

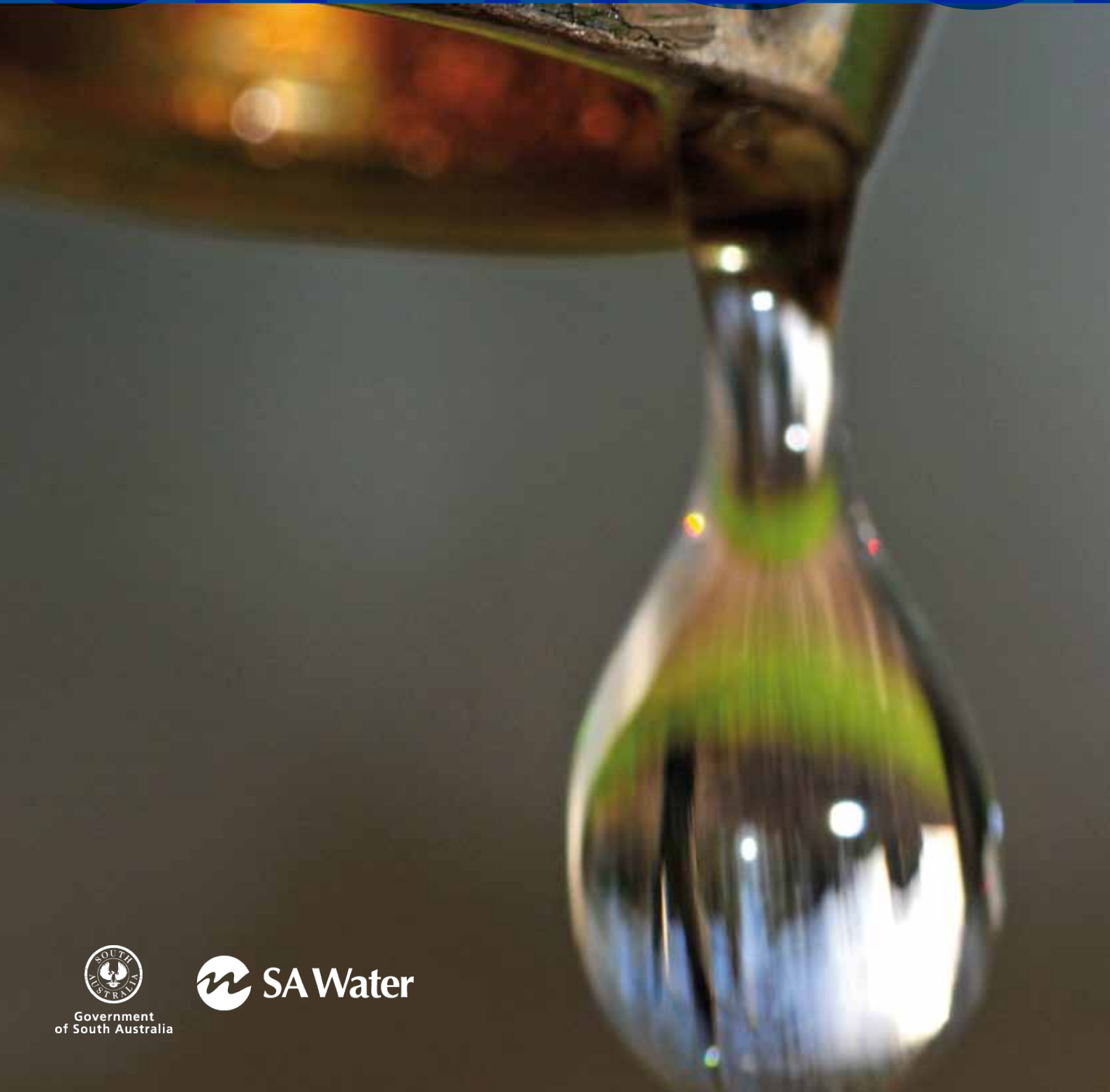


University of  
South Australia

# SA Water Centre for Water Management and Reuse

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Government  
of South Australia



SA Water



The establishment of the SA Water Centre for Water Management and Reuse at the University of South Australia adds significant expertise and capability in research of water conservation, recycling and reuse in South Australia, as well as nationally and internationally.

## Welcome to the SA Water Centre for Water Management and Reuse.

The establishment of the SA Water Centre for Water Management and Reuse at the University of South Australia adds significant expertise and capability in research of water conservation, recycling and reuse in South Australia, as well as nationally and internationally.

