable lower cost option to maximise plant capacity and reduce disinfection by-products, while creating a market for local chemical manufacturers to scale up polyelectrolyte production.

NOM control is a key priority in our Drinking Water Improvement Plan

Case Study

Water Network Pilot Plant



We've constructed a Pilot Plant to investigate changes in water quality as it moves through our drinking water system.

This is part of the ARC Linkage *Smart Management of Disinfectant in Chloraminated Water Supply Systems*, a collaboration with Western Sydney University, CSIRO, SEQWater, UnityWater and Logan City Council.

Enhancing assets and operations

To meet customer expectations, we're striving to improve the performance and extend the life cycle of our assets, as well as increase the efficiency of our operations using advanced analytics and intelligent technologies.

Using robots to inspect our sewers

Along with our long-term partners the University of Technology Sydney (UTS), Sydney Water won the AWA Research Innovation Award in 2019.

Our planned and rapid response condition assessment robots have been implemented as business as usual, and in 2019–20 were deployed 17 times to assess pipe condition during emergency repairs.

Our planned maintenance robot can travel up to 500m through pipes

Case Study

AUSTRALIAN WATER ASSOCIATION

AUSTRALIAN WATER AWARDS

ANZ

RESEARCH INNOVATION AWARD

Innovative Sensor Suites and Intelligent Robotics for Condition Assessment of Concrete Sewers

