Water Research Centre
Annual Report 2016
Vision Statement

Australia’s water future will require a synthesis of new and advanced understanding coupled with innovative approaches to all aspects of the water cycle; water use and reuse; aquatic environments; flooding; estuaries and the coast.

Our vision for the UNSW Water Research Centre is to lead Australian water research, continuing UNSW’s 66 year history of holistic, international water research from catchment to ocean.
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Once again I am thrilled to report on a highly successful year for the UNSW Water Research Centre (WRC) with consolidation and growth in key areas of i) staff and research students, ii) peer-reviewed research output and iii) external grants and applied research with industry.

Some of our research highlights have been recognised by faculty media awards. These include two Water Research Laboratory (WRL) lead activities that reported on the "Superstorm", which battered the east coast of Australia in June; and how "Floodwaters can turn cars into deathtraps" - our 2016 feature story.

Other key items from the year in review are i) Associate Professor Tommy Wiedmann being named among the world’s most influential researchers by Thomson Reuters and ii) Dr Arash Zamyadi been awarded an International Water Association (IWA) Fellow for his contribution as a young water professional.

Our staff focus for 2016 has highlighted two staff; Dr Conrad Wasko a WRC Postdoctoral Fellow, for his research on understanding how rainfall is changing under climate change, and the impact this will have on engineering design and water supply, which was featured in the journal “Nature”. Alice Harrison is a Project Engineer at WRL who has been involved in a large-scale ocean diffusion study at Manly Vale, and has been developing a database and website to bring large beach survey datasets to the public domain.

The centre had 14 PhD students graduate in the School of Civil and Environmental Engineering, we welcomed two water academic staff, Dr Kristen Splinter and Associate Professor William Glamore of WRL, and sadly saw the departure of Drs Hoori Ajami, Robert Parinussa and Xinguang Wang.

Our commitment to high quality research has been again awarded by new Australian Research Council Discovery Linkage and Linkage, Infrastructure, Equipment and Facilities grants by Dr Lucy Marshall, Dr Richard Collins, Associate Professor Stuart Khan, Associate Professor Tommy Wiedmann, Professor Ashish Sharma and Professor David Waite.

We are looking forward to continuing this success in 2017.

Professor Richard Stuetz
WRC is a large multidisciplinary water research group and plays a major role in the training of Australia’s future water engineers. The water industry in Australia underpins the entire Australian economy. Consequently, WRC is advised by senior water industry leaders who make recommendations to the Director regarding strategies to ensure the ongoing relevance of the centre and its ability to address and anticipate contemporary water issues.

Operating out of two locations – Kensington campus (established in 1987) and the Water Research Laboratory, at Manly Vale (established in 1959), the UNSW Water Research Centre (WRC) is at the forefront of multidisciplinary research in water resources, engineering, management and the development of tools for environmental management and sustainability for improving the aquatic and atmospheric environments.

The Water Research Centre director is Professor Richard Stuetz and the Water Research Laboratory director is Professor Ian Turner. As an externally funded research centre within the School of Civil and Environmental Engineering, WRC interacts and collaborates with industry, both State and Federal governments, and research groups in other universities in Australia and overseas. It maintains the largest postgraduate and undergraduate teaching programmes in water engineering in Australia, and currently supports over 60 research engineers/scientists and 62 PhD research students. The Centre’s activities are grouped around three dominant research themes:

**Water Supply**

Australia is a continent of low rainfall and its development and economic robustness is constrained by presently available and potential water supplies.

**The Coast**

Over 86% of the Australian community live in the coastal zone with consequent environmental impact and climate vulnerabilities.

**Sustainability**

To maintain Australia’s current level of population and economic growth, water and contamination management, with innovative solutions in terms of environmental, energy and social considerations.

Research is actively undertaken using the specialist laboratories in the School of Civil and Environmental Engineering and at our Water Research Laboratory in Manly Vale. During 2015, Water Research Laboratory (WRL) celebrated its 56th year as a leading international research laboratory in hydraulics, groundwater and coastal engineering. WRL projects group provide specialist professional engineering advice on specific water engineering projects using large-scale physical facilities at the Manly Vale site.

**Centre Steering Committee**

As required for all UNSW Centres, a Management Committee for WRC was established by the Vice-Chancellor, on advice from the Pro-Vice-Chancellor (Research) and the Dean of Engineering. This Management Committee is responsible to the Vice-Chancellor for ensuring the objectives of the Centre are pursued and the terms of reference of the Centre are implemented. During 2016, the Management Committee for WRC was made up of the following members:

- **Professor Mark Hoffman**
  Dean, Faculty of Engineering (Chair)
- **Professor Stephen Foster**
  HoS, School of Civil & Environmental Engineering
- **Professor Richard Stuetz**
  Director, UNSW Water Research Centre
- **Professor Ian Turner**
  Director, UNSW Water Research Laboratory
- **Professor Jason Middleton**
  School of Aviation, Faculty of Science
- **Grantley Smith - by invitation**
  Manager, UNSW Water Research Laboratory
- **Robert Steel - by invitation**
  Business Manager, UNSW Water Research Centre

**Meeting Date:** 22 September 2016

**Program Areas**

WRC has 12 core program areas of research and applied research activities, supported by academic and researchers from the Centre, and PhD students from the School of Civil and Environmental Engineering. The 12 core program areas are:

- Civil and Environmental Hydraulics
- Coastal Engineering
- Biogeochemical Processes
- Waste Management
- Hydroclimatology
- Risk Assessment
- Sustainability Assessment
- Groundwater
- Trace Organics
- Water and Wastewater Treatment
- Atmospheric Emissions and Odours
- Estuarine Engineering
## Directors
- Professor Richard Stuetz - WRC
- Professor Ian Turner - WRL

## Business Managers
- Grantley Smith
- Robert Steel

## Academics
- Professor David Waite
- Professor Ashish Sharma
- Associate Professor Ron Cox
- Associate Professor Tommy Wiedmann
- Associate Professor Stuart Khan
- Dr Fiona Johnson
- Dr Stefan Felder
- Stephen Moore

## Professional Engineers
- Doug Anderson
- Matt Blacka
- James Carley
- Ian Coghlan
- Matthew Dieber
- Chris Drummond
- Dr Francois Flocard
- Dr William Glamore
- Alice Harrison
- Daniel Howe
- Brett Miller
- Ben Modra

## Research Staff
- Associate Professor Sivakumar Bellie
- Associate Professor Sven Lundie
- Dr Hoon Ajami
- Dr AJ Anceno
- Dr Radoslaw Barczak
- Dr Xavier Barthelemy
- Dr Mark Bligh
- Dr Richard Collins
- Dr Juan Pablo Alvarez Gaitan
- Dr Shikha Garg
- Dr Michalis Hadjikakou
- Dr Mitchell Harley
- Dr Di He
- Dr Adele Jones
- Dr Andrew Kinsela
- Dr Peter Kovalsky
- Dr Hung Viet Le
- Dr Nhat Le
- Dr Xiaomin Li
- Dr Jingwan Li
- Dr Simin Maleknia
- Dr Lucy Marshall
- Dr James McDonald
- Dr Rajeshwar Mehrotra
- Dr Christopher Miller