With Australia being one of the highest water users per capita in the world, the Centre is helping to find alternative ways of meeting our future water supplies and to help Australians use water smartly and to use water of different qualities for fit for purpose reuse. The Centre is researching a broad range of sustainable technologies ranging from low energy desalination to permeable pavements with underlying rainwater storage.

The Centre has established research and consultancy strengths in water management and reuse and sustainability of water resources. Our strong links with domestic and international water industries are also ensuring a vibrant research capability, delivering national and international water solutions for our generation and beyond.

Professor Simon Beecham

SA Water Centre for Water Management and Reuse

## Our Mission.

The SA Water Centre for Water Management and Reuse aims to advance the science and technology of sustainable water management through fundamental and applied research.

## Our collaborative partnership.

The SA Water Centre for Water Management and Reuse was established in 2004 as a joint venture between the South Australian Water Corporation and the University of South Australia (UniSA), adding significant expertise to the water research capability in South Australia.

The significant investment in research by the South Australian Water Corporation has delivered important outcomes for South Australia (in terms of water management and reuse), to such an extent that their investment is continuing for a further five years. The successful relationship will undoubtedly continue to deliver sustainable water solutions both nationally and internationally.

*Dr Terry Lucke researching siphonic roofwater harvesting.*



## Our Vision.

To be Australia's leading research centre for water reuse, with a major focus on developing sustainable solutions to water resource management issues.

The Centre's measurement and management principles for the Murray-Darling basin are helping to ensure the survival of Australia's greatest natural asset.



## Excellence in Water Management and Reuse.

The SA Water Centre for Water Management and Reuse has added significant expertise to the water research capability in South Australia since it was established in 2004. It has built on established strengths in the key research areas of desalination, membrane and nanotechnology, securing water supplies, treatment for fit-for-purpose reuse and water recycling systems design. It has developed capabilities in the conservation, recycling and reuse of water and in the sustainable management of water resources.

### Desalination, Membrane and Nanotechnology

Research in this area involves advanced treatment systems using membrane technologies for brackish and seawater desalination. In addition, advanced oxidation processes and nanotechnology enhanced absorption processes are used to remove salts and trace organic pollutants for non-

potable water reuse and ground water aquifer recharge. In particular, the Centre is developing innovative low energy desalination processes.

#### Key research areas include:

##### *Integrated membrane systems*

Integrated membrane systems produce water for agricultural irrigation with higher water production and lower energy costs. These systems can remove excess sodium ions to avoid high soil salinity and minimise negative impacts on plant growth. They also increase the quantity of recycled water that contains useful nutrient ions, and the membrane systems reduce the volume of waste brine for disposal.

##### *Electrosorption desalination*

Electrosorption desalination using capacitive deionisation is developing and optimising new electrode materials that have superior properties for electrosorption and desorption.

##### *Nano-composites of activated carbon*

Nano-composites of activated carbon involves a new generation of photocatalysts to absorb disinfection by-products such as NDMA formed during the chlorination process of water and wastewater. This also involves decomposing by-products in-situ.

##### *Treated and concentrated membrane filtration*

Treating concentrated membrane filtration waste involves using mediated electrochemical oxidation processes to

eliminate harmful organic pollutants while minimising the environmental impact of brine disposal.

### Securing Water Supplies

Research in securing water supplies focuses on developing resilient fit-for-purpose water supplies by judiciously utilising water in the landscape. Ensuring a resilient water supply requires access to water resources and responses to the natural water cycle that are based on an integrated approach to the interconnectivity of water resources and the systems that drive them. Judicious use of water resources involves providing cost effective technologies for access, distribution and treatment that support socio-economic benefits and continue to maintain a healthy landscape.

#### Projects include:

##### *Waterproofing the Northern Adelaide Region*

This project includes the development of regional and sub-regional models for collecting, treating and storing runoff using managed aquifer systems. This is anticipated to lead to an additional 20GL of water supply to support development in northern Adelaide.

##### *Development of key measurement and management principles for the Murray-Darling*

This project will provide a fundamental basis for optimal water management decisions for

the Murray-Darling and other river systems.

#### Projects continued:

##### ***Investigation of the connectivity between surface and groundwater resources***

This investigative project is analysing the connectivity between surface and groundwater resources in the Flinders and Gawler Ranges.

