Acknowledgement of Country

We acknowledge the Elders, families and forebears of the Boorwurrung and Wurundjeri tribes of the Kulin Nation who were the custodians of University land for many centuries. We acknowledge that the land on which we meet was the place of age-old ceremonies of celebration, initiation and renewal and that the Kulin Nation people's living culture had and has a unique role in the life of this region.
MANAGEMENT STRUCTURE

INDUSTRY ADVISORY BOARD

GRAEME ALLINSON
Principal Research Scientist, Dept of Primary Industries

PAUL AthERTON
Regional Development Officer, Grampians Wimmera Mallee Water

EMMA BISHOP
Senior Policy Officer, Dept of Sustainability & Environment

STEVE BIRD
CEO, Victorian Water Industry Association

PROFESSOR STEWART BURN
Scientist, CSIRO

RODNEY DEDMAN
Manager, Water Policy, Department of Health

DR DHARMA DHARMABALAN
Executive Manager, Coliban Water

ROBERT FRANKLIN
General Manager, Western Water

GEOFF GARDINER
General Manager, City West Water

DAVID GREGORY
Research and Technology, Melbourne Water

DR DAVID HALLIVELL
Wastewater Program Manager, Water Quality Research Australia

STEPHEN LANDSELL
Project Coordinator – Water Environment Protection Authority (EPA)

JASON MCGREGOR
Environment Manager, Central Highlands

PETER MCKINNON
Manager, Environment and Sustainability Wyndham City Council

PAUL NORTHEY
Corporate Manager, Barwon Water

PETER SCOTT
General Manager, Melbourne Water

TERRY TURNNEY
Chief Executive Officer, Asia Nanomaterials

GREG VERO
Engineering and Technical Manager, ORICA Watercare

MANAGEMENT COMMITTEE

MAX COSTER
Department of Sustainability & Environment

EDDY OSTARCEVIC
Integrated Elements

PETER MCKINNON
Wyndham City Council

PROFESSOR LINDA ROSENMAN
Victoria University

PROFESSOR MICHELLE TOWSTOLESS
Victoria University

PROFESSOR STEPHEN GRAY
Victoria University

ASSOC. PROFESSOR MIKEL DUKE
Victoria University

JANETTE FRANCIS
Resources Officer
The Institute or Sustainability and Innovation (ISI) maintained a reasonable external income performance, receiving >$800,000 in external income for 2010, and the main focus was again water research.

The National Centre of Excellence for Desalination Australia (NCEDA) had two rounds of funding and ISI received 4 research grants as project leader and 2 as a research partner on NCEDA projects. The Australian Water Recycling Centre of Excellence (AWRCoE) also had rounds of funding and ISI was included on two of these projects.

While the grants were awarded in 2010, formalising the contractual arrangements was slow as the Centre’s of Excellence negotiated their first contracts, and therefore, little income arrived from these sources in 2010. However, funding opportunities from these centres of excellence will continue in 2011.

The number of research students also grew to 29 in 2010, and Dr Lata Ramchandran was retained within ISI after the completion of her DIAL cheese starter cultures project. Overall, our staff numbers remained steady, with no staff departing in 2010.

ISI continued to develop its international reputation with Assoc Professor Mikel Duke receiving an Endeavour Travel Award to visit Fudan University in Shanghai and Dr Bo Zhu receiving an Ian Potter Travel Award to visit the Nanjing University of Technology, China. Collaboration with these leading Chinese universities is planned for 2011.

Highlights of 2010 also included 2 conferences that were chaired by ISI staff. Assoc Professor Duke also chaired the 3rd International Inorganic Membrane Symposium in Melbourne during November, 2010, and Prof Paul Boon chaired the National Conference on the ecology and management of the Gippsland Lakes during October 2010. Both conferences were well attended with high quality presentations.

The support of the University, our Industry Advisory Board, and management committee, along with the efforts of our staff, students, adjuncts and colleagues during 2010 is gratefully acknowledged.

Director,
Institute for Sustainability and Innovation
STAFF

DIRECTOR
Professor Stephen Gray, PhD (Melbourne), BE (Melbourne)

RESEARCH PROFESSORS
Professor John Cary, PhD (Melbourne), M.Agr.Sc., (Melbourne), B.Agr.Sc., (Massey)
Professor Paul Boon, PhD (Griffith), BSc Hons (Sydney)

ASSOCIATE RESEARCH PROFESSOR
Assoc Professor Mikel Duke, PhD (UQ), BE Hons (UQ)

RESEARCH FELLOWS
Dr Peter Sanciolo, PhD (Swinburne), B App Sci (Swinburne), Dip.Ed (MCAE), Cert IV in Assessment & Workplace Training
Dr Bo Zhu, PhD (Deakin), Masters (Zhejiang, China), BSc (Zhejiang, China)
Dr Nicholas Milne, PhD (New South Wales), BE (New South Wales)
Dr Marlene Cran, PhD (VU), BSc Hons (VU)
Dr Dung Tran, PhD (VU), BE (Vietnam)
Dr Jing He, PhD (Chinese Academy of Sciences, China), Masters (SWPU, China), BSc (SWPU, China)
Dr Patrick Guay, PhD Zoology (Melbourne), MSc Medical Research (McGill, Montreal, Canada), BSc Honours Biochemistry (McGill, Montreal, Canada).
Daniel Ooi, Masters (Sydney), BPsych Hons (Sydney)
Dr Matthew Stewart, PhD (VU), BSc Hons (VU), BSc: Medical Forensic and Analytical Chemistry (VU)

RESEARCH ASSOCIATES
Shameem Ali, Lecturer, School of International Business/Business and Law
Assoc. Prof Jack Antonas, Biomedical and Health Sciences, Faculty of Health, Engineering and Science
John Bentley, Senior Lecturer, Management and Info Systems, Faculty of Business and Law
Prof Stephen Bigger, Deputy Dean, Faculty of Health, Engineering and Science
Wayne Binney, Lecturer, Hospitality, Tourism and Marketing, Faculty of Business and Law
Dr Domenico Caridi, Senior Lecturer, Engineering and Science, Faculty of Health, Engineering and Science
Dr Stephen Collins, Director, Telecommunications and Microelectronics, Faculty of Health, Engineering and Science
Prof Peter Creamer, PVC (Industry and Community), Office for Industry and Community Engagement
Dr Nivedita Datta, Lecturer, Food Science, Biomedical and Health Sciences, Health, Engineering and Science
Prof Terry Delacy, Professorial Fellow, Centre for Tourism and Services Research, Faculty of Business and Law
Osanna Donkor, Postdoctoral Research, Biomedical and Health Sciences, Faculty of Health, Engineering and Science
Dr Alison Duncan, Lecturer, Microbiology, Engineering and Science, Faculty of Health, Engineering and Science
Greg Evans, Senior Lecturer, Engineering and Science, Faculty of Health, Engineering and Science
Prof Mike Faulkner, Engineering and Science, Faculty of Health, Engineering and Science
Dr Adrian Fisher, Assoc. Professor, Science and Psychology, Faculty of Arts, Education and Human Development
Assoc Prof Sam Fragomeni, Engineering and Science, Health, Faculty of Engineering and Science
Sarah Fraser, Research Assistant, Engineering and Science, Faculty of Health, Engineering and Science
Dr Colin Higgins, Lecturer, Management and Information Systems, Faculty of Business and Law
Dr Colin Hocking, Senior Research Fellow, Executive Dean’s Unit, Faculty of Health, Engineering and Science
Dr Sardar Islam, Professor, Business Economics, Centre for Strategic Economic Studies, Faculty of Business and Law
Prof Leo Jago, Centre for Tourism Services Research
Dr Kanchana Jayasuriya, Language and Learning, Faculty of Health, Engineering and Science
Dr Kandiah Jegasothy, Senior Lecturer, Accounting and Finance, Faculty of Business and Law
Robert Jovanovic, Lecturer, Management Information System, Faculty of Business and Law
Prof Akhtar Kalam, Engineering and Science, Faculty of Health, Engineering and Science
Dr Wally Karnilowicz, Senior Lecturer, Social Science and Psychology, Arts, Faculty of Education and Human Development
 Rachael Keefe, Environment co-ordinator, Operations Planning
Jennifer Laurence, Social Science and Psychology, Faculty of Arts, Education and Human Development
Peter Lechte, Senior Lecturer, Engineering and Science, Faculty of Health, Engineering and Science
Assoc Prof Jun-De Li, Engineering and Science, Faculty of Health, Engineering and Science
Assoc Prof David McCallum, Social Science and Psychology, Faculty of Arts, Education and Human Development
Prof Terence McCann, Nursing Research, Nursery and Midwifery, Faculty of Health, Engineering and Science
Sandra McKechnie, Lecturer, Biotechnology, Engineering and Science, Faculty of Health, Engineering and Science
Assoc Prof Mary Millikan, Lecturer, Engineering and Science, Faculty of Health, Engineering and Science
Dr Vijay Mishra, Senior Lecturer, Biomedical and Health Sciences, Faculty of Health, Engineering and Science
Dr Shobha Muthukumaran, Lecturer, Engineering and Science, Faculty of Health, Engineering and Science
Dr Nitin Muttill, Lecturer, Water Engineering, Engineering and Science, Faculty of Health, Engineering and Science

Dr Anne Ng, Lecturer, Water Engineering, Engineering and Science, Faculty of Health, Engineering and Science

Assoc Prof Barry Omahony, School of International Services, Faculty of Business and law

Prof John Orbell, Engineering and Science, Faculty of Health, Engineering and Science

Dr Cagil Ozansoy, Lecturer - Power Systems, Engineering and Science, Faculty of Health, Engineering and Science

Dr Rohani Paimin, Senior Lecturer, Engineering and Science, Faculty of Health, Engineering and Science

Michael Pearlman, Senior Lecturer, International Business, Faculty of Business and law

Prof Chris Perera, Assoc. Dean Research & Training, Faculty of Health, Engineering and Science

Adrian Ramp, Governance Policy/PVC Institutional Services

Tina RANKOVIC, Director, Innovation and Commercial Development, Office of DVC Research

Dr Gina Reyes, Business Analyst, Business Review and Improvement

Dr Randall Robinson, Lecturer, Engineering and Science, Faculty of Health, Engineering and Science

Assoc Prof Vincent Rouillard, Assoc. Professor, Engineering and Science, Health, Engineering and Science

Nick Sciulli, Senior Lecturer, Accounting and Finance, Faculty of Business and Law

Prof Nagendra Shah, Biomedical and Health Sciences, Faculty of Health, Engineering and Science

Assoc Prof Nalin Sharda, Engineering and Science, Faculty of Health, Engineering and Science

Dr Juan Shi, Senior Lecturer, Engineering and Science, Faculty of Health, Engineering and Science

Dr Xiao Su, Lecturer, Bio Science, Biomedical and Health Sciences, Faculty of Health, Engineering and Science

Prof Graham Thorpe, Director, C.E.S.A.R.E, Faculty of Health, Engineering and Science

Prof Michelle Towstoless, Executive Dean, Faculty of Health, Engineering and Science

Dr Danh Tran, Senior Lecturer, Engineering and Science, Faculty of Health, Engineering and Science

Trinh Tuong, Jobs Plus Client Services, Employer & Apprentice Services Employer

Assoc Prof Todor Vasiljevic, Biomedical and Health Sciences, Faculty of Health, Engineering and Science
Dr Srikanth Venkatesan, Lecturer, Structural Engineering, Engineering and Science, Faculty of Health, Engineering and Science
Assoc Prof Aladin Zayegh, Engineering and Science, Faculty of Health, Engineering and Science
Prof Yanchun Zhang, Engineering and Science, Faculty of Health, Engineering and Science

RESEARCH OFFICERS
Dr Lata Ramchandran, MSc (Gujarat Agricultural University, India), BSc (Gujarat Agricultural University, India)
Noel Dow, B. App Sci (Victoria)

ADJUNCT RESEARCH PROFESSORS
Neil Barr, DPI
Stewart Burn, CSIRO
Robert Fairclough, Wyndham City Council
Manh Hoang, CSIRO
Syed Hussainy, Melbourne Water
Anne Pisarski, Queensland University of Technology
Ashok Sharma, CSIRO
Elankovan Ponnampalam, Dairy Innovation Australia Limited
Yonggang Zhu, CSIRO
Michel Lefebvre, Steripak
Andrew Barton, Grampians Wimmera Mallee Water (GWMWater)

ADJUNCT RESEARCH ASSOC. PROFESSORS
Hal Aral, CSIRO
Nohemi Quispe-Chavez, Dairy Innovation Australia Limited
Dharma Dharmabalan, Coliban Water
Vincent Pettigrove, Melbourne Water
Terry Turney, Asia Nanomaterials
Simon Wilson, Arris