## Visiting Academics
- Prof Nicholas Ashbolt, Uni of Alberta, Canada
- Prof Paolo Burlando, ETH Zurich, Switzerland
- Prof Amin A. Elshorbagy, Uni of Saskatchewan, Canada
- Prof Gary Jones, eWater Limited, Australia
- Prof Ian King, Uni of California, Member ASCE
- Prof Venkat Lakshmi, Uni of South Carolina, USA
- Prof Michele Prevost, Polytechnique Montreal, Canada
- Prof Jane Meri Santos, Federal Uni of Espirito Santo, Brazil
- A/Prof Ian Cording, UNSW, Australia
- A/Prof Mark Davidson, Plymouth University, UK
- A/Prof William Peirson, New College, Australia
- A/Prof Ataur Rahman, Western Sydney Uni, Australia
- Dr Baichuan Cao, Beijing Jiaotong Uni, China
- Dr Bruce Cathers, UNSW, Australia
- Dr Heather Coleman, Uni of Ulster, United Kingdom
- Dr Stuart Dever, Kimbriki Resource Recovery Centre, Aust
- Dr Manabu Fujii, Tokyo Institute of Technology, Japan
- Dr Alexandra Gkemitzi, Democritus Uni of Thrace, Greece
- Dr Weijia Gong, Harbin Institute of Technology, China

## Technical & Administration
- Anna Blacka
- Grace Carlino
- Robert Jenkins
- Coral Johnson
- Patricia Karwan
- Ross Mathews
- Larry Paice
- Joan Terleckyj
- Robert Thompson

## Other Academics
- Dr Robert Parinussa
- Dr An Ninh Pham
- Dr Md Mamunur Rashid
- Dr David Roser
- Dr Hazel Rowley
- Dr Kristen Splinter
- Dr Xiu Yuan
- Dr Xabier Vazquez Campos
- Dr Xinguang Wang
- Dr Yuan Wang
- Dr Conrad Wasko
- Dr Arash Zamyadi
- Mohammed Hasan
- Zaved Khan
- Gough Lui
- Daniel Micevski
- Judith Schinabeck
- Jeffrey Yu

Dr Jing Guan, Beijing Origin Water Technology, Beijing
Dr Heng Liang, Harbin Institute of Technology, China
Dr Fen Fang Lin, Nanzan University, Japan
Dr Liang Liu, Changzhou University, China
Dr Tongxu Liu, Guangdong Inst of Eco-Environmental & Soil Sciences, China
Dr Stephan Pfister, ETH Zurich, Switzerland
Dr David Poulson de Sousa, Uni of Southern Denmark
Dr Michael Short, Uni of South Australia
Dr Gareth Swarbrick, Pells Sullivan & Meynink, Australia
Dr Jacqueline Thomas, Uni of Sydney, Australia
Dr Conrad Wasko, Postdoctoral Fellow

Conrad is a Postdoctoral Research Fellow at the Water Research Centre specialising in hydrology. Conrad comes from a strong engineering background having worked as a project engineer at the Water Research Laboratory delivering many consulting and applied research projects during his tenure. Currently, his research is focused on understanding how rainfall is changing under climate change and the impacts this will have on engineering design and water supply.

Dr Wasko completed his PhD at the University of New South Wales in September 2016, submitting a dissertation consisting of eight manuscripts focusing on the relationship between precipitation and temperature and their applications to design flood estimation. His research was the first of its kind to show that storms intensify both in space and time as temperatures increase. This work gained worldwide media attention and was featured in the journal ‘Nature’, due to its significant implications to increased urban flash flooding. His research developed a novel method of predicting future rainfall patterns using stochastic methods and suggested that climate change may have a much greater effect on rainfall than first thought. Conrad has gained significant recognition for his work in understanding his changes in temperature affect rainfall

Alice Harrison, Project Engineer

Alice studied Civil Engineering and Finance at UNSW between 2010 - 2015, and completed her honours thesis in coastal engineering under the guidance of Association Professor Ron Cox. Her honours work concerned 2D wave flume modelling and economic analysis on the impact of climate change on coastal structure along the New South Wales coast. After completing her undergraduate degree with first class honours, Alice joined Water Research Laboratory in 2016, working on a wide range of applied research projects for industry and government.

Alice’s experience at WRL has involved her in a diverse range of projects that span many facets of water engineering, from coastal water, to groundwater and urban water management. Presently, she is also involved in a large-scale ocean diffusion field study that is being undertaken by WRL. Throughout 2016, Alice has been developing a database and website for the NSW Office of Environment and Heritage to bring large beach survey datasets to the public domain. This work was recently presented by Alice at the Australasian Coasts and Ports Conference. At the conference, Alice also attended a Coastal Engineering short course, run by WRL Project and Academic staff, to further develop her technical skills.

With the support of the strong team based at the WRL Manly Vale campus, Alice has gained significant knowledge and skill in numerical and physical modelling, field studies and technical communication. WRL’s position as a leading group in the field of fundamental and applied water engineering has given her unique opportunities to learn from the best in the business in the early stages of her professional career. Alice is looking forward to seeing what the years ahead have to bring at WRL, knowing it will be full of exciting and interesting challenges.
PhD Graduates

**Bracs, Melissa Anne**
Efficient monitoring of sandy shoreline variability at the regional scale  
*Supervisor:* I. Turner

**Hasan, Mohammad Mahadi**
Radar rainfall estimation: consideration of input and structural uncertainty  
*Supervisor:* F. Johnson, A. Sharma

**Howe, Daniel**
Bed shears stress under wave run-up on steep slopes  
*Supervisors:* C. Blenkinsopp, I. Turner

**Khan, Mohammad Zaved Kaiser**
Modelling seasoned rainfall forecasts forced with improved predictive ocean surface temperature  
*Supervisor:* A. Sharma

**Kobayashi, Yumi**
Holistic environmental health impact assessment: hybridisation of Life Cycle Assessment and Quantitative Risk Assessment using disability adjusted life years  
*Supervisors:* S. Khan, G. Peters

**Le, Hung Viet**
Fate of volatile sulfur compounds in odour bags  
*Supervisor:* R. Stuetz

**Lui, Gough Yumu**
Investigating photovoltaic-powered light-emitting diode based disinfection of water for point-of-use application  
*Supervisor:* D. Roser, R. Corkish

**Ma, Xiaoming**
Investigations of reactivity of nanoscale iron particles for degradation of chlorinated organic contaminants in seawater  
*Supervisor:* D. Waite

**Maheshwari, Pradeep**
Experimental and computational investigation of the formation, transformation and reactivity of iron oxides in wastewater treatment  
*Supervisor:* D. Waite

**Pells, Steven Edward**
Erosion of rock in spillways  
*Supervisors:* W. Peirson, K. Douglas

**Rocheta, Eytan**
On low-frequency rainfall variability bias in climate model simulations  
*Supervisors:* A. Sharma, J. Evans

**Teo, Tiffany Li Lee**
Chemical contaminants in swimming pools: occurrence and health risk assessment  
*Supervisors:* S. Khan, H. Coleman

**Tsarev, Sergey**
Uranium interactions with reduced iron species: electron transfer between uranium and Fe(0)-Fe(II)-Fe(III) in natural clays and nanoscale zerovalent iron  
*Supervisor:* R. Collins