University of Technology Sydney and Sydney Water

AWARD SPONSORED BY

Water Research AUSTRALIA

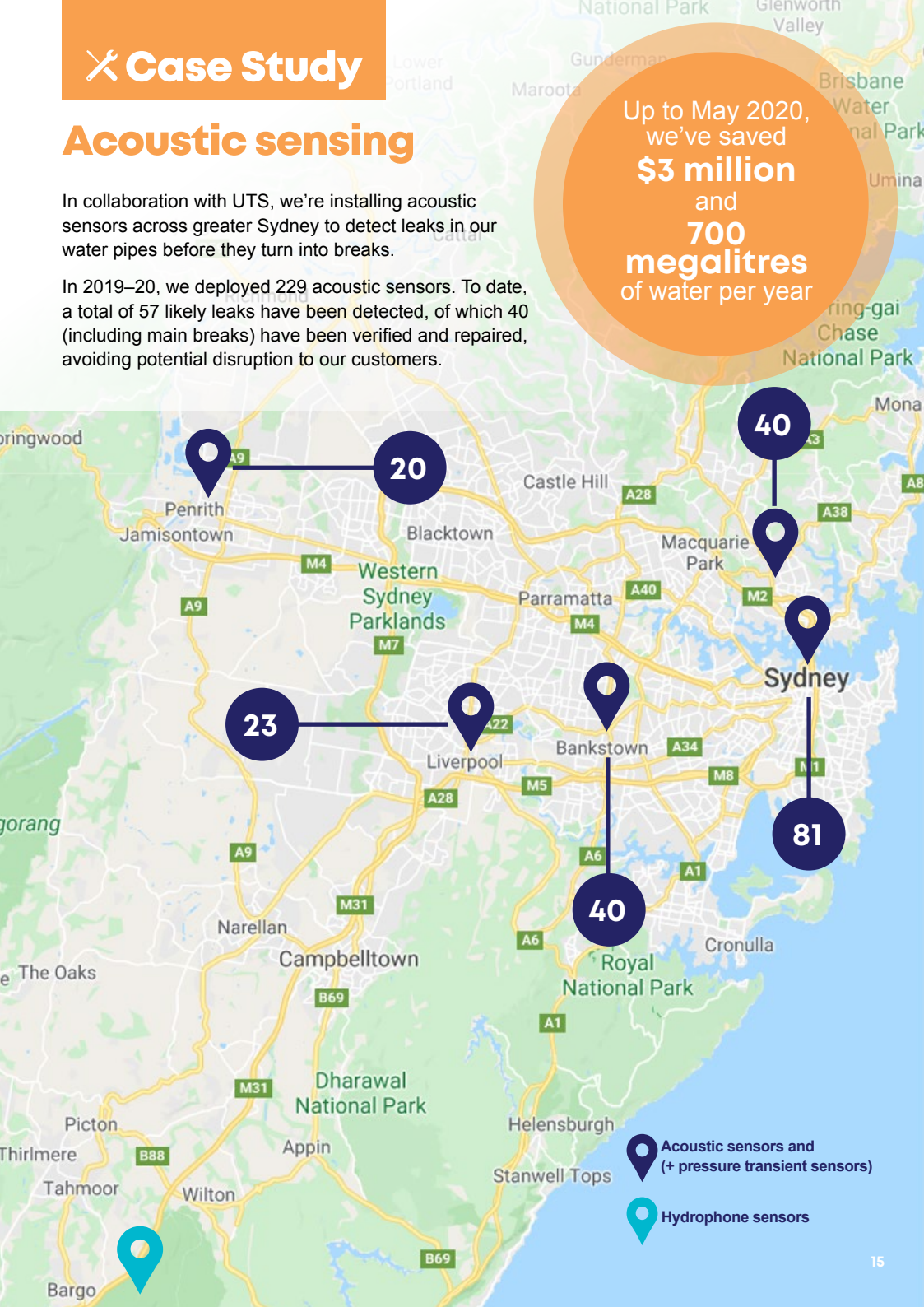
Case Study

Acoustic sensing

In collaboration with UTS, we're installing acoustic sensors across greater Sydney to detect leaks in our water pipes before they turn into breaks.

In 2019–20, we deployed 229 acoustic sensors. To date, a total of 57 likely leaks have been detected, of which 40 (including main breaks) have been verified and repaired, avoiding potential disruption to our customers.

Up to May 2020, we've saved **$3 million** and **700 megalitres** of water per year



Protecting and enriching our natural waterways

We will contribute to healthy waterways and clean beaches that our communities can continue to enjoy. To achieve this in a dynamic and rapidly growing city will require new and innovative ways of operating in a holistic catchment approach.

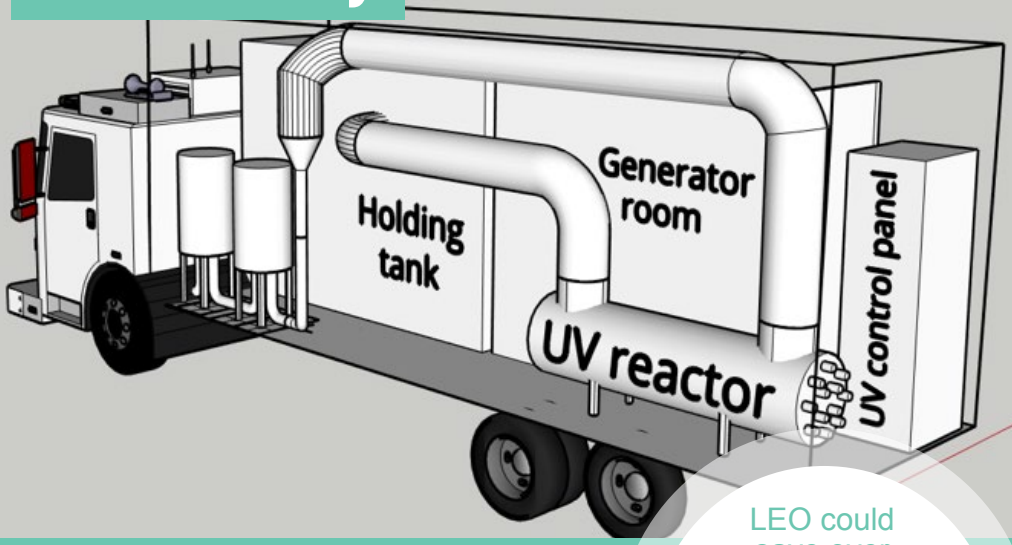
Nutrients in the Hawkesbury-Nepean

We're continuing to understand **the role of nutrients in the Hawkesbury-Nepean Rive**r by investing in nutrient equivalency research. This will lead to improved trading ratios for offset proposals with the NSW Environmental Protection Authority (EPA), making this a cost effective option to tackle water quality degradation and improve river health.