ADJUNCT SENIOR RESEARCH FELLOWS
Simon Coutts, Grantus
Kevin Zhang, RMIT

ADJUNCT VISITING PROFESSORS
Andrew Groth, Siemens
Eric Peterson, University of Sunshine Coast
Grant Stanley, CQ University
POSTGRADUATE STUDENTS

DEGREES AWARDED

David King
Shishutosh Barua
Alice Taysom
Angela Hausmann
Anne Venables
Bernard Agana
Chi Lai
Danaka Nilantha Gamage
Darli Myat
Eddy Ostarcevic
Ian Faithful
Iwan Juwana
Jianhua Zhang
Ludovic Dumée
Marta Slawuta
Matthew Hatton
Nepi Marleni Ni
Nur Shams
Po Zhang
Prasad Imandar
Sachindra Dhanapala
Safaet Hossain
Senaviratna Abeykoon Mudiyanselage
Shahram Molavi
Stephanie Ashbolt
Suchana Barua
Sushil Kumar Das
Uchenna Kennedy Kesieme
Walter Godoy
Wieslaw Jan Zielinski
Zongli Xie
### Key Performance Indicators

<table>
<thead>
<tr>
<th>KPI</th>
<th>Target</th>
<th>Actual 2010</th>
<th>Actual 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Income</td>
<td>$1.5 million</td>
<td>$866,000</td>
<td>1.3 million</td>
</tr>
<tr>
<td>Journal Publications</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A*/A Journal Publications</td>
<td>11</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Conference publications</td>
<td>8</td>
<td>31</td>
<td>64</td>
</tr>
<tr>
<td>PhD students</td>
<td>10</td>
<td>29</td>
<td>20(1)</td>
</tr>
<tr>
<td>Consultancies</td>
<td>2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Training courses</td>
<td>1</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Projects in faculties</td>
<td>23</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

(1) number of completed PhD students
### INCOME

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>$355,413</td>
</tr>
<tr>
<td>Research Infrastructure Block Grants (RIGB)</td>
<td>$74,186</td>
</tr>
<tr>
<td>Priority Research Innovation Projects (PRIIP)</td>
<td>$750,000</td>
</tr>
<tr>
<td>Australian Research Council (ARC)</td>
<td>$217,947</td>
</tr>
<tr>
<td>Research Projects</td>
<td>$566,118</td>
</tr>
<tr>
<td>Consultancy</td>
<td>$79,027</td>
</tr>
<tr>
<td>Education/Workshops/Misc</td>
<td>$7,438</td>
</tr>
<tr>
<td><strong>Total income</strong></td>
<td><strong>$2,050,129</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 Carry Forward</td>
<td>$629,455</td>
</tr>
</tbody>
</table>

**Expenses**

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
<td>$1,507,266</td>
</tr>
<tr>
<td>Travel</td>
<td>$46,038</td>
</tr>
<tr>
<td>Operations</td>
<td>$1,189,779</td>
</tr>
<tr>
<td>Research Project Consumables</td>
<td>$75,631</td>
</tr>
<tr>
<td>Education/Workshops</td>
<td>$32,041</td>
</tr>
<tr>
<td>Consultancies</td>
<td>$65,948</td>
</tr>
</tbody>
</table>

**Total Expenses**

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2,916,703</td>
</tr>
</tbody>
</table>

**Operating Result**

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>$237,119</td>
</tr>
</tbody>
</table>
## Research Funding

<table>
<thead>
<tr>
<th>Project</th>
<th>Investigators</th>
<th>Industry Partners</th>
<th>Funds ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerated seeded precipitation for high recovery RO of wastewaters.</td>
<td>Peter Sanciolo, Stephen Gray (Victoria University), Greg Leslie (UNSW), Tony</td>
<td>Grampians Wimmera Mallee Water</td>
<td>180,000</td>
</tr>
<tr>
<td>“Crystallization to Enhance Two Stage Reverse Osmosis (RO) Recovery</td>
<td>Fane (UNSW), Yoram Cohen (UCI), Eddy Ostarcevic (Grampians Wimmera Mallee Water)</td>
<td>(Grampians Wimmera Mallee Water), Tony Palmer, Hiep Le (United Utilities Australia)</td>
<td></td>
</tr>
<tr>
<td>Alia Water - electrochemical treatment</td>
<td>Noel Dow, Stephen Gray (Victoria University)</td>
<td></td>
<td>3,900</td>
</tr>
<tr>
<td>Alternative Membrane Treatment Process to Produce Low Salt and High</td>
<td>Peter Sanciolo (Victoria University), Linda Zou (University of SA), Greg</td>
<td>Smart Water Fund</td>
<td>50,000</td>
</tr>
<tr>
<td>Nutrient Value Fit for Purpose Recycled Water</td>
<td>Leslie (UNSW), Ken Mann (City West Water)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>An investigation into the factors required to achieve total water</td>
<td>John Orbell (Victoria University), Darrell Reeve (Cleaner Production Australia)</td>
<td>Cadbury Schweppes, Toyota, City West Water (CVWW)</td>
<td>150,000</td>
</tr>
<tr>
<td>recycling at two major Australian industrial manufacturing sites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anammox Membrane Bioreactor for Treatment of High Ammonia Waste -</td>
<td>Warren Flentje, Mikel Duke, Todor Vasiljevic, Grant Stanley, Nicholas Milne</td>
<td>Central Highlands, Melbourne Water, Yarra Valley Water, City West Water, South</td>
<td>25,000</td>
</tr>
<tr>
<td>Feasibility study</td>
<td>(Victoria University), Cecile Dechamps (Victoria University), Eddy</td>
<td>East Water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ostarcevic (Integrated Elements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment of alternative to disposal of used RO membranes</td>
<td>Pierre Le-Clech (UNSW), Greg Leslie (UNSW), Mikel Duke, Marlene Cran,</td>
<td>National Centre of Excellence for Desalination (NCED)</td>
<td>137,700</td>
</tr>
<tr>
<td></td>
<td>Cecile Dechamps (Victoria University), Bradley Ladewig (Monash), Kai Uwe-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hoefflin (Dow Chemical), Amanda Hazell (Water Corporation), Stephen Rody (</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sydney Water), Con Pelekani (SA Water)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biodegradability analysis of polystyrene samples under test method</td>
<td>Marlene Cran, Stephen Gray (Victoria University)</td>
<td>Rema Industries and Services</td>
<td>4,000</td>
</tr>
<tr>
<td>Biosol</td>
<td>Warren Flentje, Lata Ramchandran, Stephen Gray, Mikel Duke, Grant Stanley,</td>
<td>Kellogg Brown and Root Pty Ltd</td>
<td>43,478</td>
</tr>
<tr>
<td></td>
<td>Sarah Fraser (Victoria University)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brine management guidelines</td>
<td>Stephen Gray, Peter Sanciolo (Victoria University), Eddy Ostarcevic (Integrated Elements), Paul Atherton (Grampians Wimmera Mallee Water)</td>
<td>Grampians Wimmera Mallee Water (GWMMWater), Environment Protection Authority (EPA), Smart Water Fund</td>
<td>140,000</td>
</tr>
<tr>
<td>Bryazon (tobacco weed) control in water distribution systems</td>
<td>John Orbell, Robin Mitra (Victoria University), Paul Atherton, Andrew Barton,</td>
<td>Grampians Wimmera Mallee Water (GWMMWater)</td>
<td>90,000</td>
</tr>
<tr>
<td></td>
<td>Steven Briggs, Darcy (Grampians Wimmera Mallee Water), Eddy Ostarcevic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Tamarama Estate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Emissions of small to medium size enterprises (SWE)</td>
<td>Barbara McLure (Victoria University)</td>
<td>Victorian Employers’ Chamber of Commerce and Industry (VECCI), Sustainability</td>
<td>7,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Victoria</td>
<td></td>
</tr>
</tbody>
</table>