**Wasko, Conrad**
Continuous rainfall simulation in a warmer climate  
*Supervisor:* A. Sharma
Abdala Prata Junior, Ademir
Assessment of odours emission rate
Supervisors: R. Stuetz

Abu Shoaiib, Syed
The relative importance and characteristics of Input Uncertainty in Hydrology
Supervisor: L. Marshall

Al-Fakher, Usama Jasim Hilo
Pumps and Sediments
Supervisor: WRL

Ali, Muhammad
Hydrology, water resources
Supervisor: S. Bellie

Beuzen, Tomas
Sediment transport, coastal processes, numerical modelling
Supervisors: I. Turner, L. Marshall

Carvajal Ortega, Guido
Esteban Aquiles
Reliability assessment and management for direct potable water recycling
Supervisors: S. Khan, D. Roser

Chang, Yingyue
Development and application of biomimetic high valence state iron complexes for contaminant oxidation
Supervisors: C. Miller, D. Waite

Chen, Guangwu
City-scale Carbon Footprint accounting and decarbonisation policy analysis
Supervisor: T. Wiedmann

Chen, Yufan
Facet-dependent electro-Fenton process with supported iron minerals as cathodic catalysts
Supervisor: D. Waite

Choudhury, Dipayan
Assessment and correction of climate drift in decadal predictions from a hydrological viewpoint
Supervisors: A. Sharma, S. Bellie, R. Mehrotra

Dunlop, Mark Wayne
Odour emissions from poultry litter
Supervisor: R. Stuetz

Eghdamirad, Sajjad
Assessing the impact of uncertainty in hydrology through numerical climate modelling
Supervisors: F. Johnson, A. Sharma

Fisher, Ruth Margaret
Optimisation of biosolid management
Supervisors: R. Stuetz, S. Moore

Freeman, Elizabeth Lucy
Coastal Engineering
Supervisors: R. Cox, K. Splinter

Hassan, M. Mahmudul
Climate change adaptation
Supervisor: W. Peirson

Hayes, James Emerson
Hydrology
Supervisors: A. Sharma, C. Wasko

Hettiarachchi, Suresh Lasitha
Olfactory analysis of arduorous emissions
Supervisor: R. Stuetz

Howard, Bahareh Sara
Scenario development, life-cycle assessment
Supervisor: T. Wiedmann

Jiang, Chao
Mechanism and kinetics of ferrous iron oxidation and ferric iron reduction in photolysed natural waters
Supervisors: S. Garg, D. Waite

Kamarulzaman, Nor Hidayatay Binti
Characterisation of odorants from natural rubber processing
Supervisors: R. Stuetz, S. Moore

Kang, Tae Ho
Piggy Back Modelling
Supervisor: A. Sharma

Khan, Mst Shakera Karim
Catchment classification and its application in environmental flow management
Supervisor: S. Bellie

Kim, Seokhyeon
Flood forecasting
Supervisors: F. Johnson, A. Sharma

Li, Jingwan
Hydroclimatology
Supervisors: A. Sharma, J. Evans, F. Johnson

Moalafhi, Ditiro Benson
Regional climate modelling for hydrological applications
Supervisors: A. Sharma, J. Evans

Mohd Zaki, Zaizatul Zafflina Binti
The effect of group wave on wave setup at estuaries
Supervisor: W. Peirson

Montano Luna, Laura Elizabeth
Water Engineering
Supervisors: R. Cox, S. Felder

Mustapha, Azwan
Dimension reduction
Supervisor: A. Sharma

Nahar, Jannatun
Bias correction of general circulation models
Supervisors: A. Sharma, F. Johnson

Naseem, Bushra
Surface water hydrology
Supervisor: A. Sharma

Nguyen, Thi Thu Ha
Hydrology
Supervisor: A. Sharma

Nury, Ahmad Hasan
Application of uncertainty methods for forecasting. Prediction of climate change
Supervisors: A. Sharma, L. Marshall
Pathiraja, Sahani Darshika
Improving the use of data assimilation for flood forecasting
Supervisors: A. Sharma, L. Marshall

Pflugrath, Brett Dean
Passage of fish through hydraulic structures
Supervisors: W. Peirson, B. Cathers,

Pham, Thanh Hung
Flood forecasting in sparsely gauged catchments
Supervisors: F. Johnson, L. Marshall

Phillips, Matthew Sean
Coastal engineering - Storm recovery
Supervisors: R. Cox, I. Turner

Rong, Hongyan
Production of oxidants on photolysis of silver halides kinetics, mechanism and technology optimization
Supervisor: S. Garg, D. Waite

Saket, Arvin
Ocean energy
Supervisor: W. Peirson

Scaturro, Salvatore
CFD modelling of negatively buoyant jets
Supervisors: W. Peirson, B. Cathers

Severi, Armaghan
Aeration due to hydraulic structures
Supervisors: S. Felder, W. Peirson

Shammay, Ariel Tal
Odour abatement in sewer networks
Supervisor: R. Stuetz

Simmons, Joshua Andrew
Real-time forecasting of storm impacts on a high energy coastline
Supervisors: K. Splinter, I. Turner

Stephens, Clare
Hydrologic modellings under climate change
Supervisors: L. Marshall, F. Johnson

Sun, Yingying
Iron and copper-mediated oxidant production in natural and engineered aquatic systems
Supervisors: A. N Pham, D. Waite

Tang, Wangwang
Removal of arsenic, fluoride nitrate from groundwater by capacitive deionisation
Supervisor: D. Waite

Tang, Yating
The analysis of uncertainties in rainfall-runoff models
Supervisor: L. Marshall

Teh, Soo Huey
Integrated carbon metrics in the built environment and assessment of indirect carbon flows in Australia
Supervisors: T. Wiedmann, S. Moore

Thwaites, Benjamin
Optimisation of granular sludge for energy efficient wastewater treatment and reuse
Supervisors: R. Stuetz, J. Alvarez Gaitan

Tumiran, Siti Aisyah Binti
Hydrology
Supervisors: S. Bellie

Wang, Kai
Implications of extracellular electron transfer by marine and freshwater phytoplankton
Supervisor: D. Waite

Watson, Phil John
Improved techniques to estimate trend, velocity and acceleration from sea level records
Supervisor: R. Cox

Wu, Hao
Optimisation of excess sludge dewatering and phosphorus recovery in submerged membrane bioreactors
Supervisors: Y. Wang, D. Waite

Xiao, Wei
Biogeochemical processes in natural waters
Supervisors: M. Bligh, D. Waite

Xing, Guowei
Generation of oxidative products in quinone-mediated CuH202 system
Supervisor: D. Waite

Xu, Wenhua
Global flood forecasting
Supervisors: L. Marshall, F. Johnson

Xu, Xia
Bayesian methods for water quality evaluation
Supervisors: A. Sharma, L. Marshall

Yasmin, Nazly
Hydrology
Supervisor: S. Bellie

Yeung, Anna Chi Ying
Factors influencing the growth & toxicity of cyanobacteria in drinking water
Supervisors: D. Waite, B. Neilan

Yu, Jeffrey Huijie
Contaminant degradation by supported Ag nanoparticles
Supervisor: D. Waite

Yu, Man
Sustainable Assessment Program - hybrid input-output life cycle assessment in construction projects
Supervisors: T. Wiedmann, R. Stuetz

Yuan, Fang
Climate change impacts on coastal shoreline erosion processes
Supervisor: R. Cox

Zhang, Changyong
Application of capacitive deionisation to water treatment
Supervisor: D. Waite
A/Prof Stuart Khan in Engineers Australia Top 100

Associate Professor Stuart Khan is a high achiever within the University of New South Wales, and well respected by industry, community and government. First he was awarded a Hans Fischer Fellowship to the Technical University of Munich. Then he was appointed to the World Health Organisation’s Water Quality and Health Technical Advisory Committee. Then he was named as one of Engineers Australia’s Top 100 Most Influential Engineers.

