

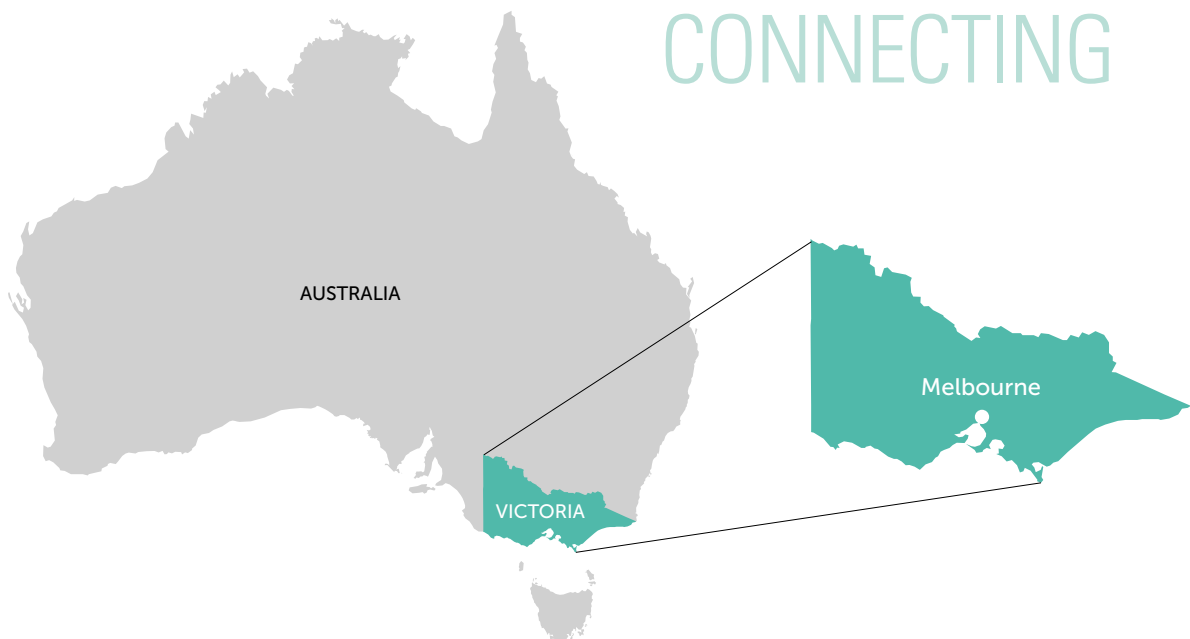
MELBOURNE

RESEARCH, EDUCATION AND TRAINING

WATER
MANAGEMENT



MELBOURNE: LEADING INNOVATING CONNECTING





Melbourne and regional Victoria are a perfect blend of economic strength and dynamism, with a lifestyle that is envied around the world. Talented people, a world-class education system, supportive government and superior infrastructure make the state of Victoria a global leader in research, education and vocational training.

Victoria's research centres, universities and vocational training providers partner with industry, governments, non-government organisations (NGOs) and other educational institutions around the world.

They offer extensive opportunities for partnerships and program collaborations, including joint research initiatives, research and development services, licensing of materials, tailored curriculum development, joint program delivery, staff/student exchange, consultancy services and customised employee development programs.

For more information about Victoria's research, higher education and vocational training capabilities, contact your region's Victorian Government Business Office at: **invest.vic.gov.au/offices**.



WATER MANAGEMENT IN MELBOURNE AND VICTORIA

Maintaining sufficient and reliable water supplies is a critical challenge for governments worldwide.

Urbanisation, environmental degradation, exponential population increases and the consequent need for greater agricultural production are placing increasing pressure on water supplies globally.

Higher annual temperatures and lower annual rainfall are making water efficiency measures an even more pressing government and research priority.

The state of Victoria is both an Australian and an international leader in all facets of water management.

Despite Australia being the driest continent on the planet, effective water management has enabled it to become one of the world's most efficient agricultural producers with an export market worth in excess of A\$36 billion.

Victoria accounts for 30 per cent of Australia's total food output on just three per cent of the country's arable land mass. The state's expertise and leadership in water management policy, research and technological innovation has been crucial in ensuring its own, and the nation's, continued water security.

POLICY AND PARTNERSHIPS EXPERTISE

Victoria has Australia's most advanced water industry and policy settings. The state has been a leader in the development of a water trading system in Australia and in implementing water rights, notably playing a lead role in the crucial negotiations for the Murray Darling Basin Plan, which was instituted in 2012. Australia's most important water basin, the Murray-Darling Basin extends across four states, covers half of Victoria and generates about 40 per cent of the nation's agricultural income.