### 2010 Annual Report
<table>
<thead>
<tr>
<th>PROJECT</th>
<th>INVESTIGATORS</th>
<th>INDUSTRY PARTNERS</th>
<th>FUNDS(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment level down casting of hydroclimatic variables from general circulation model outputs. Multi-objective optimisation of water supply systems: A shared vision - PhD project</td>
<td>Chris Perera, Funchan Huang (Victoria University), Andrew Barton (Grampians Wimmera Mallee Water)</td>
<td>Grampians Wimmera Mallee Water [GWMWater]</td>
<td>7,222</td>
</tr>
<tr>
<td>Chemically tolerant advanced ceramic membranes for reduced cost water treatment</td>
<td>Mikel Duke, Stephen Gray (Victoria University), Gayle Morris [University of SA], Kenichi Nishizu [CI Ceramics (Aust) Pty Ltd], Domun Choi [Chosun Refractory Co Ltd], Il-Shik Moon (Sunchon National University)</td>
<td>Australia Research Council [ARC] linkage with CI Ceramics (Sydney), Chosun Refractory Company</td>
<td>405,000</td>
</tr>
<tr>
<td>Cleaner Production and Resource Recovery: Encouraging Best Practice and Innovation</td>
<td>Nicholas Milne [Victoria University]</td>
<td>Smart Water Fund</td>
<td>180,000</td>
</tr>
<tr>
<td>Continued Development of REALM water supply planning software tool</td>
<td>Chris Perera (Victoria University)</td>
<td>Department of Sustainability and Environment</td>
<td>20,000</td>
</tr>
<tr>
<td>Converting waste or solar heat to treated water (Membrane Distillation)</td>
<td>Noel Dow, Mikel Duke, Stephen Gray, Jun-De Li (Victoria University), Eddy Ostarcevic (Integrated Elements), Paul Atherton (Grampians Wimmera Mallee Water), Rohan Barron (City West Water)</td>
<td>Smart Water, Water Quality Research Australia [WQRA]</td>
<td>$50,000</td>
</tr>
<tr>
<td>CSIRO Cluster Project</td>
<td>Stephen Gray, Jun-De Li, Mikel Duke (Victoria University)</td>
<td>CSIRO</td>
<td>132,827</td>
</tr>
<tr>
<td>Data enhancement, integration and access services for smarter, collaborative and adaptive whole of water cycle management</td>
<td>Yanchun Zhang (Victoria University)</td>
<td>Australia Research Council [ARC], SE Queensland Healthy Waterways Partnerships</td>
<td>0</td>
</tr>
<tr>
<td>Decision Support System for Management of Urban Stormwater Drainage Network</td>
<td>Chris Perera (Victoria University)</td>
<td>VU PhD project</td>
<td>0</td>
</tr>
<tr>
<td>Designing the surface and structural properties of MFI zeolite membranes for low energy ion-selective desalination</td>
<td>Mikel Duke, Bo Zhu (Victoria University), Anita Hill (CSIRO)</td>
<td>Australia Research Council [ARC]</td>
<td>285,000</td>
</tr>
<tr>
<td>Developing a water sustainability index for West Java, Indonesia</td>
<td>Chris Perera, Nitin Mutill (Victoria University)</td>
<td>VU PhD project</td>
<td>0</td>
</tr>
<tr>
<td>Development of a Forecasting Scheme for Reservoir Inflows</td>
<td>Dung Tran, Chris Perera, Anne Ng (Victoria University)</td>
<td>VU Post Doctoral Project</td>
<td>0</td>
</tr>
<tr>
<td>Development of cleaning guidelines for desalination membrane users</td>
<td>Marlene Cran (Victoria University), Eddy Ostarcevic (Integrated Elements), Stephen Gray (Victoria University), Dr Andrew Head [Nalco], Veolia Water, Orica, Chemnet, BASF, Degremont</td>
<td>National Centre of Excellence for Desalination (NCED)</td>
<td>70,700</td>
</tr>
<tr>
<td>PROJECT</td>
<td>INVESTIGATORS</td>
<td>INDUSTRY PARTNERS</td>
<td>FUNDS($)</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Development of multifunctional TiO2-based composite membranes for water treatment</td>
<td>Bo Zhu, Mikel Duke (Victoria University)</td>
<td>VU Research Development Grant Scheme</td>
<td>28,175</td>
</tr>
<tr>
<td>Ecology of waterfowl on wastewater treatment lagoons</td>
<td>Patrick-Jean Guay, Megan O’Shea (Victoria University)</td>
<td>Waterways, Melbourne Water</td>
<td>38,311</td>
</tr>
<tr>
<td>Effect of climate change on storm intensity, frequency and duration</td>
<td>Chris Perera, Fuchan Huang (Victoria University)</td>
<td>VU PhD project</td>
<td>0</td>
</tr>
<tr>
<td>Environmental Sustainability Program</td>
<td>Stephen Gray, Barbara McLure (Victoria University)</td>
<td>Department of Innovation, Industry and Regional Development (DIIRD)</td>
<td>15,000</td>
</tr>
<tr>
<td>Endeavour Executive Award to visit laboratory of Advanced Materials, China</td>
<td>Mikel Duke, Bo Zhu (Victoria University)</td>
<td>Dongyuan Zhao (Fudan University)</td>
<td>12,250</td>
</tr>
<tr>
<td>Evaluation of potential stormwater harvesting opportunities and sites in an urban development</td>
<td>Chris Perera (Victoria University), Ashok Sharma (CSIRO)</td>
<td>CSIRO Water for a Healthy Country</td>
<td>0</td>
</tr>
<tr>
<td>Funding to work as visiting scientist with Prof Dongyuan Zhao, China</td>
<td>Bo Zhu (Victoria University)</td>
<td>Ian Potter Foundation</td>
<td>750</td>
</tr>
<tr>
<td>Guidelines for industrial use of recycled water</td>
<td>Nicholas Milne (Victoria University), Kevin Zhang (RMIT), Stephen Gray (Victoria University)</td>
<td>Clare Diaper, Grace Tjandraatmadja, Russell Taylor (CSIRO) and Darrell Reeve (Cleaner Production Australia)</td>
<td>283,400</td>
</tr>
<tr>
<td>Host 3rd International Symposium on Inorganic Membranes</td>
<td>Mikel Duke, Bo Zhu and Nicholas Milne (Victoria University)</td>
<td>Ian Potter Foundation</td>
<td>7,000</td>
</tr>
<tr>
<td>Humidification/dehumidification desalination technology</td>
<td>Junde Li (Victoria University)</td>
<td>CSIRO</td>
<td>0</td>
</tr>
<tr>
<td>Hybrid Membrane Materials</td>
<td>Stephen Gray (Victoria University)</td>
<td>CSIRO</td>
<td>0</td>
</tr>
<tr>
<td>Hybridisation between Mallards and Black Ducks</td>
<td>Patrick-Jean Guay (Victoria University)</td>
<td>Victoria University of Wellington</td>
<td>3,900</td>
</tr>
<tr>
<td>Impact of decentralised servicing options on sewer networks</td>
<td>Nitin Muttil, Stephen Gray, Ashok Sharma (Victoria University)</td>
<td>CSIRO Water for a Healthy Country</td>
<td>81,000</td>
</tr>
<tr>
<td>Improving cheese starter culture processes using novel membrane systems</td>
<td>Lata Ramchandran, Mikel Duke, Peter Sanciolo, Todor Vasiljevic (Victoria University)</td>
<td>Dairy Innovation Australia</td>
<td>96,434</td>
</tr>
<tr>
<td>Improving the durability and performance of hollow fibre membranes with nanocomposite and inorganic/organic hybrid materials.</td>
<td>Jessica Lai, Mikel Duke/Stephen Gray (Victoria University), Dr A Groth (Siemens Water Technology)</td>
<td>Australian Research Council (ARC), Siemens Memcor</td>
<td>155,007</td>
</tr>
<tr>
<td>PROJECT</td>
<td>INVESTIGATORS</td>
<td>INDUSTRY PARTNERS</td>
<td>FUNDS(S)</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Innovative zero-energy membrane technologies to reduce water consumption in the dairy industry</td>
<td>Angela Hausmann, Mikel Duke, Peter Sanciolo, Todor Vasiljevic (Victoria University)</td>
<td>Australian Research Council (ARC)</td>
<td>78,420</td>
</tr>
<tr>
<td>Investigate rapid detection methods for blue-green algae from Grampians Wimmera Mallee Water (GWMMWater)</td>
<td>Mary Millikan, Stephen Gray (Victoria University), Barbara Bowles (Grampians Wimmera Mallee Water)</td>
<td>Grampians Wimmera Mallee Water (GWMMWater)</td>
<td>80,000</td>
</tr>
<tr>
<td>Investigate recycling of water and foam from training operations</td>
<td>Stephen Gray, Marlene Cran, Matthew Stewart (Victoria University)</td>
<td>Tricomms</td>
<td>26,300</td>
</tr>
<tr>
<td>Investigating hybridisation between Pacific Black Ducks and Mallards in Victoria</td>
<td>Alice Taysom (PhD student), Patrick-Jean Guay (Victoria University)</td>
<td>Birds Australia</td>
<td>1,500</td>
</tr>
<tr>
<td>Investigations of techniques for maximising the utilisation of harvested rain water using a digital ecosystem</td>
<td>Nalin Sharda, Chris Perera (Victoria University)</td>
<td>Water Quality Research Australia (WQRA), W. Bliss, Wobelea Pty Ltd</td>
<td>15,000</td>
</tr>
<tr>
<td>Lowering membrane fouling by matching pre-treatment to membrane type</td>
<td>Stephen Gray, John Orbell (Victoria University)</td>
<td>Australian Research Council (ARC), ORICA</td>
<td>164,669</td>
</tr>
<tr>
<td>Managing disturbance to waterbirds at the western treatment complex: understanding the basic patterns* $30,000 for 1st year with a possibility of $22,000 per year for a further 2 years from Melbourne Water.</td>
<td>Patrick-Jean Guay (Victoria University)</td>
<td>Melbourne Water</td>
<td>30,000</td>
</tr>
<tr>
<td>Membrane Autopsy</td>
<td>Marlene Cran (Victoria University)</td>
<td>Actiflux Pty Ltd</td>
<td>2,500</td>
</tr>
<tr>
<td>Membrane degradation</td>
<td>Marlene Cran, Stephen Gray (Victoria University)</td>
<td>Water Quality Research Australia (WQRA), Coliban Water, Water Corporation, Professor Benny Freeman, Uni of Texas-Austen</td>
<td>0</td>
</tr>
<tr>
<td>Membrane Integrity</td>
<td>Stephen Gray, Marlene Cran</td>
<td>Central Highlands Water</td>
<td>0</td>
</tr>
<tr>
<td>Membrane integrity</td>
<td>Marlene Cran, Eddy Ostarcevic (Victoria University), Paul Atherton (Grampians Wimmera Mallee Water), Dharmaraj Dharmabalan (Coliban Water)</td>
<td>Water Quality Research Australia (WQRA), Grampians Wimmera Mallee Water (GWMMWater)</td>
<td>140,000</td>
</tr>
<tr>
<td>Membrane integrity test for Dow</td>
<td>Marlene Cran (Victoria University)</td>
<td>Dow Filmtec</td>
<td>15,000</td>
</tr>
<tr>
<td>National conference on the ecology and management of the Gippsland Lakes</td>
<td>Paul Boon (Victoria University)</td>
<td>Department of Sustainability and Environment (DSE), Parks Victoria, CMAAs, Coast Board etc</td>
<td>60,000</td>
</tr>
<tr>
<td>New Membrane Materials</td>
<td>Stephen Gray, Mikel Duke (Victoria University)</td>
<td>CSIRO Textiles and Fibre Technology</td>
<td>0</td>
</tr>
<tr>
<td>PROJECT</td>
<td>INVESTIGATORS</td>
<td>INDUSTRY PARTNERS</td>
<td>FUNDS ($)</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>----------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Novel separation processes in the mining industry</td>
<td>Uchenna Kesieme, Mikel Duke, Nicholas Milne</td>
<td>CSIRO</td>
<td>78,000</td>
</tr>
<tr>
<td>Penguin Foundation</td>
<td>John Orbell (Victoria University)</td>
<td>Penguin Foundation</td>
<td>20,000</td>
</tr>
<tr>
<td>Practical viability and health issues of concentrating brine to solids sourced from inland groundwater desalination</td>
<td>Rhett Richardson (Summer Scholarship student), Mikel Duke, Peter Sanciolo (Victoria University), Paul Atherton (GWMWWater), Hal Aral (CSIRO)</td>
<td>Water Quality Research Australia (VWQRA)</td>
<td>5,000</td>
</tr>
<tr>
<td>Proactive Management System for Sewerage Assets</td>
<td>Dung Tran, Chris Perera, Anne Ng</td>
<td>VU Research project</td>
<td>0</td>
</tr>
<tr>
<td>Public perception of, and response to, desalination in Australia</td>
<td>John Cary (Victoria University), Tanya King (Deakin), Renato Schibeci (Murdoch), Kristina Murphy (Alfred Deakin Institute, Deakin), Kevin O'Toole (Deakin), Adrian Fisher, Daniel Ooi (Victoria University), Geoff Syme (Edith Cowan)</td>
<td>National Centre of Excellence for Desalination (NCED)</td>
<td>170,000</td>
</tr>
<tr>
<td>Quantification of non point source pollution in Yarra River Catchment</td>
<td>Anne Ng, Chris Perera, Nitin Muttil</td>
<td>VU PhD project</td>
<td>0</td>
</tr>
<tr>
<td>Real-time and Self-Adaptive Stream Data Analyser for Intensive Care Management</td>
<td>Yanchun Zhang, Xun Yi, Jing He, Chaoyi Pang, Michael Steyn (Victoria University)</td>
<td>ARC Linkage project (LP100200682)</td>
<td>345,000</td>
</tr>
<tr>
<td>Recycling of hydroponic wastewater</td>
<td>Peter Sanciolo (Victoria University), April Chan</td>
<td>Water Quality Research Australia (VWQRA) Summer Scholarship</td>
<td>5,000</td>
</tr>
<tr>
<td>Recycling of fire fighting water</td>
<td>Lata Ramchandran, Mikel Duke, Stephen Gray, Bo Zhu, Yaoxin Hu (Victoria University)</td>
<td>ARUP</td>
<td>35,000</td>
</tr>
<tr>
<td>Robust ceramic membranes for waste water treatment and demonstration of novel ozone cleaning</td>
<td>Stephen Kennedy (Summer scholarship student), Bo Zhu, Mikel Duke (Victoria University), Judy Blackbeard (Melbourne Water)</td>
<td>Water Quality Research Australia (VWQRA) Summer Scholarship</td>
<td>5,000</td>
</tr>
<tr>
<td>Satellite Tracking of Pink-eared ducks dispersing from the Western Treatment Plant, Werribee</td>
<td>Patrick-Jean Guay, Megan O’Shea (Victoria University)</td>
<td>VU Researcher Development Grant</td>
<td>29,196</td>
</tr>
<tr>
<td>Septic Tank Model for Yarra River Management</td>
<td>Anne Ng, Shobha Muthukumarar (Victoria University)</td>
<td>VU PhD project</td>
<td>0</td>
</tr>
<tr>
<td>Site trial of membrane distillation</td>
<td>Jianhua Zhang, Mikel Duke (Victoria University), Eddy Ostarevic (Integrated Elements), Stephen Gray (Victoria University)</td>
<td>Billfinger Burger</td>
<td>20,000</td>
</tr>
<tr>
<td>Short-term Nonresidential Water Demand Modelling</td>
<td>Anne Ng, Shobha Muthukumarar (Victoria University)</td>
<td>VU PhD project</td>
<td>0</td>
</tr>
<tr>
<td>Statistical analysis to detect climate change implications on water resources.</td>
<td>Nitin Muttil, Chris Perera (Victoria University)</td>
<td>VU PhD project</td>
<td>0</td>
</tr>
<tr>
<td>PROJECT</td>
<td>INVESTIGATORS</td>
<td>INDUSTRY PARTNERS</td>
<td>FUNDS ($)</td>
</tr>
<tr>
<td>---------</td>
<td>---------------</td>
<td>------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Streamflow Reconstruction of Yarra River to Assess extreme drought conditions</td>
<td>Anne Ng, Nitin Muttil (Victoria University)</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Sustainable Water Options for Sportsfields</td>
<td>Nicholas Milne, Sally Weller (Victoria University), John Tower, Kevin Zhang (RMIT), Stephen Gray (Victoria University)</td>
<td>Smart Water Fund</td>
<td>160,000</td>
</tr>
<tr>
<td>Use of remote sensing data for generation of stream flow time series in data-poor regions</td>
<td>Chris Perera (Victoria University)</td>
<td>International Water Management Institute</td>
<td>0</td>
</tr>
<tr>
<td>Victorian Statewide River Health Social Condition Benchmarking</td>
<td>John Cary (Victoria University), Anne Pisarski (Queensland University of Technology)</td>
<td>Queensland University of Technology, in collaboration with Department of Sustainability and Environment (DSE)</td>
<td>12,500</td>
</tr>
<tr>
<td>Water Conservation by Replacing Cooling Towers</td>
<td>Jun-De Li, Josef Rojter, Graham Thorpe, Stephen Bigger, Stephen Gray, Marlene Cran (Victoria University)</td>
<td>Smart Water Fund</td>
<td>103,028</td>
</tr>
<tr>
<td>Water Grid Issues - PhD Project</td>
<td>Chris Perera (Victoria University)</td>
<td>CSIRO</td>
<td>0</td>
</tr>
<tr>
<td>Zero Liquid Discharge review</td>
<td>Tom O’Rielly (Summer scholarship student), Mikel Duke, Nicholas Milne (Victoria University), Paul Atherton (GWMWater)</td>
<td>Grampians Wimmera Mallee Water (GWMWater)</td>
<td>0</td>
</tr>
</tbody>
</table>
PUBLIC PERCEPTIONS AND RESPONSE TO DESALINATION IN AUSTRALIA (WITH DEAKIN UNIVERSITY AND MURDOCH UNIVERSITY)

Project Description:
The project has three components: consumer perceptions of water quality changes and desalination; water professionals’ responses to feedback from the community regarding desalination plants; and social justice elements in the placement and operation of desalination plants. The project will also help develop an understanding for consumers’ perceptions of water quality and the impact of desalinated supply and changes in water sources and cost on consumer perception and behaviour.