All these honours are evidence of a blossoming career born of a passionate and disciplined commitment to envisioning a better world. His various voluntary roles on regulatory bodies and providing expert advice to government have provided a platform for the international recognition of his work. Stuart is keenly involved in government and community engagement, in particular he has promoted the importance of recycling as a future water supply strategy.

The World's most Influential Scientific Minds - Tommy Wiedmann

Associate Professor Tommy Wiedmann has been named among the world’s most influential researchers in a new analysis of thousands of academic papers by Thomson Reuters. The "Highly Cited Researcher” list and the "World’s Most Influential Scientific Minds” report are based on the number of cited research papers an academic published from 2003 to 2013.

They identify the best and most influential scholars from among the world’s estimated nine million researchers who publish upwards of two million papers each year. Tommy Wiedmann is one of four researchers who are listed from UNSW.

Arash Zamyadi IWA Fellow

Dr Arash Zamyadi has been awarded as an International Water Association Fellow. The IWA Fellows programme recognises an individual’s sustained outstanding contribution to the water profession, and to delivering the IWA mission of creating a water wise world. IWA Fellows are nominated based on their significant contributions as engineers, educators, utility managers, regulators, researchers, scientists, or technical leaders.

An IWA Fellow is appointed for an initial period of 5 years. During this time Dr Zamyadi will represent the IWA through relevant activities, events and meetings, and support the IWA’s mission and leadership in the implementation of the organisation’s strategic plan.

UNSW Grand Challenges - Engineering Disruption People's Choice Award

As part of the UNSW Grand Challenges Engineering Disruption campaign, several WRL staff (A/P Ron Cox, Dr. Kristen Splinter) and students (Vera Li) participated in the Responding to Climate Change Challenge. Their team formed the Pacific Island Safe Sanitation. They won the People’s Choice Award in Responding to Climate Change at the finals event held at the Michael Crouch Innovation Centre and are now pursuing ways and financial support to implement their project on Kiribati.
Ian Coghlan Receives the WRL Excellence Award

Congratulations to Senior Coastal Engineer Ian Coghlan for being the recipient of the WRL Excellence Award for 2016! Ian was commended for the high standard of his project work, his generosity with his time and advice for others and for always maintaining a friendly and unassuming way.

WRL Hosts Myanmar Government’s DWIR for River Hydraulic Course

In December, the UNSW Water Research Laboratory hosted six delegates from the Myanmar government’s Directorate of Water Resources and Improvement of River systems (DWIR) on a two week intensive training course. DWIR’s primary responsibility is maintaining the navigability of Myanmar’s river systems, which remain the country’s most important transportation system. The most pressing issue with navigability of the river systems is dealing with increasing sediment loads caused by de-forestation of the catchment and also legal and illegal mine discharges.

Over the last twenty years or so, the political situation in Myanmar has meant that the country’s borders have been closed and the people largely isolated from the outside world. The DWIR employees visited WRL to improve their knowledge of the leading edge techniques for assessing river hydraulics and sediment transport. The training was coordinated by the UNSW Global Water Institute through the ‘Australian Water Partnership’ which is coordinating a capacity building program in Myanmar addressing water resources planning and management on behalf of the Federal Department of Foreign Affairs and Trade.

Regional Meeting of PIANC International in Manila, Philippines

William Glamore attended and helped coordinate the 2nd Asia-Pacific meeting of PIANC’s Young Professionals (YP) Commission from 10-14 April, 2016. Hosted in Manila, by the Philippines Port Authority, the meeting included over 80 delegates from 12 countries and included technical presentations, site tours and networking events.

PhD Student Florence Choo Receives Nancy Millis Award from WaterRA

PhD student Florence Choo has been presented with the Water Research Australasia (WaterRA) Nancy Millis award. The award is a recognition of a student who have demonstrated initiative, academic merit, exceptional qualities and a passion for research.
WRL Awarded the 2016 Dean’s Media Award for Story of the Year: “June Superstorm”

WRL coastal engineers documented the worst erosion at Collaroy since 1974 and made world news headlines. June 2016 captured an amazing opportunity of documenting a ‘Superstorm’ that battered eastern Australia. WRL’s team of coastal forecasters monitored the extreme event emerging on the horizon as early as six days prior the June 4th East Coast Low event. This early forecast enabled the team to collaborate with the NSW Office of Environment and Heritage and UNSW Aviation to mobilise unprecedented coastal monitoring capabilities and capture rare high-resolution observations of how coastlines evolve during extreme events.

WRL manages one of the world’s longest-running beach erosion research programs, at Narrabeen-Collaroy on Sydney’s northern beaches. Such long-term measurements of coastal variability are extremely rare and provide a unique insight into beach variability at different scales – from rapid erosion caused by extreme storms to changes over years and decades due to more subtle shifts in the wave climate.

Dean’s Media Award for Outstanding Valour

Awarded to WRL Manager Grantley Smith (for spending two days standing in a wave tank with a floating car), for the story “Floodwaters can turn cars into deathtraps”, and the runner-up for this same award given to Mitchell Harley (for his multi-channel media presence during the June storm).
A team at the UNSW Water Research Laboratory has been testing how small and large cars behave when they encounter flash floods, replicating scenarios faced by many stranded motorists, but doing so in an especially configured test tank in Manly Vale, in northern Sydney.

“What was surprising was just how little water it took to make even a large vehicle unstable,” said principal engineer Grantley Smith, who led the research. “They became vulnerable to moving floodwaters once the depth reached the floor of the vehicle. Even in low water depths and slow flow speeds, floodwaters had a powerful enough force to make them float away.”

The tests are a world first: previous experiments to understand the force of floodwaters have relied on using vehicle miniatures, rather than actual cars. Even the engineers were surprised how easily cars weighing more than a tonne quickly became buoyant and unstable.

WRL Engineers have discovered just how easily cars can be washed away by even the smallest currents – making the crossing of floodwaters a dangerous and potentially life-threatening decision.

“What was surprising was just how little water it took to make even a large vehicle unstable...”

Even in low water depths and slow flow speeds, floodwaters had a powerful enough force to make them float away.”

Grantley Smith, WRL Principal Engineer
Professor David Waite; Dr Richard Collins

Peter Nico received a $335,000 ARC Grant regarding ‘Reactive oxygen species productions on oxygenation of subsurface sediments’. This project aims to examine the nature, extent and effect of redox processes in subsurface environments. Reactive oxygen species, including hydrogen peroxide, superoxide and hydroxyl radicals, transform and affect redox-active substances in the environment such as arsenic, uranium and natural organic matter (which may be oxidised to carbon dioxide). Production of significant quantities of reactive oxygen species on oxygenation of subsurface sediments through actions such as aquifer recharge and high flow events may alter the form and mobility of trace elements and influence the cycling of carbon and eventual efflux of carbon dioxide to the atmosphere. This project will examine the nature, extent and effect of these redox processes in selected subsurface environments. This research could have implications for contaminant transformation and fate and carbon cycling.