Raingardens

We're working with the Blue Mountains Council to trial raingardens and stormwater channel naturalisation to reduce nutrient pollution and improve water quality.

Case Study



Mobile environmental overflow treatment unit

LEO could save over

500,000 litres

of drinking water for every dry weather overflow

A mobile wastewater treatment unit that reduces the amount of potable water required to restore waterways impacted by sewage.

The Less Environmental Overflows (LEO) Truck was the winning idea from our October 2019 Wave session. In collaboration with the University of Sydney, we engaged an undergraduate student to turn LEO from an idea into a detailed concept design.

Challenge:

Sewer chokes can lead to dry weather overflows of wastewater into our waterways. Sydney Water restores impacted waterways by pumping and flushing large volumes of potable water to dilute the overflow. A standard clean up will use up to one million litres of drinking water. During times of drought, current processes become less sustainable.

Solution:

The LEO Truck is a mobile, compact and robust wastewater treatment unit. Sewage impacted water is pumped into the unit, treated to the required standard, then recycled back upstream of the overflow to perform another flush.

The LEO Truck is supported in principle by NSW Health and the NSW EPA, and will soon be moving into the detailed design phase.

Improving treatment and resource recovery

We will look for sustainable treatment solutions, incorporating the recovery of valuable material from our wastewater, managing the impact of our waste products, and reducing our carbon footprint.

Case Study

Reliable, Affordable Clean Energy

Sydney Water is RACE-ing to 2030!

The Reliable Affordable Clean Energy for 2030 Cooperative Research Centre (RACE for 2030 CRC) is an industry-led research effort to drive energy innovation across the supply chain to deliver better value for energy customers.

This will include cutting-edge research and development of new technologies to boost business energy productivity, integrate distributed energy resources into the grid, reduce energy bills for consumers, enhance energy reliability and cut carbon emissions.

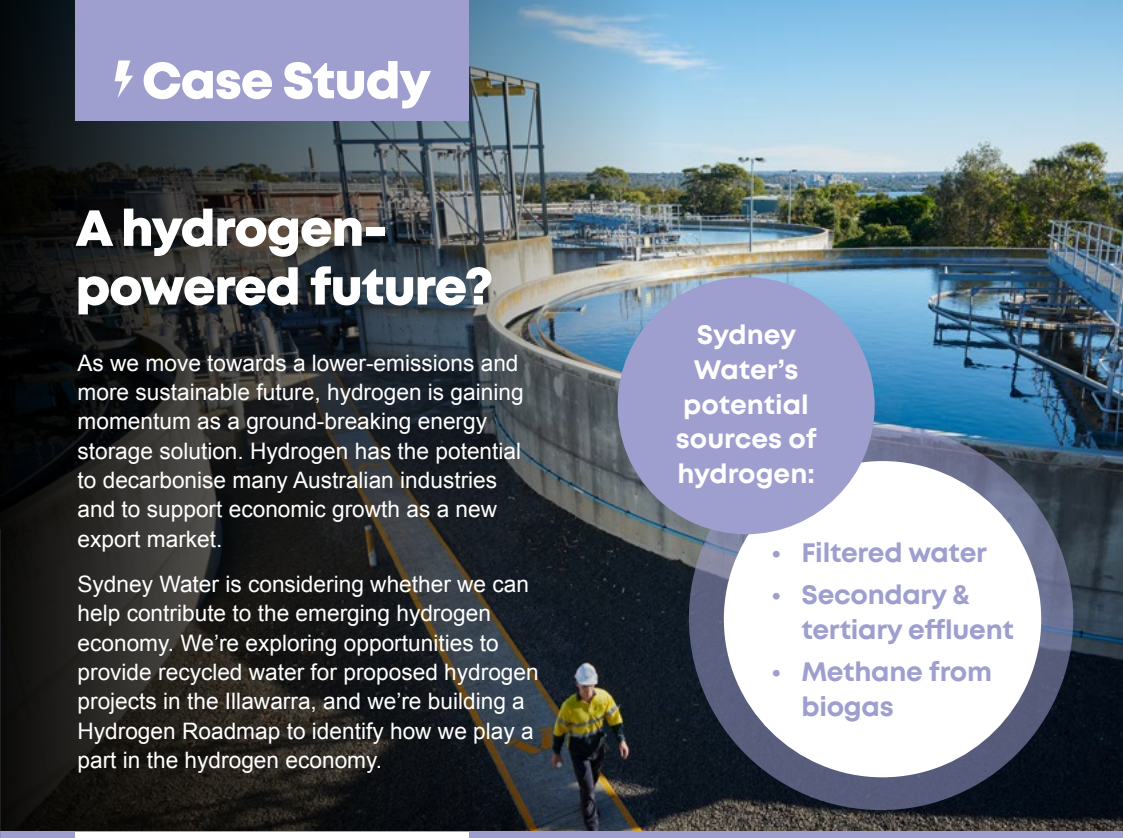
We're excited to be a partner of the RACE for 2030 CRC.