Research Sponsors:
National Centre for Excellence in Desalination (NCED)

Chief Investigators:
John Cary, Adrian Fisher (Victoria University)
Investigator: Daniel Ooi (Victoria University)

DEVELOPMENT OF CLEANING GUIDELINES FOR DESALINATION MEMBRANE USERS

Project Description:
This project will assess current practices and literature for cleaning desalination membranes and compile a set of guidelines for users to optimise the operational performance of their membranes.

Research Sponsors:
National Centre of Excellence for Desalination (NCED), Nalco and Integrated Elements

Chief Investigators:
Marlene Cran (Victoria University), Andrew Head (Nalco), Eddy Ostarcevic (Integrated Elements)

MEMBRANE INTEGRITY

Project Description:
Screening of potential chemical indicators of membrane integrity is continuing with the completion of the first milestone report for Water Quality Research Australia (WQRA). A range of food and fluorescent dyes have been screened and their suitability as surrogates evaluated. Currently, fluorescent microspheres are undergoing screening and testing on flat sheet membrane apparatus. A pilot scale RO unit is being prepared and the surrogates will be tested in this rig. Fluorescence detectors from Sydney University are also being sourced.

Research Sponsors:
Water Quality Research Australia (WQRA)

Chief Investigators:
Marlene Cran, Stephen Gray, (Victoria University), Eddy Ostarcevic (Integrated Elements)

FOULING OF MEMBRANE DISTILLATION MEMBRANES IN INLAND DESALINATION

Project Description:
This project is focused on membrane fouling and cleaning for the membrane distillation processes in its most significant potential application: inland desalination. The project is in part of a project funded by the National Centre of Excellence in Desalination Australia (NCEDA) in partnership with the CSIRO, Grampians Wimmera Mallee Water (GWMWater), Osmollo and Siemens Water Technologies. The project commenced late in 2010.

Research Sponsors:
National Centre of Excellence for Desalination in partnership with the CSIRO, Grampians Wimmera Mallee Water (GWMWater), Osmollo and Siemens Water Technologies

Chief Investigators:
Po Zhang (PhD student), Mikel Duke, Stephen Gray (Victoria University)
ASSESSMENT OF ALTERNATIVES TO DISPOSAL OF USED RO MEMBRANES

Project Description:
This project in partnership with Dow FilmTec is exploring alternatives to disposal of RO membranes. This addresses a growing concern in the uptake of massive scale desalination systems in Australia. The project supported an intern visiting from Poitiers in France, Cécile Prince. Cécile’s part has been presented to OzWater 2011 and a paper was published in the proceedings. This work is now completed, but has continued into a project funded by the National Centre of Excellence for Desalination lead by University of New South Wales. This project is lead by Dr Pierre Le-Clech, University of New South Wales.

Research Sponsors:
National Centre of Excellence for Desalination (NCED)

Chief Investigators:
Pierre Le-Clech (UNSW), Greg Leslie (UNSW), Mikel Duke, Marlene Cran (Victoria University), Bradley Ladewig (Monash), Kai Uwe-Hoehn (Dow Chemical), Amanda Hazell (Water Corporation), Stephen Roddy (Sydney Water), Con Pelekani (SA Water)

DEVELOPMENT OF MULTIFUNCTIONAL TiO2-BASED COMPOSITE MEMBRANES FOR WATER TREATMENT

Project Description:
This project is aiming to develop advanced titania membranes with the multifunctional capability (such as decomposition of organic pollutants and physical separation of contaminants) and enhanced performance for water treatment. These membranes can benefit water treatment and reduce costs due to their chemical tolerance allowing for minimal pre-treatment and cleaning routines compared to their polymer counterparts, which have a problem of an increase in the operational cost due to membrane fouling. This project will demonstrate titania coated membranes to treat significant industry waters and novel cleaning techniques. Through this project, we aim to build strong links to the State Key Laboratory of Materials-Oriented Chemical Engineering, Nanjing University of Technology, China. Ms Yaoxin Hu from the State Key Laboratory of Materials-Oriented Chemical Engineering, Nanjing University of Technology, China is currently working on this project. The work so far has led to 2 journal papers “Dual function filtration and catalytic breakdown of organic pollutants in waste water using ozonation with titania and alumina membranes”, accepted by the Journal of Membrane Science, doi:10.1016/j.memsci.2010.11.045; “Combined TiO2 membrane filtration and ozonation for efficient water treatment to enhance the reuse of wastewater”, accepted by Desalination and Water Treatment. The results have also been presented at the NAMS-ICIM 2010 Conference held in Washington DC, USA in July 2010, and the AMS6-MSTEC10 Conference in Sydney in November 2010.

Research Sponsors:
VU Research Development Grant Scheme

Chief Investigators:
Bo Zhu, Mikel Duke (Victoria University), Yaoxin Hu (Nanjing University of Technology, China)
IMPROVING THE DURABILITY AND PERFORMANCE OF HOLLOW FIBRE MEMBRANES WITH NANOCOMPOSITE AND INORGANIC/ORGANIC HYBRID MATERIALS

Project Description:
Nano composite materials will be developed in partnership with Australia’s largest membrane manufacturer, Siemens Water Technologies, to produce more robust polymeric membranes. The material will feature advanced nanoparticles to offer enhanced material and membrane performance characteristics. This PhD project is funded by Siemens Water Technologies and the Australian Research Council (ARC).

Research Sponsors:
Australian Research Council (ARC), Siemens (Memcor)

Chief Investigators:
Jessica Lai (PhD student), Mikel Duke, Stephen Gray, (Victoria University), Andrew Groth (Siemens Water Technologies)

NOVEL SEPARATION PROCESSES IN THE MINING INDUSTRY

Project Description:
The mining industry has opportunities for improved efficiency for its sustainable operations in the adoption of novel separation systems including membrane distillation. In this project, membrane distillation will be explored as a potential means to recover acid and compared to other separation techniques. This project is sponsored and in partnership with the CSIRO Minerals Division.

Research Sponsors:
CSIRO

Chief Investigators:
Uchenna Kennedy Kesieime (PhD student), Mikel Duke, Nicholas Milne (Victoria University), Hal Aral (CSIRO Minerals)

BRINE MANAGEMENT GUIDELINES

Project Description:
Develop guidelines for management of brine concentrates in partnership with Grampians Wimmera Mallee Water (GWMWWater), Environment Protection Authority (EPA) and Smart Water Fund. The guidelines will become an industry reference for management of brines. Partial funding was received from the Smart Water Fund and additional funds will need to be sourced before the project commences. Funds will be requested from the Australian Water Research Centre of Excellence (AWRCoE) and National Centre of Excellence in Desalination Australia (NCEDA).

Chief Investigators:
Stephen Gray, Peter Sanciolo (Victoria University)

VICTORIAN STATEWIDE RIVER HEALTH SOCIAL CONDITION BENCHMARKING PROJECT (IN CONJUNCTION WITH SCHOOL OF MANAGEMENT, QUEENSLAND UNIVERSITY OF TECHNOLOGY)

Project Description:
Final report submitted and accepted by Department of Sustainability and Environment, Victoria.

Research Sponsors:
Queensland University of Technology

Chief Investigators:
John Cary (Victoria University), Anne Pisarski (Queensland University of Technology)
CONVERTING WASTE OR SOLAR HEAT TO TREAT WATER

Project Description:
Membrane distillation (MD) will be demonstrated to treat industry water using waste heat in order to produce treated water with minimal electricity requirement. In partnership with City West Water, Grampians Wimmera Mallee Water (GWMWater), the Victorian Smart Water Fund and WQRA, the project seeks to examine the viability of MD in an industrial setting by designing a MD pilot plant to operate, unattended, producing 10 to 20 L/hr of desalinated water continuously over a 3 month period. The measure of the project’s success will be the collection of verifiable data that demonstrates the effectiveness of the treatment technology to recover potable water without an increase in greenhouse gas emissions.

The project has completed the initial phase where the factors affecting successful demonstration of the technology and an examination of potential industrial sites were carried out. Six organisations in Melbourne’s west were surveyed for participation in the project which comprised of site visits and laboratory assessment of effluent waters. The results of this survey indicated the presence of industrial operations with suitable effluent quality together with sufficient waste heat to drive the MD process, and enabled a choice of site to host the demonstration phase of the project. Concurrent with the site selection process, the pilot plant was designed and constructed to treat wastewater with minimal operator interaction. Incorporated into the plant is a new multilayer membrane module (designed by the project team) that initial testing has shown significant improvements over previous module designs.

The pilot plant will be relocated to the site chosen to host the demonstration in May 2011. VU personnel will then visit the plant once or twice per week to collect recorded data and perform any maintenance needed. At the conclusion of the trial phase, critical cost and energy values will be measured against other technologies such as reverse osmosis and an assessment of resource consumption and greenhouse gas emissions from a full scale operation will be made. Potential unique benefits for niche use will also be identified for further consideration as a commercially developed system. Hence, the report will explore and discuss the next steps in scale-up along the technology’s development pathway.

Research Sponsors:
Smart Water and Water Quality Research Australia (WQRA)

Chief Investigators:
Noel Dow, Mikel Duke, Stephen Gray, Jun-De Li (Victoria University), Eddy Ostarcevic (Integrated Elements), Paul Atherton (Grampians Wimmera Mallee Water) and Audra Luibinas (City West Water)

Hybridisation between Mallards and Black Ducks

Hybridisation with Mallards has decimated the Black Duck population in New Zealand. Using DNA sequencing techniques, we will assess if the problem arose from Mallards introduced from Europe or North America.

Research Sponsors:
Victoria University of Wellington

Chief Investigators:
Patrick-Jean Guay (Victoria University)
SATellite tracking of Pink-eared Ducks dispersing from the Western Treatment Plant, Werribee

Project Description:
Pink-eared Ducks are highly dispersive and can breed wherever water is available. Using satellite tracking, we will monitor dispersal of duck from the Western Treatment Plant in Werribee to determine whether the site is a locally, regionally or nationally important drought refuge for Pink-eared Ducks.

Research Sponsors:
VU Researcher Development Grant; Melbourne Water Corporation

Chief Investigators:
Patrick-Jean Guay, Megan O’Shea (Victoria University)

Lowering Membrane Fouling by Matching Pre-Treatment to Membrane Type

Project Description:
Commissioning of a single fibre, constant flux, hollow fibre membrane fouling rig was completed after many reliability issues were identified and preliminary results were obtained. Molecular dynamics modelling results of the fouling process will be compared to experimental outcomes and two conference papers were presented.

Research Sponsors:
Australian Research Council, ORICA

Chief Investigators:
Stephen Gray, John Orbell (Victoria University)

Designing the Surface and Structural Properties of MFI Zeolite Membranes for Low Energy Ion-Selective Desalination

Project Description:
This project aims to uncover fundamental properties of zeolites to design performance targeted desalination membranes. Recent progress in this project includes research on the ion uptake capacity of the zeolites used to make membranes followed by powder diffraction analysis of the samples at the Australian Synchrotron.

Research Sponsors:
Australian Research Council

Chief Investigators:
Mikel Duke, Bo Zhu (Victoria University), Linda Zou (University of South Australia), Anita Hill (CSIRO), Jerry Lin (Arizona State University)

New Membrane Materials

Project Description:
The PhD student, Ludovic Dumée, completed his experimental work on carbon nanotube bucky-paper membranes for membrane distillation. He wrote several journal and conference papers, receiving an award at the IMSTEC conference for the best student presentation. Ludovic commenced drafting his thesis for submission after 3 years of study.