Dr Lucy Marshall; Dr Hoori Ajami; Dr David Nott received a $245,000 ARC grant for their work in ‘Uncertainty quantification in terrestrial hydrologic systems’. This project aims to develop a framework to simulate, quantify and analyse the uncertainty in streamflow and vegetation dynamics via approximate Bayesian computation. Water is a fundamental resource, and a difficulty in water resource management is to make predictions in a changing environment. Uncertainties in predictions of natural systems due to observational and model error make this more difficult. It is anticipated that the results from this project will advance uncertainty analysis in hydrology and help understand how different types of data and information can inform model characterisation. This will be useful in providing vital information on the attributes and extent of uncertainty to inform water resources analysis, management and decision making.

Professor David Waite; Professor Stephen Foster; Associate Professor Arnaud Castel; Professor Christoph Arns; Dr Louise Keyte; Dr Redmond Lloyd

Dr David Nott received a $450,000 ARC Linkage grant with industry partner Boral Construction Materials Ltd. This project aims to develop innovative low carbon cement formulations for the Australian construction industry. It will design new binder formulations that include a high level clinker replacement and achieve high early strength by controlling early hydration reactions (<24 hrs) through combining admixtures. Using geochemistry to improve early hydration, it will use commonly available supplementary cementitious materials to prepare low carbon concrete. This research is expected to transform the Australian construction industry by developing higher performing, more durable structures with dramatically lower embodied carbon dioxide and improved life-cycle costs.

Associate Professor Stuart Khan; Associate Professor Frederic Leusch secured a $376,000 ARC grant regarding ‘The effect of wastewater treatment on the ecotoxicity of chiral chemical’. This project aims to assess the environmental implications of pharmaceuticals discharged in effluents from wastewater treatment plants. Trace levels of human pharmaceuticals occur in sewage and urban waterways, but during sewage treatment, some pharmaceuticals can undergo a chemical transformation known as ‘chiral inversion’. In some cases, this may convert relatively benign environmental contaminants to more ecologically toxic species. This project will investigate why and how some pharmaceuticals become susceptible to chiral inversion and assess ecotoxicological differences. This work is expected to determine the significance of considering chiral inversion in environmental risk assessment, with applications to a broader range of chemicals including pesticides and industrial chemicals.

Professor David Waite; Dr Richard Collins; Dr Peter Nico received a $335,000 ARC Grant regarding ‘Reactive oxygen species productions on oxygenation of subsurface sediments’. This project aims to examine the nature, extent and effect of redox processes in subsurface environments. Reactive oxygen species, including hydrogen peroxide, superoxide and hydroxyl radicals, transform and affect redox-active substances in the environment such as arsenic, uranium and natural organic matter (which may be oxidised to carbon dioxide). Production of significant quantities of reactive oxygen species on oxygenation of subsurface sediments through actions such as aquifer recharge and high flow events may alter the form and mobility of trace elements and influence the cycling of carbon and eventual efflux of carbon dioxide to the atmosphere. This project will examine the nature, extent and effect of these redox processes in selected subsurface environments. This research could have implications for contaminant transformation and fate and carbon cycling.
This project aims to make the water industry capable of foreseeing and managing adverse raw water organic matter quality from the catchment to the treatment plant. It will research the triggers for organic matter excursions that compromise treatment plant performance and affect public health. The project will develop and deploy innovative sensors to detect targeted water quality changes at the molecular level in situ and real time, and improve operating strategies for robust and reliable performance of existing treatment plants. This catchment to plant approach is expected to make existing treatment assets more productive and defer additional treatment costs.

**Industry partners:** Sydney Water Corporation; Water NSW

**Award:** $450,000

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**Western Sydney University:** Associate Professor Arumugam Sathasivan; Professor Brajesh Singh; **Associate Professor Stuart Khan;** Professor Jens Coorssen; Professor Linda Blackall; Professor Bruce Rittmann; Dr Maneesha Ginige; Dr Peter Cox

This project aims to develop an adaptive, real-time control system for managing disinfectant residuals in chloraminated water supply systems. While chloramine delivers microbiologically safe drinking water in warmer climates and in long distribution systems, it is largely unpredictable, costs water utilities millions of dollars annually, and has uncertain benefits. This project's control system will be guided by quantitative models formulated from multi-pronged, fundamental experiments. The project will quantify microbial chloramine decay and determine mechanisms to increase predictability. The project will develop and demonstrate a real-time control technology which delivered microbiologically safe, cost-efficient drinking water to people in warmer climates, despite warming climate and increasing population.

**Industry partners:** Commonwealth Scientific And Industrial Research Organisation; Sydney Water Corporation; Central Seq Distributor-Retailer Authority; South East Queensland Water; Logan City Council; Unitywater

**Award:** $710K

**Associate Professor Tommy Wiedmann** was part of the Linkage Infrastructure, Equipment and Facilities (LIEF Grant) of $260,000. Research Topic looks into ‘Enhanced modelling capacity of the Industrial Ecology Virtual Laboratory’.
## ARC and CRC Funded Grants