As nations across the globe face the challenges of managing their water basins, and the competing interests that depend on them, Victoria is providing its experience and policy expertise in managing water as a commodity, including water pricing, water trading and water rights.

In 2013, in a project funded by Australia's former aid agency AusAID, a partnership comprising Victorian Government agencies, Victorian water authority City West Water and a private Victorian company completed delivery of a road map for removing tannery industry waste from India's Ganges Basin.

That road map was strongly informed by the social, environmental, technological and economic mechanisms that government, industry and academia have successfully created in partnership in Victoria over many years. These collaborations have resulted in Victoria's sophisticated trade waste system, which successfully supports industry to thrive in an urban environment, maintains the state's clean drinking water and protects the environment and public health.

RESEARCH AND DEVELOPMENT

Victoria is home to internationally significant researchers in water management. Water research in Victoria focuses on three critical areas:

- Urban integrated water management and design
- Water delivery and storage modernisation
- Water treatment and recycling.

Research and Development (R&D) in Victoria is multidisciplinary in nature, including advanced engineering and manufacturing improvements to water asset management. Automated and advanced water delivery, storage systems, and broader policy and sustainable management solutions such as tariff and water flow release and regulation are but a few of the state's areas of expertise.

Victoria is especially advanced in R&D for water-sensitive cities. As nations around the world struggle with the challenges of rapid urbanisation and high density populations, Victoria is exporting its innovations in grey water recycling and rainwater capture.

KEY FACILITIES

Melbourne and regional Victoria are home to a number of important facilities undertaking world-leading research to maintain access to quality water resources.

The Centre for Sustainable Infrastructure at Swinburne University of Technology has a water resources engineering component, which incorporates elements of civil engineering, hydrology, natural resource management, conservation, hydraulics, meteorology, geology and environmental science.

Monash University is a major partner in the **Cooperative Research Centre (CRC) for Water Sensitive Cities**. The CRC collaborates with over 70 research, industry and government partners to deliver socio-technical urban water management solutions, education and training programs and the industry engagement required to make towns and cities water sensitive.

The Monash University Water for Liveability Centre consolidates investigations into advancing sustainable, water-sensitive cities, climate adaptation, drought resilience, neighbourhood and urban planning, water harvesting, ecological planning and sociopolitical governance.

The Centre for Water Policy and Management at La Trobe University is an applied research organisation dedicated to improving understanding of water policy and management choices and the impact of those choices on water users. It draws on research disciplines including economics, law, agriculture, public policy and hydrogeology.

The **Australia-China Joint Research Centre on River Basin Management** led by the **University of Melbourne** provides both Australia and China with a new capacity to address national priorities for water resources management including water catchment management, water productivity and environmental and rural community sustainability.

The **Institute of Sustainability and Innovation at Victoria University** is conducting applied research into drinking water, wastewater, recycled water, stormwater, and industrial water applications.

WORKFORCE CAPABILITY

Victoria's highly skilled and educated workforce supports its water management with specialised knowledge and training across the spectrum of relevant capabilities. The state's universities and vocational education and training (VET) institutions deliver expertise across an extensive range of areas including:

- Aquaculture and hydroponics
- Automated irrigation
- Dam safety and dam operations
- Desalination process and engineering
- Flood and drought policy and planning
- Hydrology and river and wetland morphology
- Operation and maintenance of water infrastructure
- Plumbing and water transportation
- River basin management
- River water quality modelling
- Sewerage and sanitation
- Social behavioural aspects to water use
- Sustainable water resource management
- Treatment, processing and recycling
- Water infrastructure and asset management
- Water management and legislation.

Victorian education institutions also provide their expertise internationally, in consultancy and partnership arrangements including the design and delivery of curriculum and training programs, accreditation standards and course regulation.

COMMERCIALISATION

Victoria is leading the world in effective partnerships between universities, public authorities, the water industry and the private sector to take fundamental water management research through to application and commercialisation.

One of Victoria's key water authorities, South East Water, has now developed a commercial arm, Iota, to capture innovation from across the organisation and commercialise successful innovation and technology. The company is growing rapidly, and offers a wide range of products, services and integrated solutions which assist utilities to more proactively monitor and control networks and to plan and implement capital works projects.

In the north of the State, the GMW Connections Project is building a stronger more sustainable future for irrigation agriculture across the Goulburn-Murray Irrigation District with more than A\$2 billion of Commonwealth and Victorian funding being invested to create an advanced water network.