Research Sponsors:
CSIRO Textiles and Fibre Technology

Chief Investigators:
Ludovic Dumée (PhD student), Stephen Gray, Mikel Duke (Victoria University)
BRYOZAN (TOBACCO WEED) CONTROL IN WATER DISTRIBUTION SYSTEMS

Project Description:

Ongoing drought conditions across Australia, exacerbated by climate change, call for a range of urgent and long-term infrastructure initiatives. In this regard, the development and construction of water pipelines are an important part of a strategy to ensure a sufficient supply of this essential resource to all sectors of the Australian population. The Wimmera Mallee Pipeline (WMP) project in Victoria is Australia’s biggest water infrastructure project and is a logical adjunct to the existing Northern Mallee Pipeline (NMP). An important consideration, for Victorian rural supplies in particular, is the problem of biological contamination and infestation. One such problem organism is known as “tobacco weed” or “pipe moss” – more correctly referred to as Bryozoan infestation. This program involves the establishment of a “research platform”, based at Victoria University, to enable an ongoing scientific investigation into this problem – and is intended to provide a resource for those affected by this problem, both in Australia and internationally. The project involves a determination of the nature and extent (distribution) of the problem in the existing NMP in consultation with Grampians Wimmera Mallee Water (GWMWater) operators, the setting up of research facilities at Victoria University and an assessment of what might be encountered with respect to Plumatella infestation for the WMP. The project commenced in October 2008 with the appointment of Research Fellow Dr. Robin Mitra. Since then, five major field trips have successfully scoped the problem and have also involved extensive sampling at different sites. This has enabled ten Bryozoan species that infest the NMP to be definitively identified – a number of these have not been observed in Australia before. These are currently being cultivated in customized facilities that include a field laboratory at Ouyen and dedicated facilities at the St. Albans campus. This will enable control and eradication measures to be scientifically investigated and optimized. Such control and eradication measures are currently being investigated and include the possible replacement of “super chlorination” of sections of pipeline by dosing with low levels of silver nanoparticles. The overall objective of this three year project is to devise a long term plan for the reduction or eradication of Bryozoan infestation in both the NMP and the WMP systems. This will have implications for pipeline systems across Australia and Worldwide. The funding for this project is provided by GWMWater: 1st year ~$110,000, 2nd year ~$120,000, 3rd year ~$115,000. Funding for the third year, to continue the appointment of Dr. Robin Mitra as a Research Fellow and to provide for materials and consumables, has recently been approved by GWMWater. Personnel and collaborators on this project include: Prof. John Orbell (SES/ISI); Dr. Robin Mitra (SES/ISI) - Postdoctoral Research Fellow; Mr. Paul Atherton (GWM Water); Dr. Andrew Barton (GWM Water); Mr. Steven Briggs (GWM Water), Mr. Eddy Ostarcevic (Tamarama Estate) and CC Technologies.

Research Sponsors:

Grampians Wimmera Mallee Water (GWM Water)

Chief Investigators:

John Orbell, Robin Mitra (Victoria University)
AN INVESTIGATION INTO THE FACTORS REQUIRED TO ACHIEVE TOTAL WATER RECYCLING AT TWO MAJOR AUSTRALIAN INDUSTRIAL MANUFACTURING SITES

Project Description:
Due to increasing water scarcity and costs, manufacturing industries around the world are moving towards the recycling of their process wastewater. However, the rate at which wastewater is recycled and reused in most manufacturing industries is quite low compared to the rate at which they consume fresh water. Worldwide, the recycling rate for industry (recycled water as a percentage of total intake) averages ~43%. Some countries perform better than others in this regard, with Japan achieving in excess of 70% for some major industries. There is enormous scope for achieving substantially higher rates and, with increases in the efficiency of water usage and with the introduction of advanced water treatment technologies, the goal of total water recycling is a very real possibility. This joint School of Engineering & Science (SES)/Institute for Sustainability & Innovation (ISI) project, in collaboration with City West Water (CWW), aims to produce an integrated approach towards achieving total water recycling at two major industrial manufacturing sites; namely, Toyota Australia and Schweppes Australia; both located within the vicinity of Victoria University. Achieving this goal will be pursued through advanced water auditing, optimization of water use through computer modelling and the introduction and viability testing of advanced technologies. The project commenced in March 2008 and detailed water audits on the Toyota and Schweppes sites have been completed. These provide input information for “water pinch analysis” – a water optimization method utilizing the Watertarget software package. Water pinch analysis has been completed for both companies. The outcomes of these analyses suggest possible strategies for increasing process efficiency. These analyses are also guiding the selection, acquisition and trialling of new water recycling technologies. This is currently being addressed and has involved the construction and implementation of a membrane testing rig at the Werribee campus. The testing of a range of membranes against the various waste streams is nearing completion with significant outcomes and recommendations emerging. Significant benefits to these two Australian-based companies are anticipated - such as a reduction in operating costs, adaptability to new environmental restrictions and less dependence on freshwater retailers. The extent to which total water recycling can be achieved will inform future work and these outcomes will be entirely transferable to other industries. The funding for this project involves: An AusAID - ALA (Australian Leadership Award) Scholarship for a three year PhD program (stipend + $6,000 study enrichment allowance); Toyota Australia, $60,000; Cadbury Schweppes Australia, $30,000; City West Water (CWW), $30,000, plus in-kind support from Victoria University. The personnel and collaborators include: Mr Bernard Agana (SES/ISI) AusAID ALA PhD candidate; Prof. John Orbell (SES/ISI); Prof. Darrell Reeve (ISI/Cleaner Production, Australia); Ms. Geraldine McKenzie-McHarg, Toyota Australia; Mr. Graeme Kentish, Cadbury Schweppes, Australia; Ms. Randa Kondos, CWW; Ms. Audra Liubinas, CWW.

Research Sponsors:
Cadbury Schweppes, Toyota, City West Water, AusAID

Chief Investigators:
John Orbell (Victoria University), Darrell Reeve (Cleaner Production Australia)
CSIRO CLUSTER PROJECT

Project Description:
PhD student Jianhua Zhang completed his experimental and theoretical work modelling membrane distillation processes, and wrote 3 journal papers and several conference papers in 2010. Jianhua developed a model of the membrane distillation process for use integrating membrane distillation into recycled water and waste heat networks, and for module design. He also drafted several versions of his thesis for submission in early 2011.

Research Sponsors:
CSIRO

Chief Investigators:
Stephen Gray, Jun-De Li (Victoria University)

HYBRID MEMBRANE MATERIALS

Project Description:
PVA – silica composite materials have been fabricated and tested for stability and will now be characterised for their salt solubility and water permeability. Pervaporation tests have demonstrated higher flux values and high salt rejection compared to similar membranes. Further characterisation of PVA membranes is to be undertaken and Zongli Xie is aiming to submit her thesis by September 2011.

Research Sponsors:
CSIRO

Chief Investigators:
Zongli Xie (PhD student), Stephen Gray (Victoria University)

MEMBRANE DEGRADATION

Project Description:
Work is continuing on the degradation and wear of membranes and other materials including rubber and polypropylene. Most experiments have been completed with data analysis underway and preparation of manuscripts for publication. Two papers are currently in press in Desalination (special issue) and Polymer Degradation and Stability.

Chief Investigators:
Marlene Cran, Stephen Gray, Stephen Bigger (Victoria University), Eddy Ostarcevic (Integrated Elements)

DECISION SUPPORT SYSTEM (DSS) FOR MANAGEMENT OF URBAN STORMWATER DRAINAGE NETWORK

Project Description:
Most urban drainage infrastructure in Australia was built during the period from 1940 to 1970. They have been designed to carry runoff from catchments with low density residential or commercial areas, prevailing at the time. With rapid development and urbanisation during the last 5 decades, the catchment characteristics have changed drastically, especially the increase in impervious areas which has resulted in increased runoff from the catchments. In addition, the pipes have deteriorated both structurally and hydraulically. One major issue facing local government councils today is how to identify the upgrade needs of the network to meet the current service levels expected by the residents and to prioritise them to match the limited funds available. This research project aims to develop a DSS for the management of urban stormwater drainage networks incorporating infrastructure maintenance, rehabilitation and upgrade needs as identified by stormwater pipe deterioration models, hydrological and hydraulic models, economic factors, social and legal aspects, and the effect of urbanisation. The work is conducted by Sena Abeykoon as a PhD project.

Research Sponsors:
VU PhD project

Chief Investigators:
Sena Abeykoon (PhD student), Chris Perera (Victoria University)
CONTINUED DEVELOPMENT OF REALM WATER SUPPLY PLANNING SOFTWARE TOOL – A COLLABORATIVE PROJECT WITH THE DEPARTMENT OF SUSTAINABILITY AND ENVIRONMENT, VICTORIA

Project Description:
Significant effort was spent on developing the REALM water supply simulation software, and enhancing the package to suit user needs. REALM simulates the harvesting and bulk distribution of water resources within a water supply system, and models the water storage behaviour due to various ‘what if’ scenarios such as increasing environmental flows. Network linear programming is used to allocate water within the supply systems. REALM has been adopted as the modelling standard for water supply planning and management in Victoria, and is extensively used also in Western Australia and South Australia, and to a lesser extent other states of Australia. REALM software and the three user manuals are available free of charge from the website http://www.dse.vic.gov.au/vro/water. REALM workshops are conducted at Victoria University at least once a year.

Research Sponsors:
Department of Sustainability and Environment

Chief Investigators:
Chris Perera (Victoria University)

IMPACT OF SOURCE MANAGEMENT PRACTICES ON SEPTICITY OCCURRENCE IN SEWERAGE NETWORKS

Project Description:
The implementation of the source management practices (SMPs) in urban areas has significantly increased in the recent past. SMPs refer to the condition where water supply and wastewater discharge are managed locally. The driving forces of these SMPs are mostly due to water shortages and the concern of the environmental protection. While the positive effects of SMPs, such as reduction of potable water demand and wastewater production have been widely acknowledged, the implementation of SMPs is also likely to alter the wastewater quality and flow characteristics. These alterations might affect downstream sewerage networks and wastewater treatment plants. SMPs tend to lower the wastewater flow which subsequently increases the concentration of contaminants. Lower flow and higher contaminant concentration lead to sewer problems such as blockages, odour and corrosion. Sewer blockages due to these SMPs have been assessed in a few studies; on the other hand impacts on odour and corrosion have not yet being investigated. The problems of odour and corrosion are mostly observed in sewerage networks. This research project investigates the impact of SMPs on the odour and corrosion problem due to hydrogen sulphide formation (septicity) in existing sewer network by setting up the base case and SMPs scenarios and modelling the existing sewerage network in selected case study area. There are three potential outcomes that were identified in this study. They are:

a. To identify the best SMPs that will not cause hydrogen sulphide formation.

b. To find the impact of each selected SMPs. The selected SMPs in this study are water demand management, rainwater harvesting, greywater re-use and sewer mining.

c. To develop a new threshold value for flow (how much reduction in water consumption and residual wastewater discharge) and pollutant concentration from each SMPs, so these practices will not cause problems which is triggered by the hydrogen sulphide formation.

Research Sponsors:
CSIRO Water for a Healthy Country

Chief Investigators:
Ni Marleni (PhD student), Nitin Muttil, Stephen Gray (Victoria University), Ashok Sharma (CSIRO)
USE OF REMOTE SENSING DATA FOR GENERATION OF STREAMFLOW IN DATA-POOR REGIONS

Project Description:
Ground networks of hydrological measuring stations are often sparse. The quality of data collected is also often poor and access to available data may be limited due to institutional and political barriers. This results in lack of discharge time series, which are essential for water resources assessment, estimating environmental flows and availability of water for agriculture, and various other types of water resources and hydrological analyses. Nilantha Gamage is working on this project for his PhD. Case studies are on the Thomson catchment in Victoria and the Blue Nile catchment in Africa.

Research Sponsors:
International Water Management Institute; VU PhD project

Chief Investigators:
Nilantha Gamage (PhD student); Chris Perera (Victoria University)

DEVELOPMENT OF A FORECASTING SCHEME FOR RESERVOIR INFLOWS

Project Description:
Risk-based planning of multi-reservoir water supply systems relies on the ability to forecast reservoir inflows under influences of global climate change and inflow uncertainty. This research project aims to develop a forecasting scheme for reservoir inflows and assess the value of forecast information in supporting medium to long term planning of water supply systems.

Research Sponsors:
VU Post Doctoral project

Chief Investigators:
Dung Tran, Chris Perera, Nitin Muttil (Victoria University)

PROACTIVE MANAGEMENT SYSTEM FOR SEWERAGE ASSETS

Project Description:
This research project investigates the deterioration of sewers using different modelling techniques and develops a fuzzy ranking model for manholes. This is a collaborative research project in which VU is a subcontractor to a joint research project between CSIRO and United Water, a sewer operator in South Australia.