<table>
<thead>
<tr>
<th>Investigators</th>
<th>Research Topic</th>
<th>Granting Organisation</th>
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<tbody>
<tr>
<td><strong>A. Sharma, F. Johnson, Y. Liu, L. Marshall (UNSW), H. Moradkhani (Portland State University), S. Muddu (Indian Institute of Science), Q. Wang, D. Robertson (CSIRO)</strong></td>
<td>Reducing flood loss - A data-assimilation framework for improving forecasting capability in sparsely gauged regions</td>
<td><strong>ARC Discovery Grant</strong> DP140102394</td>
</tr>
<tr>
<td><strong>S. Westra (Uni. Adelaide), F. Johnson (UNSW), F. Zwiers (Uni of Victoria, Canada), H. Fowler (Uni Newcastle Upon Tyne, UK), G. Lenderink (Royal Netherlands Meteorological Institute)</strong></td>
<td>A spatial extremes framework for predicting subdaily rainfall intensity</td>
<td><strong>University of Adelaide / ARC Discovery Project shared Grant</strong> DP150100411</td>
</tr>
<tr>
<td><strong>R. Crawford (Uni Melbourne), T. Wiedmann (UNSW), A. Stephan (Belgian National Fund for Scientific Research, Free University of Brussels (French))</strong></td>
<td>Improving the environmental performance of Australian construction projects</td>
<td><strong>University of Melbourne / ARC Discovery Project Shared Grant</strong> DP150100962</td>
</tr>
<tr>
<td><strong>I. Turner, K. Splinter, M. Harley (in collaboration with UNSW Aviation, Delft Technical University, University of Plymouth,University of Bath)</strong></td>
<td>Beach erosion and recovery: quantifying the hazard</td>
<td><strong>Australia Research Council – Discovery</strong> DP150101339</td>
</tr>
<tr>
<td><strong>A. Sharma, J. Evans, A. Sen Gupta (UNSW), A. Chanan, G. Singh (State Water Corporation), M. Barfi, J. Luo (Bureau of Meteorology), F. Chew (CSIRO), L. Band (University of North Carolina at Chapel Hill)</strong></td>
<td>A decadal to inter-decadal streamflow prediction system</td>
<td><strong>ARC LP130100072</strong> State Water Corporation, Bureau of Meteorology</td>
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<tr>
<td><strong>D. Waite, G. Leslie (UNSW), X. Wang (Tsinghua University), J. Guan (Beijing Origin Water Technology), C. McNees (Water Research Australia), P. Spencer (Water Corporation of WA), N. Riethmuller (Power and Water Corporation)</strong></td>
<td>Innovative hybrid membrane-based pre-treatment strategies for remote community groundwater supplies</td>
<td><strong>ARC LP130101107</strong> Beijing Origin Water, Water Research Australia, Water Corporation of WA, Power and Water Corporation</td>
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<tr>
<td><strong>F. Johnson, A. Sharma (UNSW), S. Chowdhury, R. Beecham (DPI Water)</strong></td>
<td>Assessing future drought risk for water resources system management</td>
<td><strong>ARC Linkage Project</strong> LP150100548</td>
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<tr>
<td><strong>D. Waite, J. Fletcher (UNSW), P. Kovalsky (Mincarb), Jianshu Zhao (Pangu)</strong></td>
<td>Optimising CDI water treatment for ion removal and energy recovery</td>
<td><strong>ARC Linkage Project</strong> LP150100854</td>
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<tr>
<td><strong>L. Nghiem (University of Wollongong), W. Price (University of Wollongong), P. Perez (University of Wollongong), R. Stuetz (UNSW), H. Bustamante (Sydney Water), S. Murthy (District of Columbia Water and Sewer Authority)</strong></td>
<td>Analytics to predict anaerobic codigestion and downstream process performance</td>
<td><strong>University of Wollongong / ARC Linkage Project Shared Grant</strong> LP150100304</td>
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<td><strong>D. Waite, S. Foster, A. Castel, C. Arms (UNSW), L. Keyte (Boral Construction Materials Limited), R. Lloyd (Boral Cement Limited)</strong></td>
<td>Development of innovative cement binders with low carbon footprint</td>
<td><strong>ARC Linkage Project</strong> LP160101153</td>
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<td>Investigators</td>
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<tr>
<td>F. Johnson, A. Sharma (UNSW), S. Chowdhury, R. Beecham (DPI Water)</td>
<td>Assessing future drought risk for water resources system management</td>
<td>DPI-Water Linkage Project LP150100548</td>
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<tr>
<td>D. O’Carroll</td>
<td>Fate of engineered nanoparticles: Challenges in informing human and ecological health risk assessments</td>
<td>Australia Research Council Future Fellowship FT140100837</td>
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<tr>
<td>T. Wiedmann, M. Diesendorf, M. Balatbat, G. Monroe (UNSW), M. Lenzen (Sydney University), S. Kenway, P. Lant, A. Halog (University of Queensland), P. Perez (University of Wollongong), R. Crawford (University of Melbourne)</td>
<td>Enhanced modelling capacity for the Industrial Ecology Virtual Laboratory</td>
<td>UNSW / ARC LIEF Central Contribution</td>
</tr>
<tr>
<td>T. Wiedmann, M. Diesendorf, M. Balatbat, G. Monroe (UNSW), M. Lenzen (Sydney University), S. Kenway, P. Lant, A. Halog (University of Queensland), P. Perez (University of Wollongong), R. Crawford (University of Melbourne)</td>
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</tr>
<tr>
<td>T. Wiedmann (UNSW), R. Zito, S. Lehmann (UniSA), A. Berry (CSIRO), O. Vitkovskaya, J. Ting, L. Oxad (SA Department of Environment, Water and Natural Resources), P. Donaldson (Renewal SA), K. Rouse (SA Water), N. Nelson (Sydney Water), L. Partridge (AECOM)</td>
<td>Integrated ETWW demand forecasting and scenario planning for precincts</td>
<td>CRC for Low Carbon Living Ltd</td>
</tr>
<tr>
<td>T. Wiedmann (UNSW), Partner Organisations: University of Melbourne, University of SA, AECOM, Aurecon, Sydney Water, Bluescope Steel</td>
<td>Integrated Carbon Metrics (ICM) – a multi-scale life cycle approach to assessing, mapping and tracking carbon outcomes for the Built Environment</td>
<td>CRC For Low Carbon Living Ltd</td>
</tr>
<tr>
<td>R. Stuetz</td>
<td>Energy Benchmarking for efficient, low carbon water recycling operations</td>
<td>CRC For Low Carbon Living Ltd</td>
</tr>
<tr>
<td>A. Sharma (UNSW), S. Muddu (Indian Institute of Science)</td>
<td>What will the future be? Projecting environmental change in a warming world for semi-arid landscapes</td>
<td>Dept. of Industry / AISRF</td>
</tr>
<tr>
<td>A. Jones, R. Collins &amp; D. Waite</td>
<td>Using mediated electrochemistry to correlate the reduction of trichloroethylene to the reduction potential of various Fe(II)-Fe oxide systems</td>
<td>Australian Synchrotron / X-ray Absorption Spectroscopy Beamline Access</td>
</tr>
<tr>
<td>A. Jones, R. Collins &amp; W. Xiao</td>
<td>Transformation kinetics of ferrihydrite induced by the dissimilatory Fe reducing bacterium Shewanella oneidensis &amp; comparison with abiotic transformation kinetics</td>
<td>Australian Synchrotron / X-ray Absorption Spectroscopy Beamline Access</td>
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<tr>
<td>G. Rau, M. Andersen, A Baker &amp; D. Meredith</td>
<td>Groundwater infrastructure program NSW</td>
<td>RAAP supporting NCRIS Funding - NSW Department of Industry</td>
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## Fellowships

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<tr>
<td>R. Cox</td>
<td>ACCARNSI – promote adaptation research and build capacity</td>
<td>NCCARF – Griffith University for Commonwealth Dept of Environment and Energy</td>
</tr>
<tr>
<td>A. Sharma</td>
<td>Flood inundation data assimilation <strong>Scholarship:</strong> Sahani Pathiraja</td>
<td>CSIRO / Postgraduate Studentship</td>
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<tr>
<td>T. Wiedmann</td>
<td>Integrated Carbon Metrics (ICM) – a multi-scale life cycle approach to assessing, mapping and tracking carbon outcomes for the Built Environment <strong>Scholarship:</strong> Soo Huey Teh</td>
<td>CRC For Low Carbon Living Ltd</td>
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<tr>
<td>T. Wiedmann</td>
<td>Integrated Carbon Metrics (ICM) – a multi-scale life cycle approach to assessing, mapping and tracking carbon outcomes for the Built Environment <strong>Scholarship top-up:</strong> Guangwu Chen</td>
<td>CRC For Low Carbon Living Ltd</td>
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<tr>
<td>R. Stuetz</td>
<td>Energy Benchmarking for efficient, low carbon water recycling operations <strong>Scholarship:</strong> Ben Thwaites</td>
<td>CRC For Low Carbon Living Ltd</td>
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<tr>
<td>R. Stuetz</td>
<td>Optimisation of granular sludge for energy efficient wastewater treatment and reuse <strong>Scholarship:</strong> Ben Thwaites</td>
<td>WQRA Postgraduate Scholarships</td>
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## Scholarships