Victoria also has a number of government grants and assistance programs that are specifically tailored to assist with the commercialisation of R&D, including product application and design, profitability testing, market position and raising of capital.



CASE STUDY



CREATING WATER SENSITIVE CITIES

Professor Ana Deletic is among the scientists at the Cooperative Research Centre for Water Sensitive Cities who are developing innovative solutions for water management to create more liveable cities.

Urban communities in Australia and around the world are experiencing significant water-related stress brought about by rapid population growth and by changes in weather patterns.

Addressing these challenges requires a new way of thinking and there is a consensus among researchers, government agencies and the water industry that cities must become 'water sensitive'.

Recipient of the 2012 Victoria Prize for Science and Innovation, Professor Ana Deletic is a world leader in stormwater management. Based at Monash University, she was the pioneer of the concept of rain gardens for harvesting of stormwater, which is polluted runoff from paved urban surfaces.

With government assistance and in partnership with industry, Professor Deletic led the development of groundbreaking green stormwater treatment technologies, contributing to the creation of more liveable and cooler cities. These technologies are now in use in Singapore, New Zealand, the United Kingdom and France. Professor Deletic has also developed and produced a sand-based filter system for use in arid environments, such as Israel.

The potential for this work to develop and expand its scope gained a huge boost through the establishment of the Cooperative Research Centre for Water Sensitive Cities, which opened in July 2012. Professor Deletic manages the Centre's Melbourne node, with other research nodes established in Brisbane, Perth and Singapore.

The Centre brings together interdisciplinary research expertise and thought-leadership to undertake research that will revolutionise water management in Australia and internationally. In collaboration with over 70 research, industry and government partners, it aims to deliver socio-technical urban water management solutions, education and training programs, and industry engagement that will make towns and cities water sensitive.

Professor Deletic continues to work on urban water management research and currently co-leads Australia's involvement in the European Commission project PREPARED, which aims to adapt urban water systems to climate change.

Over the next nine years, the Cooperative Research Centre for Water Sensitive Cities will have a research budget in excess of A\$100 million. This research will guide capital investments of more than A\$100 billion by the Australian water sector and more than A\$550 billion of private sector investment in urban development over the next 15 years.

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BREAKTHROUGH TECHNOLOGY IMPROVES WATER DISTRIBUTION AROUND THE WORLD

A revolutionary irrigation management system developed by engineers at the University of Melbourne and Rubicon Water is now being used across Australia, and in the USA (Imperial Valley Irrigation), China and Europe (Northern Italy).

According to research leader and Dean of Engineering at the University of Melbourne, Professor Iven Mareels, the water-saving technology, known as Total Channel Control, will achieve annual water savings in rural Victoria that are equivalent to the volume of water available to Melbourne.

Produced in partnership with Rubicon Water, Total Channel Control consists of hardware and software that modernises irrigation infrastructure, measuring, modelling and managing water flow.

About 70 per cent of all water the world uses is transported through open channels, with a typical transport efficiency of less than 50 per cent. This means that more than twice the water delivered at the final destination has to be extracted from the environment.

In the Australian context, Total Channel Control runs open channel distribution systems at near 90 per cent water efficiency, that is, 90 per cent of the water is delivered for the purpose it is extracted. Total Channel Control forms the backbone of the A\$2 billion Victoria Northern Irrigation Renewal Project.

Total Channel Control employs solar-powered flume gates to control and monitor the flow and depth of water distributed through irrigation channels in agricultural regions such as the Goulburn Valley district. The system has already delivered significant water efficiency gains.

"With fresh water management recognised as a critical global issue, central to food security, this IT-based system is now tapping into a vast international market, while improving Australia's water productivity," says Professor Mareels. "Total Channel Control can assist to create true water markets, improve water productivity and support the sustainable exploitation of Australia's limited water resources. And that can be done worldwide.

"Australia represents just one per cent of the irrigation market in the world. Our irrigation systems are minuscule compared to China, Pakistan and India, where this technology can deliver even greater economic and environmental benefits."

Engineers have investigated the problem of water losses in irrigation for decades, with varying degrees of success. Much of the research work undertaken by Professor Mareels' team focuses on accurate waterflow measurement, precision flow management and enabling system-wide water balances.

The research teams designed a radio network integrated sensor system that provides irrigation managers with detailed information about the behaviour of the distribution system. This in turn enables water trading to operate efficiently. The system is automated to manage water movement across the entire irrigation network. Unlike manually operated systems, Total Channel Control can quickly identify and respond to problems such as leaks, equipment failure and water storms.