##### ***Water Sensitive Urban Design***

Research in this area aims to use Water Sensitive Urban design to restore pre-urbanised flow characteristics.

##### ***Regional stream flow analysis for climate change***

Regional stream flow analysis for climate change investigates variability effects on extreme low and high flow hydrology.

##### ***Investigation of climate change impacts on observed rainfall***

This project involves analysis of the climate change impacts on observed rainfall and the effects this has on water harvesting projects in Australia. It entails sophisticated methods for characterising measured rainfall data and its variability at different time scales.

##### ***Smart metering for enhanced irrigation***

Smart metering through the detection of key flow characteristics aims to enhance irrigation and urban water efficiencies.

## Treatment for Fit-for-Purpose Reuse

Treatment for Fit-for-Purpose Reuse involves developing innovative treatment processes for water use and reuse. Research projects conducted under this theme include:

##### ***Long-term effects of application of soil amendments***

This research aims to reduce carbon and phosphorous transport from soils to drinking water sources in the Mt Lofty Ranges to improve water quality.

##### ***Investigation into changes in water quality associated with climate change***

Water quality changes in drinking water sources from the Murray-Darling Basin and local catchments in South Australia are being investigated on the basis of their treatability by conventional processes and by novel monitoring technologies under development.

##### ***Pollutant attenuation in pulp and paper mill effluents***

The research in this project focuses on the optimisation of wastewater treatment for pollutant attenuation.

##### ***Coagulation modelling and chemical dose prediction***

Research is underway into coagulation modelling and chemical dose prediction to optimise water treatment processing.

## Developments of fit-for-purpose coagulants

- The Centre is collaborating closely with SA Water and the State Key Laboratory for Environmental Aquatic Chemistry, Chinese Academy of Sciences, in the application of novel fit-for-purpose coagulants that are designed for source waters of particular quality.

## Advanced Water Quality Sensing and Optimisation

The Advanced Water Quality Sensing and Optimisation Group undertakes research and development in advanced sensor technologies and systems.

## Water Recycling Systems Design

This focuses on integrated urban water management and Water Sensitive Urban Design (WSUD). Research facilities include:

- Three full-scale bioretention systems, including a pioneering deposit and retrieval system to eliminate the need for irrigation with municipal water during inter-storm dry periods.
- A full-scale testing facility for permeable pavements with harvesting and reuse functionality. Harvested stormwater from the pavement's underlying storage tank is used to irrigate an adjacent rainwater garden, using solar powered pumps.
- A full-scale siphonic roof drainage system for harvesting and reusing rainwater from commercial and industrial buildings (32m long, 6m high).
- Salinity management and optimum water use efficiency for crops and parklands irrigated with recycled water.



A cross section through a reverse osmosis membrane unit.

The SA Water Centre for Water Management and Reuse aims to maintain a balance between fundamental and applied research in a way that attracts key intellectual capability, promotes innovation and builds intellectual property.

*Full-scale testing of valves and meters at CWMR.*



## Research Facilities.

The research facilities of the SA Water Centre for Water Management are world-class. Desalination and membrane research laboratories are used to synthesise mesoporous carbon electrodes for alternative desalination processes and nano-materials, including metal oxides as photocatalysts. The membrane testing rigs area is also used to conduct flat sheet membrane performance assessments. Equipment is also available to conduct experiments using advanced oxidation processes, including ozonation, UV irradiation and photocatalysis.

The Australian Irrigation and Hydraulics Testing Facility is one of the largest hydraulic research and testing laboratories in Australia. In 2008, the Centre was awarded \$1.13m by the Federal Minister for Climate change and Water to develop new water meter and irrigation test facilities to NATA standards.

The facility conducts full scale research and testing of flow meters, sprinklers, subsurface drainage and dripper systems. Many hydraulic technologies have been assessed in the laboratory, including gross pollutant traps, valves, flow rate and pressure control devices, stormwater junction pits, flow gauging systems, fishway ladders, flow diversion structures, open channel conduits and various physical scale models. The key features of the laboratory include:

- A full-scale (20m long) tilting road drainage rig (with 350L/s recirculating water capacity)
- 15m long tilting flume
- Towing tank for hull testing (30m x 1.9m x 1.3m deep)
- Total pump flow capacity of 900 L/s
- Pump flow and pressure capacities of 1,000kPa (at 100L/s) and 500kPa (at 450L/s)
- Hydrostatic pump with a pressure capacity of 15,000kPa
- Over 20 flow measuring devices
- Undercover and open test areas of approximately 3,000m<sup>2</sup> and 1,000m<sup>2</sup> respectively
- Environmental chamber for temperature (-15 to +65°C) and humidity control
- Electromagnetic chamber (30m<sup>3</sup>) for assessing electronic flow measuring devices