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<tr>
<td>A. Anceno</td>
<td>Multi-functional reactor systems for liquid and gas phase treatment of agroindustrial and municipal effluents: toward pollution and odour abatement with energy cogeneration</td>
<td>UNSW_VC PostDoc Support</td>
</tr>
<tr>
<td>R. Stuetz (UNSW), R. Barczak (Warsaw University of Technology)</td>
<td>OdourCOB - Odour characterisation of odorants from biosolids</td>
<td>European Commission / Marie Curie International Outgoing Fellowships for Career Development (IOF)</td>
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# Others

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<tr>
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<tr>
<td>D. Waite (UNSW), B. Rittmann (Arizona State University), G. Rundblad (Kings College London)</td>
<td>Human health implications of intentional and non-intentional nanoparticle ingestion, injection and inhalation</td>
<td>UNSW / PluS Alliance Collaborative Research Seed Grants</td>
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<tr>
<td>D. Waite</td>
<td>Development of sustainable zero-discharge wastewater treatment systems</td>
<td>UNSW / Tsinghua University Collaborative Research Fund - Seed Grants</td>
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<tr>
<td>T. Wiedmann</td>
<td>City carbon footprint networks using the Global Industrial Ecology Virtual Lab</td>
<td>UNSW / Tsinghua University Collaborative Research Fund - Seed Grants</td>
</tr>
<tr>
<td>B. Miller, A. Harrison &amp; I. Turner</td>
<td>Publicly available datasets: online photogrammetry web portal</td>
<td>OEH – NSW Adaptation Research Hub: Coastal Processes Response Node</td>
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<tr>
<td>R. Cox</td>
<td>Review of finance mechanisms for climate change adaptation</td>
<td>Griffith University – Department of the Environment</td>
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<tr>
<td>R. Cox</td>
<td>Optimisation of seawalls and beach nourishment for coastal adaptation</td>
<td>OEH – NSW Adaptation Research Hub: Coastal Processes Response Node</td>
</tr>
<tr>
<td>D. Waite</td>
<td>Determination of factors causing strength increase on high level retardant addition to Portland Cement</td>
<td>Boral Cement Limited</td>
</tr>
<tr>
<td>M. Hadjikakou</td>
<td>Our ‘foodprint’ matter – Australian diets and their environmental, economical and health impacts</td>
<td>Australian Academy of Science / WH Gladstones Population and Environment Fund</td>
</tr>
<tr>
<td>B. Stanford, G. Johns (Hazen and Sawyer), S. Khan, T. Wiedmann, M. Hadjikakou (UNSW)</td>
<td>Methodology for a comprehensive analysis (TBL) of alternative water supply projects compared to direct potable reuse WRRF-14-03</td>
<td>Hazen and Sawyer &amp; Water Research Australia / WateReuse Research Foundation Subcontract</td>
</tr>
<tr>
<td>S. Khan (UNSW), J. Drewes (Technical University of Munich)</td>
<td>Modelling contaminant removal during wastewater treatment</td>
<td>UNSW / Australia- Germany Joint Research Cooperation Scheme</td>
</tr>
<tr>
<td>D. Waite, P. Kovalsky &amp; A. Kinsela</td>
<td>Development of robust low cost capacitive deionisation technology</td>
<td>Sir Ratan Tata Trust / International Contract</td>
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<td>S. Khan</td>
<td>Emerging contaminant research prioritisation decision framework</td>
<td>Water Environment and Reuse Foundation (WE&amp;RF) / International Contract</td>
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<tr>
<td>R. Collins</td>
<td>Faculty Silver Star</td>
<td>UNSW Faculty of Engineering</td>
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<tr>
<td>D. Waite</td>
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<td>UNSW Faculty of Engineering</td>
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<tr>
<td>S. Felder</td>
<td>Faculty Silver Star</td>
<td>UNSW Faculty of Engineering</td>
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## Applied Research

### Investigators

- **G. Smith, B. Miller, S. Felder, B. Cathers, R. Cox, D. Anderson, A. Harrison, B. Modra & P. Rahman**

### Research Topic

- **Coastal Engineering**
- **Civil Engineering Hydraulics**
- **Hydrology, Flooding and Water Resources**
- **Environmental Engineering**

### Granting Organisation

- **Asian Development Bank via Tonkin and Taylor, Aurecon, Beatty Legal Pty Ltd, Bega Valley Shire Council, Byron Shire Council, Central Coast Council, City of Gold Coast, Clarence City Council, CMS Surveyors, Coasts and Ports 2015 c/- Tonkin & Taylor Ltd, Department of Environment, Land, Water & Planning (Vic), Eco Logical Australia Pty Ltd, GHD Pty Ltd, Grün Solutions, Horton Consulting, HWL Ebsworth, James de Soyes & Associates Pty Ltd, JK Geotechnics, Manly Hydraulics Laboratory, Moine Shire Council, Northern Beaches Council, NSW Department of Primary Industries - Fisheries, SIMS, Office of Environment and Heritage, Office of Strategic Lands Department of Planning & Environment, Pitt & Sherry, Shoalhaven City Council, Sydney Water, Tonkin and Taylor, Tweed Shire Council, Umwelt (Australia), Waverley Council**
- **Drying Green Alliance, ACO Polycrane Pty Ltd, Golder Associates, NSW Fisheries, SPEL, Sydney Water Corp, ACO Polycrane Pty Ltd, Australian Water Partnership, Jindex Pty Ltd, Golder Associates**
- **NSW SES, NSW OEH, City of Newcastle, WMAWater**
- **ARUP Pty Ltd, Clarence Valley Council, Department Of Commerce (For Clarence Valley Council), Ferrier Hodgson, Griffith University, Hornsby Council, Hunter Water Corp, National Climate Change Adaptation Research Facility (NCCARF), National Parks and Wildlife (OEH), Newcastle City Council, Newcastle Coal Infrastructure Group, North Coast Local Land Services, NSW Department of Primary Industries (Fisheries), NSW Environmental Protection Authority, NSW Office of Environment & Heritage, NSW Office of Water, DPI, Shoalhaven City Council, Sutherland Shire Council, NSW Office Of Environmental And Heritage: Parks And Wildlife Divi, Sydney Water Corp**
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<tr>
<td>W. Glamore &amp; M. Andersen</td>
<td>The role of organic carbon for determining water quality in an artificially de-stratified dam, Chichester Dam</td>
<td>Hunter Water Corporation</td>
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<td>L. Marshall</td>
<td>Paxton catchment improvement program: Peer Review</td>
<td>Hunter Water Corporation / State Government Contract</td>
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<td>S. Khan</td>
<td>Critical control point assessment to quantify robustness and reliability of multiple treatment barriers of a DPR Scheme</td>
<td>Hazen and Sawyer</td>
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<td>S. Khan</td>
<td>From collection system to tap: Resiliency of treatment processes for direct potable reuse</td>
<td>Sustainable Systems LLC - Consulting</td>
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<td>A. Sharma</td>
<td>Wathnet model independent expert review</td>
<td>WREMA Pty Ltd / Contract Research</td>
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<td>D. Roser</td>
<td>Wet weather overflows health monitoring</td>
<td>Sydney Water Corporation / State Government Contract</td>
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<tr>
<td>D. Waite</td>
<td>Overview of options for wastewater treatment and resource recovery</td>
<td>Beijing Origin Water Technology Co Ltd / International Contract</td>
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<tr>
<td>S. Khan</td>
<td>Strategic analysis of water quality in the Parramatta river catchment</td>
<td>Jacobs Group (Australia) Pty Ltd / Parramatta City Council Subcontract</td>
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<td>S. Khan &amp; J. McDonald</td>
<td>Trace Organics analysis</td>
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<td>N. Le Minh</td>
<td>Odour analysis</td>
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<td>Peter Stephenson &amp; Associates Pty Ltd</td>
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<td>Abigroup Contractors &amp; CH2M Hill Australia Pty</td>
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<td>R. Henderson</td>
<td>LCOCRD analysis</td>
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<td>D. Waite</td>
<td>Consulting</td>
<td>Norton Rose Fulbright</td>
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<tr>
<td>D. Roser</td>
<td>Consulting</td>
<td>Office of the Environment</td>
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</table>
Sivakumar, B. Chaos in hydrology: Bridging determinism and stochasticity.