Professor Mareels says researchers hope to explore the integration of all aspects of water distribution across an entire river basin, and tackle the issue of water supply-and-demand management over longer time scales, such as seasons and years.

"Our ongoing work will focus on leveraging the sensor technology for the integration of water management across the vast time and spatial scales inherently associated with water supply and demand in a basin."



CASE STUDY



CASE STUDY

PROTECTING OUR WATER SUPPLY

Monash University researcher Professor Jayantha Kodikara is leading an international research team comprising utilities, research organisations and technology providers, in a A\$16 million project investigating why and when buried water pipes burst.

The project is the largest international research collaboration led by Australia on water pipes and has worldwide significance as buried pipes provide around 70 per cent of the world's urban water supply.

Monash University and its partners at the University of Technology Sydney and the University of Newcastle are developing cost-effective advanced condition assessment and failure prediction models that can evaluate pipes before they burst. Pipe burst occurs due to a complex interaction of a range of factors including pipe and soil type and the climate. As the pressures of climate change mount, this issue is becoming ever more important. Being able to predict the life of water pipes means water suppliers can better manage replacement and rehabilitation strategies, save customers' money and reduce community risk.

State-owned water corporation Sydney Water is contributing A\$5.5 million to the project. Paul Freeman, Sydney Water's General Manager Asset Management and chair of the project's management team, said burst water pipes can cut water supplies to residents and businesses, affect safety and transport and cause financial loss.

MONASH UNIVERSITY AND ITS PARTNERS ARE DEVELOPING COST-EFFECTIVE ADVANCED CONDITION ASSESSMENT AND FAILURE PREDICTION MODELS THAT CAN EVALUATE PIPES BEFORE THEY BURST.

"The project's groundbreaking research and development will assist the water industry to save drinking water and customers' money," Mr Freeman said.

Professor Jayantha Kodikara agrees. "In major urban centres, water pipes are often very old and replacing them is not straightforward. At the same time, pipe bursts can be devastating and cost the community millions of dollars. When a pipe breaks, the cost is a staggering A\$500,000," he says.

A major outcome of the work to date is the establishment of a dedicated 1.5 kilometre test bed for pipe research. The test bed provides a facility for condition and failure assessments using sensors which provide data that will be used to build a realistic predictive model.

The project is funded by seven Australian water authorities Melbourne Water, South East Water, Sydney Water Corporation, Hunter Water Corporation, Water Corporation (Western Australia), South Australia Water and City West Water; the US Water Research Foundation; and UK Water Industry Research.

ENHANCING INSTITUTIONAL PERFORMANCE IN WATERSHED MANAGEMENT IN ANDHRA PRADESH, INDIA

La Trobe University worked in partnership with Indian agencies to enhance livelihoods in rain-fed areas of the Indian Central Plateau by improving the institutional performance of watershed development programs.

The ambitious watershed management project was undertaken to foster social, economic and environmental benefits by ensuring that water resources were managed within sustainable limits in the non-irrigated parts of the Indian state of Andhra Pradesh.

The project specifically targeted the institutional design of watershed development programs as it was identified that improvements in this area had the potential to provide a significant economic benefit to the livelihoods of people in the rain-fed areas of Andhra Pradesh.

One conservative estimate calculated that farmer incomes in the state could be raised by about US\$460 million annually as a result of the project.

Led by Professor Lin Crase, Director of La Trobe University's Centre for Water Policy and Management, the project included researchers from the Indian Institute of Management, International Water Management Institute (India) and Edith Cowan University (Australia).

The project formally commenced in May 2009 when a dialogue was established between the Andhra Pradesh Department of Rural Development, non-government organisations operating in the sphere of watershed development, representatives from the Victorian Department of Environment and Primary Industries and the Australian research team.

"The project had significant buy-in from the Department of Rural Development which meant the results gained traction early," says Professor Crase.

A detailed set of case studies was completed in early 2010 which formed the basis for a series of meetings, workshops and field visits held in Australia to enhance the knowledge and understanding of the institutional issues in watershed development, as well as gaining insights from approaches to natural resource management in Australia.

Professor Crase explains that the initial response from practitioners managing watershed development in Andhra Pradesh was most encouraging.

"The project attracted the attention of influential government officials, some of whom have now taken up roles at the Indian national level. There have also been discussions about how to use this approach outside Andhra Pradesh, especially in some states where progress has proven more problematic."

The data captured by the La Trobe University-led study, covers over 18 villages and over 500 households. The analysis of this data was used to shape the reform of watershed development programs in Andhra Pradesh and is likely to have significant benefits for rural communities.

"Most problems relating to water are not about engineering fixes," says Professor Crase.