Research Sponsors:
CSIRO and United Water

Chief Investigators:
CSIRO, United Water and Dung Tran (Victoria University)

DEVELOPING A WATER SUSTAINABILITY INDEX FOR WEST JAVA, INDONESIA – PHD PROJECT

Project Description:
A water sustainability index is a useful tool to assess current water sustainability status and prioritise water-related issues, which can be used to assist decision makers in improving water resource management. This study aims at developing a water sustainability index for West Java in Indonesia. Water resources in West Java are currently over-exploited. The National Planning and Development Council of Indonesia predicted that cities in Java Island would suffer critical water-deficit by 2025. Once developed, the West Java Water Sustainability Index (WJWSI) will be used as a tool to prioritise water-improvement programs and increase the water sustainability awareness of various water resources stakeholders. This will eventually lead into a significant improvement of water resources management in West Java. A conceptual framework for the WJWSI was developed and the Delphi technique (which is a method to seek consensus among the selected experts through the distribution of a series of questionnaires) was used to establish the final WJWSI framework. The index was applied to three West Java catchments, which included the uncertainty and sensitivity analysis of the index. This work, undertaken by PhD student Iwan Juwana, is expected to be completed in 2011.

Research Sponsors:
AusAid; VU PhD project

Chief Investigators:
Iwan Juwana (PhD student), Chris Perera, Nitin Muttil (Victoria University)
WATER CONSERVATION BY REPLACING COOLING TOWERS

Project Description:
Over 100 GL of fresh water, or 25% of Melbourne’s water consumption, is lost annually through cooling towers in power stations and large air-conditioning systems in Victoria. This makes cooling towers one of the largest industry demands for fresh water. Currently power stations and large air-conditioning systems use cooling towers to reject waste heat. The waste heat is carried by warm water which is normally sprayed, evaporated and mixed with cooling air inside cooling towers. The cooling air together with the evaporated water is rejected to the atmosphere and thus water is lost by cooling towers. By eliminating water losses through cooling towers, valuable fresh water can be saved for Victorian communities. The aims of this project are to design and study a new waste heat rejection system which consists of a highly compact heat exchanger made of polymer films, to study the feasibility of replacing cooling towers in power stations and large air-conditioning systems by this new system, and to establish its operational parameters. Prototype heat exchangers have been constructed and are currently being modified to improve performance. Milestone 5 of the project has been completed and currently trying to set up the experiments at Yallourn Power station. A hybrid air cooling-water evaporation system to cope with hot days is currently being trialled.

Research Sponsors:
Smart Water Fund

Chief Investigators:
Jun-De Li, Josef Rajter, Graham Thorpe, Stephen Bigger, Stephen Gray, Marlene Cran (Victoria University)

SUSTAINABLE WATER OPTIONS FOR SPORTSFIELDS

Project Description:
This project investigated the socioeconomic impacts of restrictions and water shortage on field’s currently in Melbourne and has placed a tentative value on the social value of fields. This report is available on the Smart Water website. The information package to assist ground managers with water options has been approved by Smart Water should be available on their website, the Institute website and the South East Water website. The supporting software has been trialled and will be made generally available in mid 2011. This project will be the main component of a Smart Water road show during July 2011.

Research Sponsors:
Smart Water Fund

Chief Investigators:
Nicholas Milne (Victoria University)

HIGH RECOVERY RO

Project Description:
The use of accelerated seeded precipitation to increase water recovery through RO systems treating saline wastewater is being investigated. A pilot plant was commissioned at Donald, Victoria and trials will commence and conclude in 2011. The project will demonstrate the possibility of achieving high water recovery from reverse osmosis plants treating saline wastewaters, where calcium phosphate scaling is prevalent.

Sponsors:
Grampians Wimmera Mallee Water (GWMWater) and Smart Water Fund

Chief Investigators:
Peter Sanciolo, Stephen Gray (Victoria University)
Institute for Sustainability and Innovation

Investigate Rapid Detection Methods for Blue-Green Algae from Grampians Wimmera Mallee Water (GWM Water)

Project Description:
This is a two year project. Work is underway and a preliminary report on a portion of the work is being prepared. Field trials are anticipated to commence in March-April 2011.

Research Sponsors:
Grampians Wimmera Mallee Water (GWMWater)

Chief Investigators:
Mary Millikan, Stephen Gray (Victoria University)

Innovative Zero-Energy Membrane Technologies to Reduce Water Consumption in the Dairy Industry

Project Description:
This project aims to implement and optimise innovative membrane technologies to reduce water consumption in Australian dairy processing which don’t require added energy (zero-energy). In Victoria alone, more than 1000ML of wastewater are produced annually by the dairy industry which is high in dissolved solids. The novel process to be used in this project is membrane distillation which can desalinate waste water streams to a very high standard using available waste low grade heat. Innovative setups of nanofiltration and reverse osmosis will also be explored. The types of membrane, unique milk interactions, handling fouling and appropriate operation conditions are novel contributions to membrane science and major dairy processing. This project is funded by the Australian Research Council Linkage Project scheme with the industry partner Dairy Innovation Australia Ltd.

Research Sponsors:
Smart Water Fund

Chief Investigators:
Angela Hausmann (PhD student), Mikel Duke, Peter Sanciolo, Todor Vasiljevic (Victoria University), Elankovan Ponnampalam, Nohemi Quispe-Chavez, Mike Weeks (Dairy Innovation Australia Ltd)

Cleaner Production and Resource Recovery: Encouraging Best Practice and Innovation

Project Description:
The project is looking at benchmarking the quality of water discharged from manufacturing facilities and highlighting best practice for improving water quality and internal reuse of resources and water. It will also be looking at ways of encouraging industry to adopt the changes or to find innovative ways of improving their environmental operations with regards to water. Due to poor feedback on the initial survey, the survey was updated and shortened to increase the chance of response. Responses have now been received throughout Australia, New Zealand, the United States and Canada. Statistically significant results are available for the metal finishing and dairy industries. Reports for these industries are being prepared. The survey is continuing.

Research Sponsors:
Smart Water Fund

Chief Investigators:
Nicholas Milne (Victoria University)

Ecology of Waterfowl on Wastewater Treatment Lagoons

Project Description:
This project will investigate use of wastewater treatment lagoons by ducks and swans at the Western Treatment Plant, Werribee in order to better understand how changes in sewage treatment regime may influence this nationally important bird community. An increased understanding of waterfowl needs will permit to better manage potential impacts of future changes in sewage treatment technology on birds. Investigations will focus on activity budgets and diet of ducks on various lagoons.

Research Sponsors:
Melbourne Water Corporation

Chief Investigators:
Patrick-Jean Guay (Victoria University)
EVALUATION OF POTENTIAL STORMWATER HARVESTING OPPORTUNITIES AND SITES IN AN URBAN DEVELOPMENT

Project Description:
The recent drought in Australia, together with concerns about climate change and growing urban demand for water have highlighted the need for managing water resources in a more sustainable way. Stormwater harvesting is now seen as a publicly preferred and fit for use alternative water resource. This research project is aimed at developing a comprehensive methodology for evaluating stormwater harvesting sites in an urban area. A Geographical Information System (GIS) screening tool will be developed as a part of this project; it will assist the decision makers in identifying the suitable locations for stormwater harvesting based on physical criteria. The stormwater harvesting schemes at these potential locations will be evaluated against social, environmental and financial objectives to determine the most feasible stormwater harvesting schemes. This assessment will be done using Multi Criteria Decision Analysis (MCDA). The Bayesian Network (BN) method will compliment the MCDA method to incorporate uncertainties in stakeholder opinions on stormwater harvesting. This methodology will be immensely beneficial to water industry and community, as it will not only assist in choosing best locations for stormwater harvesting, but also will reduce the subjectivity in decision making related to stormwater harvesting issues under conflicting opinions of stakeholders. The project is conducted by the PhD student Prasad Inamdar and is financially supported by CSIRO.

Research Sponsors:
CSIRO Water for a Healthy Country

Chief Investigators:
Prasad Inamdar (PhD student); Chris Perera (Victoria University), Ashok Sharma (CSIRO)

EFFECT OF CLIMATE CHANGE ON STORM INTENSITY, FREQUENCY AND DURATION

Project Description:
Climate change is expected to have important impacts on hydrologic cycle and structures such as dams, culverts, roads, bridges and stormwater drainage systems. The evaluation of adequacy of these structures requires the Intensity-Frequency-Duration (IFD) curves of storms. However, the currently available IFD information does not consider the likely effects of climate change. This study will develop and demonstrate methodologies to construct storm IFD relationships that consider the likely effects of climate change produced by different General Circulation Models (GCMs). The project first will develop a spatial downscaling model to generate monthly rainfall data using GCM outputs up to year 2100. The temporal disaggregation models will then be developed to disaggregate monthly rainfalls to daily rainfalls, and daily rainfalls to sub-daily rainfalls up to 6 minutes. Finally, through frequency analysis, the storm IFD curves will be constructed which accounts for likely climate change. The methodology will be demonstrated using the rainfall gauging station that represents Melbourne. The work on the project is carried as a PhD project by Safaet Hossain.

Research Sponsors:
VU PhD project

Chief Investigators:
Safaet Hossain (PhD student), Chris Perera, Fuchun Huang (Victoria University)
MULTI-OBJECTIVE PLANNING AND OPERATION OF WATER SUPPLY SYSTEMS SUBJECT TO CLIMATE CHANGE

Project Description:
Water supply systems are currently undergoing significant modifications in response to climate change. Operators have limited experience with the reconfigured systems and revised water balances, and they require new operating rules. This project aims to develop methods to determine the optimum operating rules of these systems considering climate change and variability, a range of social, economic, environmental, and sustainability objectives, and stakeholder preferences on these objectives. These rules will enable planners to manage their water systems more effectively under future short and long term planning conditions, and drought conditions, while reducing environmental impacts and improving sustainability. A case study of the Grampians headwork’s system in Victoria will provide the opportunity to trial methods that account for diverse stakeholder preferences in the context of climate change and climate variability, including drought events. The project is funded by an ARC Linkage grant with further funding from Grampians Wimmera Mallee Water. Two students, Sachindra Dhanapala and Walter Godoy started their PhDs and their candidature proposals were approved in December 2010. Sachindra’s project is on ‘Catchment level downscaling of hydroclimatic variables from general circulation model outputs’, while Walter’s project is on ‘Multi-Objective Optimisation of Water Supply Systems: A Shared Vision’.

Research Sponsors:
Australia Research Council (ARC), Grampians Wimmera Mallee Water (GWM Water)

Chief Investigators:
Sachindra Dhanapala, Walter Godoy (PhD students), Chris Perera, Fuchun Huang (Victoria University), Andrew Barton (Grampians Wimmera Mallee Water (GWM Water))

CATCHMENT LEVEL DOWNSCALING OF HYDROCLIMATIC VARIABLES FROM GENERAL CIRCULATION MODEL OUTPUTS

Project Description:
Due to recent droughts, the Grampian-Wimmera-Mallee headwork’s system experienced a large drop in inflows to its reservoirs. Recently, the inefficient open channel transmission network has been replaced with a pipeline. Due to this system reconfiguration, the operating rules need to be revisited. Development of daily optimized operating rules requires daily hydro-climatic data which also accounts for climate change. The aim of this research is to predict daily stream flows, precipitation, temperature and evaporation at strategic points in the catchment, from outputs of 24 General Circulation Models up to year 2100. Monthly GCM outputs will be downscaled statistically to catchment scale hydroclimatic variables with Support Vector Machine. Then these monthly data will be disaggregated to daily scale with the method of fragments. Stream flows will be downscaled from GCMs, as well as hydrologically modelled from downscaled climatic variables. The research will employ downscaling models based on 12 calendar months enabling a better capture of hydroclimatic variables in terms of extreme values.

Research Sponsors:
VU PhD project, Grampians Wimmera Mallee Water (GWM Water)

Chief Investigators:
Sachindra Dhanapala (PhD student), Chris Perera, Fuchun Huang (Victoria University), Andrew Barton (Grampians Wimmera Mallee Water (GWM Water))
MULTI-OBJECTIVE OPTIMISATION OF WATER SUPPLY SYSTEMS: A SHARED VISION

Project Description:
Water resource management involves the planning and operation of water supply systems for the benefit of all users. Simulation and optimisation modelling have proven effective analytical tools but have lacked the structure and transparency required to address such multi-dimensional problems and account for value judgements. This project aims to develop a multi-objective optimisation procedure that integrates quantitative and qualitative information in the search for optimal solutions. The procedure will be developed for the Grampians Headwork’s System which has recently undergone major infrastructure and water allocation changes. New operating rules are required to account for the needs of various users and complex operating rules considering climate change effects. This procedure will combine the formation of optimal operating plans with multi-criteria decision analysis to deliver a practical tool that may be used in Australia and internationally.