Book Section


Software

Journal Articles


Garg, S., Rong, H., Miller, C. J., & Waite, T. D. Chlorine-mediated regeneration of semiconducting AgCl(s) following light-induced Ag formation: Implications to contaminant degradation. *Journal of Physical Chemistry C, 120*(11), 5988-5996. doi: 10.1021/acs.jpcc.5b11273


Liu, T., Li, X., Li, F., Han, R., Wu, Y., Yuan, X., & Wang, Y. In situ spectral kinetics of Cr(VI) reduction by c-type cytochromes in A suspension of living shewanella putrefaciens 200. *Scientific Reports*, 6. doi: 10.1038/srep29592


McCarroll, R. J., Brander, R. W., & Turner, I. L. Bathymetric controls on very low frequency rip current motions. *Journal of Coastal Research* (SI 75), 418-422.


Nunez Garcia, A., Boparai, H. K., & O’Carroll, D. M. Enhanced dechlorination of 1,2-dichloroethane by coupled nano iron-dithionite treatment. *Environmental Science and Technology*, 50(10), 5243-5251. doi: 10.1021/acs.est.6b00734


Sun, Y., Pham, A. N., & Waite, T. D. Elucidation of the interplay between Fe(II), Fe(III), and dopamine with relevance to iron solubilization and reactive oxygen species generation by catecholamines. *Journal of Neurochemistry*, 955-968. doi: 10.1111/jnc.13615


**Conference Proceedings**


Conferences


Hadjikakou, M. A Triple Bottom Line (TBL) approach to decision making LGNSW Water Management Conference. Broken Hill, New South Wales, Australia.

Hadjikakou, M., Roser, D. J., & Wiedmann, T. Planetary health impacts of the nutrition transition: understanding causal links and changes through time Opportunities for the Critical Decade – Decoupling Well-Being from Environmental Pressures and Impacts (Gordon Research Conference on Industrial Ecology). Stowe, Vermont.


Modra, B. D., Coghlan, I. J., Carley, J., Blumberg, G., & Boyd, W. Wave forces and overtopping on stepped seawalls NSW Coastal Conference. Coffs Harbour, NSW, Australia.

Rau, G. C., Turner, I. L., Austin, M., & Andersen, M. S. Experimental investigation of the flow dynamics within sandy coastal barriers under different water level and wave conditions Salt Water Intrusion Meeting & Asia-Pacific Coastal Aquifer Management Meeting. Cairns, Australia.


Reports


Khan, S. J., & Byrnes, K. Strategic analysis of water quality in the Parramatta River: how should recreational water quality in the Parramatta River be assessed?


Zamani, K. Efficient and reliable mathematical modeling techniques for multi-phase environmental flows. University of California, Davis.
With Thanks

We wish to acknowledge and thank the following for their continued support in 2016:

**Association, Industry, and Research Partners**
2020 Projects Pty Ltd
AINE
Airepure Australia Pty Ltd
Aquatic Ecologist
Aurecon Australia Pty Ltd
Aurecon Hatch
Aust Academy of Technological Sciences & Engineering
Austpac Properties Pty Ltd
Australian Blue Mountain International
Australian Synchrotron Company Ltd
Beijing Origin Water Technology Co Ltd
Bureau of Meteorology
Byron Shire Council
Cardno (NSW/ACT) Pty Ltd
Clarence City Council
Clarence Valley Council
Climate Change Cook Islands
CoastalCOMS Pty Ltd
Dams Safety Committee
Department of Foreign Affairs & Trade
Department of Natural Resources & Mines
Department of Planning & Infrastructure
Department of Sustainability & Environment
Department of the Environment
Dept of Environment & Primary Industries
Dept of Environment Climate Change Water
Dept of Innovation, Ind, Science & Res
Dept of Sustainability Environment Water
Dept of Trade & Investment, Regional
dSEWPAC
Ecotext Pty Ltd
EECW Pty Ltd
Elforsk AB
Energy Resources of Australia Ltd
Engineers Australia
EPA Victoria
Eurobodalla Shire Council
Fraser Coast Regional Council
Geoscience Australia
GHD Pty Ltd
Gosford City Council
Gothenburg University
Goulburn-Murray Rural Water Corporation
Greater Taree City Council
Hornsby Shire Council
Hunter Water Corporation Limited
Industry and Investment NSW
IVL Swedish Environmental Research Inst
Lake Coal Pty Ltd
Leishman Associates
Manly Council
Melbourne Water Corporation
Melton and Christina Mowbray
Moyne Shire Council
Murdock University
Myriax Pty Ltd
Nambucca Shire Council
National ICT Australia Limited
NSW Canegrowers Association
NSW Department Primary Industries
NSW Office of Water
NSW Public Works
NSW Sugar Milling Co Operative Ltd
NSW Trade & Investment
Office of Environment and Heritage
Outotec (Australasia) Pty Ltd
Port Waratah Coal Services Ltd
Poultry CRC Ltd
Power and Water Corporation
Queensland Bulk Water Supply Authority
Queensland Nickel Pty Ltd
RMIT
Seqwater
SHCAG Pty Ltd
Shoalhaven City Council
Shoalhaven Riverwatch Incorporated
Shore Regional Organisation of Councils
Sinclair Knight Merz Pty Ltd
SMEC Australia Pty Ltd
Smithsonian Environmental Southern Water
SunWater
Swerea IVF AB
Sydney Catchment Authority
Sydney Institute of Marine Science
Sydney Water
Sydney Water Corporation
Sydney Water Odour Alliance Joint Venture
Synchrotron Light Source Australia P/L
The City of Newcastle
The University of Queensland
Toowoomba Regional Council
Total Earth Care
Tweed Shire Council
Umwelt Australia Pty Ltd
UNSW Global Pty Limited
Veolia Water Operations Pty Ltd
Warringah Council
Water Corporation
Water Quality Research Australia Ltd
Water Research Australia Limited
Water Technology Pty Ltd
WetlandCare Australia
Wygong Shire Council

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Melbourne University
Monash University
RMIT
Tsinghua University, China
University College Dublin, Ireland
University of Colorado, USA
University of Columbia, USA
University of Newcastle
University of Plymouth
University of Queensland
University of Sydney
University of South Australia
University of Tasmania
University of Technology, Sydney
University of Western Australia