"They are usually about people and how they organise themselves. The more we learn about the effectiveness of human institutions in managing water, the better we are able to find solutions that work."

**FARMER INCOMES
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CASE STUDY



CAPABILITY STATEMENTS





Key areas of expertise

- Treatment Processes
- Water Recycling Systems
- Sewerage
- Water Storage
- Monitoring Programs
- Sustainable Practices
- Compliance
- River Basin Management
- Mitigating Water Pollution
- Dam Safety and Dam Operations
- Flood/Drought Policy and Planning
- Operation and Maintenance of Water Infrastructure
- Stormwater Harvesting
- Confined Space Entry
- Occupational Health and Safety
- Plumbing
- Management
- Business

Research/program delivery capabilities

As social, environmental and economic changes continue to exert pressure on water supplies, water organisations need partners with resources that represent leading-edge technological development. Chisholm is fast becoming recognised by water industry stakeholders as a centre for world's best practice in water treatment training and research.

Chisholm's National Water Resource Training Facility comprises 440 square metres of undercover training space and a permanent 216 square metre sandpit. The centre can accommodate heavy machinery, allowing staff to get hands-on experience with earth moving plant equipment and be taught civil construction skills such as pipe-laying, trenching and shoring.

Training programs are designed to meet the needs of existing workers and trainees, with flexible delivery including on work sites, online and at the facility. Recognition of prior learning is also available.

CHISHOLM INSTITUTE

Chisholm is a highly successful Registered Training Organisation, that delivers government-funded and fee-for-service training and consultancy services to industry, business, government and community organisations across Australia and internationally.

Chisholm offers quality industry-based research and training expertise in all areas of water and waste water treatment, irrigation and related areas.

Chisholm's training facilities include a world-class A\$10 million multi-purpose centre that features a pioneering water treatment plant, water quality testing, industry research and development area, recycling programs and controlled environment horticulture facility.

Skill development ranges from the areas of basic treatment processes through to water facilities management.

Chisholm's staff have extensive industry experience. Many also have experience in international business contexts that utilise their extensive technical and training capability. Chisholm works with a wide range of industry advisory groups to ensure training is consistently relevant to governments and employers.

Examples of recent customised training include:

- Management of a three-week Australian Leadership Awards fellowship program on behalf of AusAid, with representatives from the water industry and councils in Zambia, Malawi, Zimbabwe and Angola participating
- Development and delivery, with partner agencies, of an integrated water resource management short course, including site visits, for 20 senior government officials from Cambodia
- Delivery of Certificate III in Water Operations to Bluescope Steel staff.

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Key Areas of Expertise

- Environmental Management and Sustainability
- Planning and Landscape Architecture
- Sustainable Infrastructure

Research/program delivery capabilities

The School of Architecture and the Built Environment operates an interdisciplinary teaching and research program. All staff are active researchers, successful in securing funded research projects and various industry consultancy-based research projects.

Focused on sustainability and its economic, social and environmental underpinnings, the Master of Landscape Architecture addresses the creation of quality places in response to current and future environmental and lifestyle challenges. Graduates of the Master of Planning (Professional) are able to confidently contribute to creative and relevant solutions to issues such as climate change, a low carbon future and demographic shifts.

deakin.edu.au/sebe/ab

DEAKIN UNIVERSITY

Deakin University is one of Australia's largest and fastest growing universities providing learning, teaching and research opportunities across multiple campuses and innovative use of online technologies through Cloud Deakin. World university rankings evidence Deakin's well established reputation for excellent teaching, innovative course delivery, high-level student satisfaction and world-class research aligned to industry and community needs.

Study programs and research opportunities offered through the Faculty of Science, Engineering and Built Environment address and respond to the emerging issues confronting cities and regions globally in the area of water management and associated planning, engineering and environmental issues.

Deakin University offers courses at both undergraduate and postgraduate levels, including PhDs.

The **School of Life and Environmental Sciences** team includes many staff that have been rewarded with university, national and international prizes and grant funding for their excellence in teaching and research. The School's environmental management and sustainability area covers a multidisciplinary field, and its research focuses on finding solutions to the world's most pressing environmental problems, including water management. This research is conducted in partnership with government departments, industry and leading international scientists, and funded by nationally and internationally competitive granting agencies.

Water engineering programs and research associated with the **School of Engineering** provides another opportunity for understanding the availability, treatment, distribution, management and re-use of water resources. The Sustainable Infrastructure research team has the expertise to deliver high impact applied and fundamental collaborative research in the areas of structural engineering, corrosion, and water management.