Case Study

A hydrogen-powered future?

As we move towards a lower-emissions and more sustainable future, hydrogen is gaining momentum as a ground-breaking energy storage solution. Hydrogen has the potential to decarbonise many Australian industries and to support economic growth as a new export market.

Sydney Water is considering whether we can help contribute to the emerging hydrogen economy. We're exploring opportunities to provide recycled water for proposed hydrogen projects in the Illawarra, and we're building a Hydrogen Roadmap to identify how we play a part in the hydrogen economy.



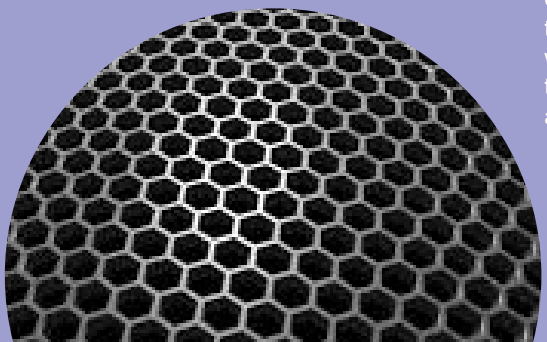
Sydney Water's potential sources of hydrogen:

- Filtered water
- Secondary & tertiary effluent
- Methane from biogas

Case Study

Graphene – the wonder material

Conventional treatment approaches to remove natural organic matter (NOM) from drinking water are reaching their maximum performance potential. Graphene is an exciting new material which could be a game changer for water and wastewater treatment.

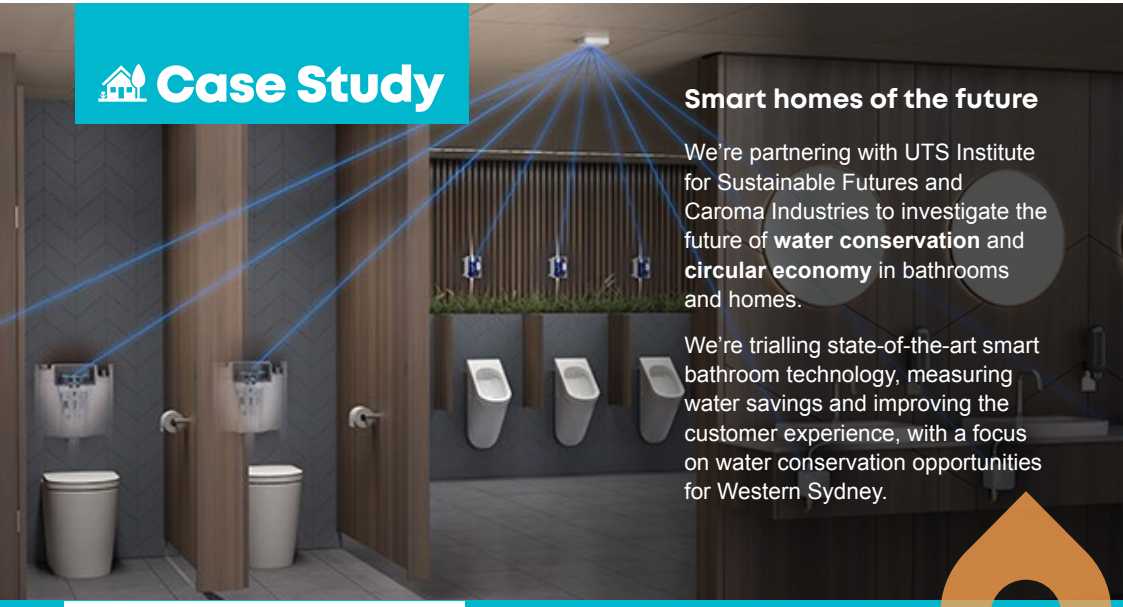


In partnership with UNSW, we're developing graphene oxide membranes which will remove 99.9% of NOM remaining in drinking water after direct filtration processes.