Research Sponsors:
VU PhD project, Grampians Wimmera Mallee Water (GWMWWater)

Chief Investigators:
Walter Godoy (PhD student), Chris Perera (Victoria University), Andrew Barton (Grampians Wimmera Mallee Water)

ASSESSMENT OF POTENTIAL IMPACTS OF CLIMATE CHANGE AND URBANIZATION ON URBAN DRAINAGE SYSTEMS

Project Description:
Climate change is unequivocal. Today there is evidence that the average temperature of the globe is increasing. With global warming, extreme events like high intensity rainfall are increasing, which in turn leads to increase in urban flash flooding because the urban drainage systems cannot cope with the increased flows. Moreover, human induced changes in land use pattern (urbanization) causes more imperviousness, which further exacerbates the problem due to increased run-off from urban catchments. Flooding in urban areas is considerably sensitive not only to the intensity and duration of extreme events but also to the hydrologic and hydraulic characteristics of urban catchments. Based on detailed discussions with two councils in Melbourne, three key characteristics of urban catchments have been identified that represent changes due to urbanization. These are:

i) Increase in imperviousness in the catchment
ii) Change in storage capacity of the catchment
iii) Change in conveyance capacity of the catchment

This project aims to assess the impacts of climate change and urbanization (in terms of the above three characteristics) on urban drainage systems functionality. The project will be implemented in 3 phases. Firstly, different future climate scenarios will be generated using Global Climate Models (GCMs). A downscaling procedure will be applied to produce precipitation for a local urban area at a high resolution to be applied into a hydrologic/hydraulic model. Secondly, urban drainage systems will be assessed using various scenarios of climate change and the three key catchment characteristics. Finally, a sensitivity analysis will be undertaken to derive the thresholds of the three catchment characteristics to maintain an appropriate level of drainage system functionality.

Research Sponsors:
VU PhD project

Chief Investigators:
Shahram Molavi (PhD student), Nitin Muttil, Dung Tran (Victoria University)
**WATER GRID ISSUES – PHD PROJECT**

**Project Description:**
Water Grid is an emerging concept in the Australian water industry as a potential solution for addressing water scarcity in major cities. In general, a water grid comprises with a network of reversible pipelines to connect major bulk water sources in a region to allow water from areas with water surplus to be moved to areas that face a shortfall. By connecting region’s major water sources, water treatment plants and bulk water transport networks, a grid will enable the coordination of delivery of urban and industrial water supplies across a region. In addition, a grid allows risk to be managed at a regional level rather than at an individual source basis. Since water grid is an emerging concept, there are many unknowns such as water quality implications of mixing and blending of water sourced from multiple sources within a network; operation of reversible pipelines; energy implications transporting water against gravity and how to minimise energy usage and carbon footprint; optimal movement of water across the region to maximise resource usage while maintaining environmental flows and minimising carbon footprint; possibility of urban/rural water trading and implication of trading on management of water grid, etc. Seawater desalination plants are also elements of a water grid.

There are also opportunities for integrating stormwater, rainwater and wastewater recycling into water grids. The primary objective in this study is to develop methods and techniques for determining optimal movement of water across the water grid to maximise resource usage while maintaining environmental flows and minimising energy consumption and greenhouse gas emissions. Stephanie Ashbolt, a CSIRO employee has started her PhD on a part-time basis to work on water grid issues. Her candidature was confirmed in March 2011.

**Research Sponsors:**
CSIRO/VU PhD project

**Chief Investigators:**
Stephanie Ashbolt (PhD student), Chris Perera (Victoria University), Shiroma Maheepala (CSIRO)

---

**QUANTIFICATION OF NON POINT SOURCE POLLUTION IN YARRA RIVER CATCHMENT**

**Project Description:**
Non Point Source (NPS) pollution can come from many different sources, and is difficult to monitor the exact source and its pollution generation, unlike point source pollution. Agricultural non-point sources of pollution of the Yarra River include pesticides, fertilisers, animal manure and soil washed into stream banks. Recent studies into the agricultural section of the Yarra River have shown that the water quality is good in the upper reaches of the section but steadily declines towards the lower reaches. These studies have shown that the levels of pH, TP, salinity and dissolved oxygen are generally satisfactory throughout the agricultural section; however the levels of TN and turbidity does not comply with the State Environment Protection Policy. The aim of this project is to develop a non-point source model which can be integrated into a river water quality model of the Yarra River Basin which will assist in determining the levels of the pollution generated from the agricultural land use, and enable the identification of best management practices (BMPs) that could be implemented to reduce the level of pollution from these areas from entering the river.

**Research Sponsors:**
VU PhD project

**Chief Investigators:**
Sithranjan Shanmugasundam (PhD student), Anne Ng, Chris Perera (Victoria University)
STATISTICAL ANALYSIS TO DETECT CLIMATE CHANGE IMPLICATIONS ON WATER RESOURCES

Project Description:
Climate change has posed a huge challenge to the existing water resources management practices. Any significant changes in climatic variables would have important implications for the environment and economic prosperity of the areas affected. Changing patterns of climatic variables like rainfall, temperature, etc. deserve urgent attention, since global climate change may influence their patterns and result in increasing occurrences of droughts and floods. This study aims at a comprehensive analysis of climatic variables, namely, rainfall, temperature and stream flow from various catchments in Victoria. Historical data for these variables will be analysed to detect change points (points in time when the variable exhibited change in a defined statistical sense) and temporal and spatial trends (to detect spatial patterns over various catchments). During the recent past, there has been occurrences of extreme events like droughts, floods, heatwaves, etc. in and around Melbourne, because of which this study will also look into analysis of these extreme events. Techniques that would be used include various statistical methods, data mining techniques and visualization as well as GIS based techniques. A new PhD student, Sithranjan S commenced work on this project in February 2009. This Masters project has been completed and the thesis was submitted in 31st March 2011.

Research Sponsors:
VU Masters project

Chief Investigators:
Sithranjan Shanmugasundam (PhD student), Nitin Muttil, Chris Perera (Victoria University)

IMPROVING CHEESE STARTER CULTURE FERMENTATION PROCESSES USING NOVEL MEMBRANE SYSTEMS

Project Description:
This project involved research in the application of membrane separation processes during production of cheese starter cultures. The research involved literature and patent review on technologies for the preparation and use of bulk cheese starter cultures (with emphasis on application of membranes), and on the biochemical and physiological factors affecting culture growth and metabolic activity. Novel processes will then be designed and tested to ascertain potential improvements to the production of starter cultures. The research work was funded by Dairy Innovation Australia Ltd (DIAL) and was performed in collaboration with DIAL. The final report was submitted.

Research Sponsors:
Dairy Innovation Australia (DIAL)

Chief Investigators:
Lata Ramchandran, Mikel Duke, Peter Sanciolo, Todor Vasiljevic (Victoria University) Ian Powell and Malcolm Broome (Diary Innovation Australia Ltd)

HOSTED 3RD INTERNATIONAL SYMPOSIUM ON INORGANIC MEMBRANES

Project Description:
Bo Zhu and Nicholas Milne were conference secretariat

Research Sponsors:
Ian Potter Foundation and Victoria University

Chief Investigators:
Mikel Duke, Bo Zhu and Nicholas Milne (Victoria University)
VICTORIAN STATEWIDE RIVER HEALTH SOCIAL CONDITION BENCHMARKING PROJECT (IN CONJUNCTION WITH SCHOOL OF MANAGEMENT, QUEENSLAND UNIVERSITY OF TECHNOLOGY)

Project Description:
Final report submitted and accepted by Department of Sustainability and Environment, Victoria.

Research Sponsors:
Queensland University of Technology

Chief Investigators:
John Cary (Victoria University), Anne Pisarski (Queensland University of Technology)

ANAMMox MEMBRANE BIOREACTOR FOR TREATMENT OF HIGH AMMONIA WASTE – FEASIBILITY TEST

Project Description:
High ammonia wastes are costly to treat, both in terms of capital and operating expenses. Anammox bioreactors are a novel technology since the bacteria and their metabolic pathway recently discovered. The aim of this project is to cultivate and demonstrate the anammox reaction and look at the possibility to utilise for a cost effective means for treating high ammonia wastewaters. Completed and final report submitted.

Research Sponsors:
Central Highlands Water, City West Water, South East Water, Melbourne Water and Yarra Valley Water

Chief Investigators:
Warren Flentje, Drikus Du-Plooy, Mikel Duke (Victoria University), Eddy Ostarcevic (Integrated Elements)

NATIONAL CONFERENCE ON THE ECOLOGY AND MANAGEMENT OF THE GIPPSLAND LAKES

Project Description:
The two-day conference was held on 27 & 28 October 2010 at Lakes Entrance. $45,000 in industry support was received, plus $25,000 in delegate registration fees. Sixteen speakers, from Victoria, SA, NSW, ACT and New Zealand, presented, and 200 delegates attended from a wide range of community and industry (government and private) groups.

Research Sponsors:
Gippsland Lakes & Catchment Taskforce, Department of Sustainability & Environment, Parks Victoria, East and West Gippsland Catchment Management Authorities, East Gippsland Water

Chief Investigators:
Paul Boon (Victoria University)

ENDEAVOUR EXECUTIVE AWARD TO VISIT LABORATORY OF ADVANCED MATERIALS CHINA

Project Description:
This award supported the travel of Assoc. Professor Mikel Duke to visit the prestigious Laboratory of Advanced Materials at Fudan University in China. The visit lasted 6 weeks, commencing in September 2010. The visit has helped strengthen ties with this top level materials institute and has an objective to explore frontier materials for water treatment membranes. Bo Zhu was also supported for a visit as part of this project.

Research Sponsors:
Endeavour Awards

Chief Investigators:
Mikel Duke, Bo Zhu (Victoria University) and Dongyuan Zhao (Fudan University)

INVESTIGATIONS OF TECHNIQUES FOR MAXIMISING THE UTILISATION OF HARVESTED RAIN WATER USING A DIGITAL ECOSYSTEM

Project Description:
Harvesting rainwater can reduce the need for fresh water, as well as minimises stormwater outflows. A household that uses only harvested rain water for its gardens can save 60 to 120 kl of water per year. These savings will be enhanced if the rainwater is used judiciously. The current project aims to investigate techniques for developing a digital ecosystem to maximise the utilisation of the available tank water, by considering factors such as current water level in the tank, predicted rainfall, soil moisture, and water usage of various appliances. Mrs. Kamatchi Pillai is investigating techniques for developing Digital Ecosystems based on Wireless Sensor Networks as her PhD project, and Mr. Ben Coyn has completed a summer scholarship looking into the real-time interfacing aspects of the same.

Research Sponsors:
Faculty of Health, Engineering and Science

Chief Investigators:
Nalin Sharda, Cagil Ozansoy (Victoria University)
CERAMIC MEMBRANES IN WATER TREATMENT

Project Description:
Ceramic membranes can withstand tough chemical and physical environments associated with the water treatment applications which traditional polymer membranes cannot perform well. This project looked at the performance of ceramic membranes in challenging water treatment environments for water recycling and also at the ability to withstand ozone pre-treatment as well as lower cost, but more aggressive forms of cleaning. The project was supported via a WQRA Summer Scholarship (Stephen Kennedy, from RMIT University) partnering with Melbourne Water, ceramic membranes from Chosun Refractory in Korea. The work was presented at the AWA Ozwater’10 Conference in Brisbane in 2010 and led to a peer reviewed conference paper “Application of ceramic membrane and novel ozone cleaning for reuse of secondary effluent in Melbourne”.

Research Sponsors:
Water Quality Research Australia (WQRA)

Chief Investigators:
Mikel Duke, Bo Zhu, Stephen Kennedy (Victoria University) and Judy Blackbeard (Melbourne Water)

GUIDELINES FOR INDUSTRIAL USE OF RECYCLED WATER – SMART WATER PROJECT

Project Description:
This project is providing information to industrial clients regarding the opportunities and challenges of accepting recycled water. A literature review/information package has been completed. The decision support framework, consisting of a quick scan tool and multi-criteria analysis, have been trialled and successfully updated. It has been made available through the Smart Water website http://www.smartwater.com.au/projects/round4/vicuni/Pages/vicuni.aspx.

Research Sponsors:
Smart Water Fund, CSIRO

Chief Investigators:
Nicholas Milne, Stephen Gray (Victoria University), Kevin Zhang (RMIT)

CONSERVING VICTORIA’S SALTMARSHES: MAPPING, INVENTORY AND CONDITION ASSESSMENTS

Project Description:
Project was completed and report submitted in August 2010, and the fully edited version is currently (May 2011) being printed for wider distribution. The project included the first State-wide assessment of Victoria’s intertidal wetlands, including a whole-of-State inventory (to the nearest ha) and 1:10,000 high-resolution maps of mangroves, coastal salt marsh and other estuarine wetlands across all coastal areas. The project team included staff from the Arthur Rylah Institute (Steve Sinclair and Matt White), Ecology Australia (Geoff Carr, Andrew McMahon and Steve Mathews), Biosis Research (Jeff Yugovic), Doug Frood, Chris Harty, Neville Rosengren, and Tim Allen.