[deakin.edu.au/study-at-deakin/
find-a-course/water-engineering](https://deakin.edu.au/study-at-deakin/find-a-course/water-engineering)

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international-students](https://deakin.edu.au/study-at-deakin/international-students)



LA TROBE
UNIVERSITY • AUSTRALIA

Key areas of expertise

- Managing environmental water demands
- Analysing the impacts of different water policy choices on different sectors, water users and taxpayers
- Water tariff regimes in both urban and irrigation settings
- Assessing the usefulness and attributes of water markets and trading mechanisms
- Urban water management
- Strategy formulation in water utilities
- Understanding the nexus between science and policy

Research/program delivery capabilities

La Trobe University's Centre for Water Policy and Management focuses on producing knowledge that is accessible and relevant to the needs of policy makers and resource managers. To this end, the Centre hosts an annual water forum that brings together practitioners and academics with an interest in water.

The Centre seeks to change water policy and management for the better. Some impacts arise through publications by the Centre's members, commissioned research and the commentary provided on emerging policy issues and events.

LA TROBE UNIVERSITY

La Trobe's Centre for Water Policy and Management (CWPM) is an applied research organisation dedicated to improving understanding of water policy and management choices and the impact of those choices on water users. The CWPM is affiliated with the La Trobe Institute for Social and Environmental Sustainability, which takes a multidisciplinary approach to sustainability research across the University.

The Centre is purposely multidisciplinary, because many of the trade-offs associated with different policies and management options are multi-dimensional. A hallmark of the CWPM is its ambition to synthesise and integrate research in a way that is useful to decision-makers.

Recent projects

Enhancing institutional performance in watershed management in Andhra Pradesh, India

The aim of this project is to enhance livelihoods in rain-fed areas of the Indian Central Plateau (particularly Andhra Pradesh), by improving the institutional performance of Watershed Development programs.

Further information is available on the ACIAR project site: aciar.gov.au

Enhancing water infrastructure provision with climate change uncertainty

The aim of this project is to apply alternative models of economic analysis under climate uncertainty to a range of water infrastructure investment projects across Victoria, to assess appropriate policy options for water utilities, regulators and other government agencies. The aim is to improve the provision of water supply infrastructure by accounting explicitly for the prospects for climate change.

Further information is available on the VCCCAR project site: vcccar.org.au

North East Greenhouse Alliance (NEGHA) adapting to a low water future

The overall goal of the project is to develop an understanding of the water supply security in the north-east region of Victoria and the capacity of the region to adapt to adverse climate change impacts.

Further information available on the NEGHA site: negha.org.au

latrobe.edu.au/cwpm

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MONASH
University

Key areas of expertise

- Water Sensitive Urban Design
- Biofiltration
- Stormwater Management
- Urban Design for Public Open Space
- Microclimate Assessment
- Desalination Technology
- Systems Modelling
- Economics of Water Supply
- Energy Recovery
- Aquatic Chemistry
- Geomorphology
- Aquatic and Marine Biology
- Environmental Science
- Water Quality Assessments
- Urbanisation Impact on Ecological Systems
- Policy and Strategy
- Industrial Design
- Water Engineering

Research/program delivery capabilities

Initiatives that save, re-use, recycle and harvest stormwater and enhance sustainable water use are key areas of focused water research at Monash. Capabilities include water technology design and construction, microclimate assessment, water sanitation management, policy development, economic valuation and modelling, ecosystem services and health, environmental planning and law, and sustainable architecture and landscape design.

Innovative research is also being undertaken in the fields of biofiltration, stormwater harvesting, water-sensitive urban design and the use of green infrastructure such as public open spaces and nature strips to capture, treat and clean water.

MONASH UNIVERSITY

Monash University has become the largest university in Australia, renowned for its outstanding teaching, transformative research, international reach and extensive alumni network. Monash is a global university possessing the ambition and ability to address momentous global challenges. Monash has campuses in Australia, Malaysia and South Africa and major partnerships with universities in China, India and the UK.

Monash has a worldwide reputation in its approach to water management and treatment. Water research and education at Monash is interdisciplinary and includes scientists, engineers, ecologists, botanists, lawyers, economists, chemists and geomorphologists.

Monash University is a major partner in the Cooperative Research Centre (CRC) for Water Sensitive Cities. The Centre undertakes research to develop new technologies for production of water, the recovery of energy, nutrients and other valuable materials embedded in urban water, minimising the carbon footprint and ecological impacts of water systems, and maximising the potential multiple beneficial values of urban water services. In addition, multidisciplinary research at Monash applies green infrastructure and climate-responsive design principles to water security, flood protection and the ecological health of terrestrial and aquatic landscapes from whole-of-catchment to street level.