The Centre's water and wastewater laboratories are used to conduct a range of water and wastewater testing including mass spectrometry and metal analyses, UV visible absorbance, pH, conductivity, dissolved oxygen, chlorophyll, alkalinity and turbidity. These analyses are performed as part of undergraduate and postgraduate studies on a range of water and wastewater related issues which currently include treatment of wastewaters from pulp and paper mills, biological treatment of Torrens Lake water, modelling coagulation and coagulants for industrial use.

# Technology Transfer.

The Centre is committed to transferring research outcomes into the water industry within Australia and internationally and has developed:

- Water Sensitive Urban Design Guidelines for the Adelaide Metropolitan Region (with Planning SA, AWE and QED)
- Source Control Handbook for Australian Practice
- PERMPAVE® software package for designing permeable pavement systems for stormwater harvesting and reuse, water quality improvement and flood mitigation.
- SWITCH and Switch2 software programs for water sensitive urban design
- Raintank Analyser program to help select optimal rainwater tank sizes
- mEnCo© software for treatment plant operators to rapidly and accurately determine optimal coagulant dose rates for NOM removal (with the CRC for Water Quality and Treatment)
- Syfon computer program, which has been used to design siphonic roof drainage systems for airport terminal buildings in Hong Kong, Kuala Lumpur, Sydney and Adelaide as well as prestigious buildings such as the Melbourne Cricket Ground, Sydney Olympic Stadium, Melbourne's Southern Cross Railway Station and IKEA Adelaide

The linking of innovation and technology is delivering sustainable solutions for global water issues, providing real community benefit.

*CWMR Syfon software was used to design the roof drainage system at the Melbourne Cricket Ground (MCG).*





*Professor Simon Beecham,  
Director of CWMR.*

## Core Research Group.

### Professor Simon Beecham

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Simon Beecham is Professor of Sustainable Water Resources Engineering and Director of the SA Water Centre for Water Management and Reuse. His research interests include total water cycle management; water sensitive urban design; siphonic roof water harvesting and climate change impacts on urban water systems.

### Associate Professor Linda Zou

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Linda Zou is the Deputy Director of the SA Water Centre for Water Management and Reuse. Her current research interests include developing porous carbon electrodes for low energy alternative capacitive desalination; designing integrated membrane systems for fit-for-purpose water reuse; synthesizing nano structured materials for water purification; and using combined advanced oxidation processes to remove organic matters for water reuse.

### Mr David Pezzaniti

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David Pezzaniti is a Senior Research Engineer whose research interests include smart metering and harvesting; treatment and reuse at all catchment scales; infiltration systems; irrigation systems and continuous simulation modelling for reuse. His expertise also extends to hydrology and runoff pollution control.

### Dr John van Leeuwen

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John van Leeuwen is a Senior Research Fellow specialising in water and wastewater treatment and reuse. He has developed models and software which enable rapid prediction of chemicals required for optimum treatment of raw waters for drinking purposes. He is also an adjunct professor with the State Key Laboratory for Environmental Aquatic Chemistry, Research Centre for Eco-Environmental Sciences at the Chinese Academy of Sciences.

### Dr Ali M Hassanli

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Ali Hassanli is an Associate Professor from Shiraz University in Iran on secondment to the Centre. His research interests include reuse of wastewater for sustainable irrigation, urban and farmland salinity, soil and water monitoring for sustainable agriculture and water harvesting and management in arid and semi-arid regions.

### Associate Professor Ian Clark

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Ian Clark is a geoscientist who specialises in securing water supplies. His current research in environmental management and sustainability includes geological aspects of groundwater resources in fractured rock aquifers and projects related to resource and environmental management in parks and natural settings.

### Dr Guna Hewa

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Guna Hewa has been researching low flow hydrology since 1995 and is currently researching climate change effects on environmental flows and regional low flow predictions. She is also examining meteorological and hydrological droughts in a changing climate and understanding the effects of WSUD measures on restoring environmental flows.

### Dr Terry Lucke

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Terry has over ten years of experience in the water industry. He completed his PhD in the Centre investigating the role of aeration in siphonic roofwater harvesting systems. His current research interests also include other water sensitive urban design technologies, such as permeable pavements.