This technology can also be used to remove contaminants in effluents from wastewater treatment plants. We'll be identifying and working directly with manufactures to ensure the membranes will be portable, retrofittable and scalable.

Enabling resilient and liveable cities

To build our resilience, we will need to understand the long-term challenges that face our growing city and the contribution of water to delivering improved liveability outcomes for our current and future customers.



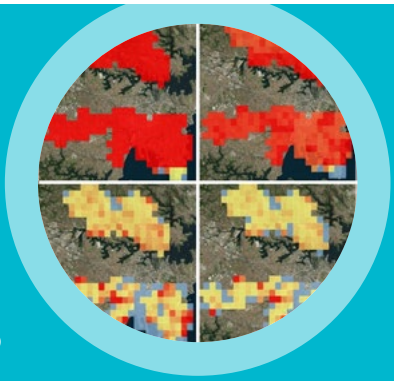
Case Study

Smart homes of the future

We're partnering with UTS Institute for Sustainable Futures and Caroma Industries to investigate the future of **water conservation** and **circular economy** in bathrooms and homes.

We're trialling state-of-the-art smart bathroom technology, measuring water savings and improving the customer experience, with a focus on water conservation opportunities for Western Sydney.

Case Study



Adapting the east

In partnership with ClimateRisk, we assessed the capability of urban cooling to reduce human heat stress and asset heat failure probability to 2050.

We focused on major urban renewal and collaboration areas aligned with our coastal wastewater distribution networks, from Liverpool to the coast, as part of our Eastern Sydney Regional Plan.

The study recommended aiming for at least 4°C ambient heat reduction, area specific adaptation measures and collaboration between stakeholders, to tackle urban heat impacts and improve liveability in eastern Sydney.

Case Study

Our digital future

Wastewater blockage detection

1000+ devices installed

47 blockages detected

We're installing IoT wastewater blockage detection devices in high risk locations across Sydney.

These sensors provide proactive notification of high sewer levels in our wastewater network, alerting field crews to complete maintenance before possible sewer surcharges. So far we've detected and cleared 47 blockages, preventing impacts on our customers and the environment.

We're also collecting data to help us understand system behaviour and better enable us to predict blockage events.

Digital water metering

8000+ digital IoT meters deployed

176 Water usage app staff participants

Our teams are deploying digital IoT meters at residential and commercial properties across the Mt Pritchard water zone and greater Sydney. Another 7,200 meters are planned for deployment next year.

We're also conducting a proof of concept trial of digital water meters and a water usage app with 176 Sydney Water employees. This is a collaborative project across Sydney Water with our Digital, Customer Services and Delivery teams. Insights and data gathered will help us detect leakage, improve water usage and assist in preventative maintenance.

What's coming up in the pipeline?

Artificial intelligence / machine learning
Improving our data analytics and operational decision making

Structural health monitoring
Using photonics to proactively manage asset maintenance

Hype
We're trialling Hype, an online open innovation platform

Exploring new ways of servicing the west
Water, wastewater, stormwater and more

Technology trial centres
Investigating innovation hubs and technology trial centres around Western Sydney

Wave 2020–21
Sydney Water's innovation challenge

Robotics commercialisation
Expanding the implementation of our award-winning robotics

Sydney Science Park
Parkland Arboretum pilot project and other trials for reducing urban heat

R&I Benefits Tool
Quantifying the benefits of research and innovation

Deep ocean outfall pilot inspections
Allowing us to safely assess the condition of our deep ocean outfalls

South Coast science tour with our Wave Innovation challenge winners

For more information on Research & Innovation at Sydney Water, email research@sydneywater.com.au

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