The Monash University Water for Liveability Centre consolidates investigations into advancing sustainable, water sensitive cities.

The Water Studies Centre has over 35 years expertise in strategic research leading to the improved understanding of the quality of Australia's waterways and the effects of disturbance such as urban development.

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Key areas of expertise

- Facilitation and delivering training courses and assessment in irrigated food production (production horticulture)
- Irrigation Specialist
- Quality Assurance
- Farm Management for crop irrigators
- Irrigation scheduling knowledge/methods using vegetation density indexing via latest satellite technology photos (any crop type, anywhere in the world)
- Partnership facilitation and engagement with regional water management specialists and researchers

Research/program delivery capabilities

The Institute owns and operates a 23-hectare commercial horticulture training farm providing an applied focus for student learning in irrigated horticultural products.

Partnerships with organisations enable the SuniTAFE Farm to showcase diversity, under a best-practice irrigation and production system. In 2011, the farm won a regional award for the production of high quality sun muscats.

An array of short courses is provided at the farm including skills for irrigation utilisation and other activities for horticultural production required by farmers.

SUNRAYSIA INSTITUTE OF TAFE

Sunraysia Institute of TAFE (SuniTAFE) is the largest vocational education and training provider in north-west Victoria's Sunraysia region. This is an area renowned for its agricultural economy including an expansive irrigation network as a component of sustainable food production.

The Institute provides tailored training solutions for clients, develops training partnerships with other providers and industry specialists and utilises in-house and external expertise with current industry on-farm water proficiency.

SuniTAFE has long-established partnerships with water resource agencies and research organisations including the Murray-Darling Freshwater Research Centre and the Mallee Catchment Authority.

The Sunraysia region has a diverse demographic of over 40 nationalities. Consequently, the Institute regularly caters for different cultural backgrounds in its products and services. For example, referral through the Sunraysia Ethnic Community Council in 2011 resulted in the Institute designing and delivering a basic food production skills set for Rwandan and Somali migrants. This provided both technical and employability skills in the irrigated techniques of specific food. The program reflected the group's diverse language, literacy, cultural observances and needs ascertained through a pre-course assessment process.

Partnerships with the Freshwater Research Institute and Mallee Catchment Management Authority enable short courses in water quality testing, bolstered by current research innovation, in a region recognised internationally as a leading centre in the adoption of sustainable irrigation technology and water management techniques.

The training farm is also partnering with a local onion seed production company to demonstrate a new and diversified product under irrigation for local farmers and showcase the Institute as a leader in regional irrigated food production.

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Key areas of expertise

Ocean Engineering:

- Air-sea interactions
- Climate
- Environmental extremes
- Maritime engineering
- Ocean waves
- Upper-ocean dynamics

Water Resources Engineering:

- Desertification
- Deterioration modelling of water supply, stormwater and sewer systems
- Hydraulic modelling of rivers and wetlands
- River and wetland hydrology and morphology
- Screening devices for urban stormwater and sewerage systems
- Sustainable water resource management
- Water, soil and vegetation interactions in semi-arid environments

Research/program delivery capabilities

Relevant research areas:

- **Centre for Ocean Engineering, Science and Technology.** The centre conducts research into ocean waves, air-sea interactions, upper-ocean dynamics, environmental extremes, climate and maritime engineering.
- **Centre for Sustainable Infrastructure (CSI).** The water resources engineering component of CSI focuses on the collection and management of water as a natural resource. Such a focus requires a multidisciplinary approach that incorporates elements of civil engineering, hydrology, natural resource management, conservation, hydraulics, meteorology, geology and geomorphology and environmental science.

SWINBURNE UNIVERSITY OF TECHNOLOGY

Swinburne is an internationally recognised research-intensive university. Its emphasis is on high quality, engaged teaching and research in science, technology and innovation – teaching and research that makes a difference in the lives of individuals and contributes to national economic and social objectives.

In 2014 Swinburne's new A\$100 million Advanced Manufacturing and Design Centre opens. The centre will provide a purpose-built teaching and learning environment for engineering, design, business and information technology students.

Swinburne's key water management programs are located within its Centre for Sustainable Infrastructure and its Centre for Ocean Engineering, Science and Technology.

Industry and organisational links:

- City West Water
- Melbourne Water
- South East Water
- Sustainability Victoria
- Yarra Valley Water.