Associate Professor  
Linda Zou, Deputy  
Director of CWMR.



## Adjunct Staff.

### Professor Dennis Mulcahy

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Dennis Mulcahy is currently a member of the Water Quality Research Australia (WQRA) Education Committee. He was formerly Education and Training Program Leader for the CRC for Water Quality and Treatment. His research interests include physical, analytical and environmental chemistry, including the development of microelectronic sensors.

### Professor Don Bursill

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Don Bursill has more than 35 years experience in water resources and water quality management. He is internationally acknowledged as one of Australia's most eminent water scientists. He was responsible for establishing and directing the Australian Water Quality Centre in South Australia.

### Professor John Argue

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John Argue is a pioneer of Water Sensitive Urban Design and editor of the definitive manual on this subject. Winner of numerous awards for his pioneering research into urban water resources management, he continues to inspire his colleagues and research students.

### Mr Lynn Brake

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Lynn Brake is a Senior Research Fellow who specialises in the human aspects of water management and reuse in rural and outback landscapes. He has worked on research projects and consultancies involving water policy, planning, conflict management, and resource use.

### Professor Chris Saint

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Chris Saint has 24 years experience in environmental science including biochemistry and genetics of pollutant biodegradation; cyanobacterial, bacterial and protozoan detection methodologies; taste and odour issues; water treatment and wastewater microbiology; and pathogens in catchments.

### Associate Professor Chris Chow

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Chris Chow is a Senior Research Chemist with the Water Treatment Unit, AWQC, SA Water. Chris is also an Adjunct Research Professor with the Research Centre for Eco-Environmental Sciences, Chinese Academy of Sciences. At the Centre he is the leader of the Advanced Water Quality Sensing and Optimisation group.

### Dr Tapas Biswas

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Tapas Biswas's research areas include irrigation, drainage, salinity and nutrient management with special emphasis on root zone solute and water dynamics. While addressing the sustainability issues of precision irrigated agriculture, his work aims to assist growers, irrigation technologists and policy makers in measuring and managing water use, deep drainage and farm salinity.

### Dr Gale Newcombe

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Gale Newcombe is the Research Leader of the Applied Chemistry Unit of the Australian Water Quality Centre. She has worked in the drinking water industry for 17 years, participating in, and leading, research projects investigating activated carbon treatment (adsorption and biofiltration) and oxidation of taste and odour compounds, NOM and algal toxins.

### Dr Lionel Ho

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Lionel Ho is a Senior Research Scientist at the Australian Water Quality Centre, where he has been involved in a range of nationally and internationally funded projects and consultancies encompassing the entire water cycle. He has over 10 years experience in the water industry with expertise in areas including water treatment, analysis and treatment of cyanobacterial metabolites and aquatic microbiology.

### Professor Dongsheng Wang

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Dongsheng Wang is Co-director of the State Key Laboratory for Environmental Aquatic Chemistry, RCEES Chinese Academy of Sciences, Beijing. He is internationally recognised for his research into water and wastewater treatment and coagulation technology, and his research focuses on achieving advanced novel drinking water treatment technologies for high quality drinking water and supply.

Strong links fostered by the Centre with local and international water industries ensures a vibrant water research capability focused on the main competencies of water, recycling and reuse and the sustainable management of water resources.

*CWMMR researchers liaising with industry.*



## Industry Collaboration and Funding Partners.

The SA Water Centre for Water Management and Reuse participates in national research and education partnerships including:

- Water Quality Research Australia
- Cooperative Research Centre for Irrigation Futures
- Cooperative Research Centre for Desert Knowledge
- Cooperative Research Centre for Sustainable Tourism
- International Centre of Excellence in Water Resources Management (ICE WaRM)

The Centre also attracts significant funding from a diverse range of sources:

- Australian Research Council Discovery and Linkage schemes
- National Water Commission
- Bureau of Meteorology
- Federal, State and Local Government Agencies

## Engage or study with us.

The Centre provides training, workshops and articulation pathways for the career development of existing water professionals and runs several short courses and training workshops in our dedicated computer training room.

Opportunities are also available for postgraduate study in a wide range of topics at Graduate Certificate, Graduate Diploma and Masters Degree levels. Research studies leading to Masters and PhD degrees also form a significant part of the Centre's activities.

Through the Centre, students have access to Australia's leading educators and researchers in water, in addition to an international network of skills in sustainable water management.



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