[swinburne.edu.au/engineering/
csi/partners](http://swinburne.edu.au/engineering/csi/partners)

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Key areas of expertise

- Built Environment and Design
- Engineering
- Land, Ecosystems and the Environment
- Law
- Science

Research/program delivery capabilities

Australia-China Water Centre

Australia and China face similar challenges in water scarcity and management, yet there are significant differences in the socio-political and environmental contexts. The Australia-China Water Centre, with one research node based at the University of Melbourne and the other in Beijing, provides the framework for the two countries to collaborate in comparative and parallel research and in knowledge exchange, and to bring together researchers, students, policymakers, managers, technology providers and water users.

eng.unimelb.edu.au/research/centres/aust-china/

UNIVERSITY OF MELBOURNE

The University of Melbourne is a public-spirited institution that makes distinctive contributions to society in research, learning and teaching, and engagement.

Ranked number one in Australia and 34 in the world for the quality of its research, the University of Melbourne harnesses interdisciplinary research to solve some of the most difficult problems facing our world.

Research across water management is both discipline-focused and multidisciplinary in nature and includes collaborations with universities, governments, industry and communities worldwide to further developments cooperatively.

Students interested in water management careers may undertake relevant bachelor, masters level and research degrees across commerce, the environments, law, the sciences and engineering.

Melbourne School of Land and Environment

Based in the Melbourne School of Land and Environment at the University of Melbourne, Professor Michael Webber has assembled a multidisciplinary, international team to identify the multiple drivers of risk to freshwater supply in Shanghai, opportunities for adaptation to sustain that supply, and the barriers and limits to these adaptations.

unimelb.edu.au/research/docs/rr-2012/index.html#/26/

Integrated Water Management

Water resource competition is increasing in Australia and the rest of the world with many river basins approaching stressed conditions. This competition is expected to intensify in future with population growth and the likely impacts of climate change.

Managing water resources to overcome these challenges requires an integrated approach. Researchers at the University of Melbourne have developed a framework called “system harmonisation” which integrates the bio-physical with the social, economic, political and legal dimensions to achieve better resource management outcomes which, they apply in Australia and internationally at spatial scales ranging from small catchments to large river basins.

ie.unimelb.edu.au/research/water/integrated-management.html

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Key areas of expertise

- Water Treatment
- Water Recycling
- Social and behavioural aspects of water use
- Water Asset Management
- E-Research, ICT technologies in environment and sustainability studies
- Environmental impact of the deterioration of stormwater pipes
- Water Resources Planning
- Integrated Urban Water Management
- Hydrological Modelling
- Water Infrastructure and Asset Management
- River Water Quality Modelling

Research/program delivery capabilities

Victoria University's Institute of Sustainability and Innovation (ISI) actively engages in a wide range of water treatment research, such as industrial water treatment, water recovery from desalination processes, and efficient use of nutrients in water streams. The University's Water Resources research group engages in extensive water management research, with most projects involving field work and monitoring. The research group works closely with ISI, the water industry and several Australian and overseas universities. Industry partners include GWMWater, Melbourne Water, City West Water, Central Highlands Water, Western Water and Barwon Water. The Centre for Applied Informatics undertakes environmental e-Water research.

VICTORIA UNIVERSITY

Victoria University provides world-class education, research and training, and has more than 100 exchange partners across Asia, Europe, Africa and the Americas. Its 10 campuses and more than 51,000 enrolled students, including 4,000 international students studying at our Melbourne campuses and 9,000 studying at offshore partner institutions.

Victoria University offers a Bachelor of Engineering (Civil Engineering), which has a heavy focus on water management, as well as masters and PhDs by research focusing on water management issues.

Victoria University conducts research in major areas of water treatment, water resource planning, urban water management, hydrological modelling, water infrastructure and asset management, and river water quality modelling.

The majority of Water Resources' research uses computer modelling, including a range of industry-standard hydrological and water resources computer software packages, such as GIS and REALM. This software simulates the harvesting and bulk distribution of water resources within a water supply system, and models the water storage behaviour. Water Resources also provides REALM software workshops to industry on behalf of the Victorian Department of Environment and Primary Industries.

Victoria University's researchers have made significant advances in the viability of membrane distillation desalination, which uses almost no electricity and has the potential to save huge amounts of water. The technology is relevant to many industries because saline effluent from industrial processes must be managed, both internally and in negotiation with water authorities.

Environmental e-Water research by the Centre for Applied Informatics includes projects in spatial-temporal data mining for water resource decision support; and data enhancement, integration and access services for smarter, collaborative and adaptive whole-of-water cycle management.

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The Melbourne: Research, Education and Training series profiles the capabilities of Victorian education providers across 13 sectors:

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