Research Sponsors:
National Heritage Trust, administered through the Victorian Department of Sustainability & Environment

Chief Investigators:
Paul Boon (Victoria University)

FUNDING TO WORK AS VISITING SCIENTIST

Project Description:
Dr Bo Zhu was invited by Prof Dongyuan Zhao of Fudan University in China to work as a visiting scientist in his group in October 2010. Professor Zhao’s work is internationally recognised in the area of advanced inorganic materials. During this trip, Bo worked closely with Assoc. Professor Mikel Duke (VU) and Prof Zhao’s group to develop magnetically functional zeolite and aligned mesoporous titania membranes for possible water treatment.

Research Sponsors:
Ian Potter Foundation

Chief Investigator:
Bo Zhu (Victoria University)
HUMIDIFICATION/DEHUMIDIFICATION DESALINATION TECHNOLOGY

Project Description:
Humidification and dehumidification desalination (HDD) technology belongs to thermal distillation as those of Membrane Distillation (MD), Multi-Effect Distillation (MED) and Multi-Flush Distillation (MFD). It uses low grade heat (40°C-80°C), produces very high quality potable water, operates under pressure close to that of the ambient, and is more tolerant to fouling. Because of this, they can produce potable water with a very high recovery ratio and the brine they produced can be close to saturation, and thus achieving close to zero liquid discharge. We have built a HDD unit at Victoria University with a Gain Output Ratio of 7. It can produce 80L of potable water per hour, and this is about 2m3/day when operating continuously. Currently, we are conducting experiments using industry water.

Chief Investigators:
Jun-De Li (Victoria University)

MANAGING DISTURBANCE TO WATERBIRDS AT THE WESTERN TREATMENT COMPLEX: UNDERSTANDING THE BASIC PATTERNS

Project Description:
The impacts of human disturbance on waterbirds are not well understood and thus it is difficult for land managers to protect and conserve habitat for our native waterbird species. This project, funded by Melbourne Water Corporation and the Faculty of Health, Engineering and Science, Victoria University will investigate the response of waterbirds to various types of human activities and establish guidelines for buffer zones to protect waterbird habitat.

Research Sponsors:
Melbourne Water Corporation; Birds Australia; FHES Collaborative Research Grant Scheme

Chief Investigators:
Patrick-Jean Guay (Victoria University), Mike Weston (Deakin University)

INVESTIGATING HYBRIDISATION BETWEEN PACIFIC BLACK DUCKS AND MALLARDS IN VICTORIA

Project Description:
Hybridisation between introduced Mallards and native Pacific Black Ducks is thought to be increasing in Australia. Using molecular tools, we will investigate the rate of hybridisation in Victoria in order provide management advice to the state wildlife agencies.

Research Sponsors:
Birds Australia - Victoria; M. A. Ingram Trust

Chief Investigators:
Patrick-Jean Guay, Alice Taysom, Megan O’Shea (Victoria University)

PRACTICAL VIABILITY AND HEALTH ISSUES OF CONCENTRATING BRINE TO SOLIDS SOURCED FROM INLAND GROUNDWATER DESALINATION

Project Description:
Inland desalination is necessary to convert brackish groundwater into potable drinking water for inland communities where groundwater is the cleanest most reliable water source. However when desalination is performed, another stream is produced which contains concentrated salts which must be disposed of and can contain concentrated toxic compounds. As it cannot be reinjected to the ground the best means of handling the salty water is to dry it to solid salt crystals extracting as much useful water out as possible. This project concentrated salty water from Edenhope’s inland desalination plant and other groundwater sources throughout the Grampians Wimmera Mallee Water (GWMWater) region and crystallising the salts. The project explored technologies to carry out concentrating brine salts including membrane distillation. Also included was an analysis of the toxic components such as arsenic that may lead to health issues Associated with the disposal of concentrated solid salts by landfill.

Research Sponsors:
WQRA Summer Scholarship

Chief Investigators:
Rhett Richardson, Mikel Duke and Peter Sanciolo (Victoria University), Paul Atherton (GWMWater), Hal Aral (CSIRO Minerals)
BIODEGRADABILITY ANALYSIS OF POLYSTYRENE SAMPLES UNDER TEST METHOD

Project Description:
A test method for determining the biodegradability of a new range of polystyrene foam cups from Rema industries is being developed. This project is currently under development for an ARC linkage (R2) proposal.

Research Sponsors:
Rema Industries

Chief Investigators:
Marlene Cran, Stephen Gray, Stephen Bigger (Victoria University), Michel Lefebvre (Steripak)

MEMBRANE AUTOPSY

Project Description:
An autopsy of a fouled RO membrane was performed for an industrial water recycling application. The membrane was contaminated with biological growth resulting in reduced performance. A report and recommendation for chemical treatment was provided.

Research Sponsors:
Actiflux Pty Ltd

Chief Investigators:
Marlene Cran, Stephen Gray (Victoria University), Richard Tarr (Actiflux Pty Ltd)

RECYCLING OF FIRE FIGHTING WATER

Project Description:
This was a consulting project with ARUP. The final report has been submitted.

Research Sponsors:
ARUP

Chief Investigators:
Lata Ramchandran, Nicholas Milne, Bo Zhu, Yaoxin Hu (Victoria University)

MEMBRANE INTEGRITY TEST FOR DOW

Project Description:
A series of 8” membranes (LE440i and BW30) were subjected to vacuum decay testing for Dow Filmtec.

Research Sponsors:
Dow Filmtec

Chief Investigators:
Lata Ramchandran, Nicholas Milne, Bo Zhu, Yaoxin Hu, Mikel Duke (Victoria University)

BIOSOL

Project Description:
Fouling control of MBR’s and funded by Kellogg Brown and Root (KBR)

Research Sponsors:
Kellogg Brown and Root

Chief Investigators:
Warren Flentje, Lata Ramchandran, Stephen Gray, Mikel Duke, (Victoria University), Grant Stanley (CQ University Australia)

RECYCLING OF WATER AND FOAM FROM MFB TRAINING OPERATIONS

Project Description:
A recycling system to recover and reuse water used in firefighting training operations was developed. A membrane-based system was designed to remove the biodegradable foam and other impurities.

Research Sponsors:
Tricomms

Chief Investigators:
Eddy Ostarcevic (Integrated Elements), Stephen Gray, Marlene Cran (Victoria University), Tricomms

MEMBRANE DISTILLATION IN POWER GENERATION

Project Description:
The aim of the project is to trial a novel application of membrane distillation in the power generation water treatment process

Research Sponsors:
Billfinger Burger

Chief Investigators:
Mikel Duke, Stephen Gray (Victoria University), Eddy Ostarcevic (Integrated Elements)
Institute for Sustainability and Innovation

HO

HONOURS AND AWARDS

Assoc. Professor Mikel Duke chaired the 3rd International Symposium on Inorganic Membranes on 26 November 2010. Dr Bo Zhu and Dr Nicholas Milne were conference secretariat. The Symposium was sponsored by the Ian Potter Foundation, Victoria University and the Membrane Society of Australasia. 32 people attended to see talks by the invited international speakers, Prof Toshinori Tsuru of Hiroshima University, Japan, Prof Jerry Lin of Arizona State University, USA, Prof Wanyin Jin of Nanjing University of Technology, China and Prof Kew-Ho Lee of Korea Research Institute of Chemical Technology. Talks were also given by National membrane experts, Dr Bo Zhu of Victoria University, Dr Simon Smart of the University of Queensland, Dr Matthew Hill of the CSIRO and Prof Huanting Wang of Monash University.

Assoc. Professor Mikel Duke received the Endeavour Executive Award to visit the prestigious Laboratory of Advanced Materials at Fudan University in China. Dr Bo Zhu was also supported for a visit as part of this project.

Ludovic Dumée won the best presentation award and Angela Hausmann won the best 1st year student presentation at the 1st Membrane Society of Australasia Student Symposium, 18-20 February, Wollongong, NSW.

Stephen Gray is a member of the Editorial board of the Desalination journal. He also remains an Assoc Editor of Water Research.

Mikel Duke is co-editor with Prof Dongyuan Zhao (Fudan University, China) and Raphael Semiat (Technion, Israel) on a book titled “Functional Nanostructured Materials and Membranes for Water Treatment”. Editor-in-chief is Prof Max Lu (University of Queensland).

Mikel Duke is on the editorial board of the new open access journal ‘Membranes’.

Dr Lata Ramchandran attended and won the graduate oral research presentation competition on 1st July 2010 at the IFT annual conference held at Chicago, US.

Sena Abeykoon participated on an overseas study tour from 8th August to 9th September 2010. He has a scholarship from the Municipal Engineers Association of Victoria (MEFVIC), which is given to 4 selected engineers in Victoria by MEFVIC. Sena is developing a model for urbanisation using Cellular Automation (CA) technique. During his tour, he met with Professor Yichun Xie at Eastern Michigan University, who developed a CA model for new developments in urban areas. He also met with Professor Mike Batty at the Centre for Advanced Spatial Analysis (CASA) in London to discuss the urbanisation models. Sena also attended the APWA (American Public Works Association) Annual conference in Boston and visited the University College London and 10 local councils in the UK, USA and Canada.

Miss Yaoxin Hu and Mr Ludovic Dumée won oral presentation awards and Miss Jessica Lai won a poster award at the AMS6/IMSTEC10 conference, 22 – 25 November, Sydney.
CONFERENCES/ WORKSHOPS

Sustainable Management of Stormwater as a Viable Resource, conducted by Adjunct Professor Syed Hussainy and Dr Nitin Muttil, 21 June 2010.

Environmentally Sustainable Manufacturing, conducted by Adjunct Professor Darrell Reeve, July 2010.

REALM Basic workshop for water industry, conducted by Prof Chris Perera, 7-9 July 2010.

Asset Management of our Storm Water Pipes Workshop, conducted by Professor Chris Perera, Dr Dung Tran, Dr Anne Ng (VU), Dr Martin Wang (City of Greater Dandenong), Mr John Thomson (Pipe Solutions) in collaboration with IPWEA Vic, 14 July, 2010 at VU.

3rd Inorganic Symposium on Inorganic Membranes, conducted by Assoc Professor Mikel Duke, Dr Nicholas Milne and Dr Bo Zhu, 26 November, VU Flinders Street Campus

Ruyang Li (WQRA Summer Scholarship student)
Wastewater recycling at a hydroponic vegetable grower using membrane technology

Stephen Kennedy (WQRA Summer Scholarship student)
Robust Ceramic membranes for Waste Water Treatment and Demonstration of Novel Ozone Cleaning

Noel Dow (Victoria University)
Demonstration of solar driven membrane distillation in remote Victoria

Geoffrey M. Geise
(The University of Texas at Austin, USA) PhD candidate

Dr Greg Foliente (CSIRO)
Climate Mitigation and Adaptation in the Built Environment

Professor Leigh Ackland (Deakin University)
Tissue engineering and cell culture application in medical research

Assoc Professor Mikel Duke (Victoria University)
Anammox membrane bioreactor for treatment of high ammonia waste: current experimental progress

Dr Nicholas Milne (Victoria University)
The use of Raman analysis in Research

Dr Matt Chan (University of Wollongong)
Axial buckling of multi-walled carbon nanotubes and nanopeapods

Steve Harding (Lotic Water Matters)
Sustainable/Environmental practices in water and wastewater including energy generation from biogas

Tina Rankovic (Victoria University)
Intellectual Property @ Victoria University – An Update

Dr Donald Payne (School of Physics, University of Melbourne, Australian Geothermal Energy Group)
Direct GeoExchange (Geothermal Heat Pump) technology

Dr Magnus Moglia (CSIRO Land and Water)
How we can support adaptive governance of decentralised water systems

Dr Yanggang Zhu (CSIRO Materials Science and Engineering)
Lab on a chip device for sensing and biomaterials development

Dr Bo Zhu (Victoria University)
Preparation and application of TiO2 nanoparticles

Angela Hausmann (Victoria University)
Membrane distillation in dairy processing

Darli Myat (Victoria University)
Study of possible organic fouling by a representative model compound during Microfiltration

Romain Dumont (Victoria University)
Effect of fat replacers on rheological properties of cake batter and physical characteristics of cake

Dr Patrick-Jean Guay (Victoria University)
Pacific Black Duck X Mallard hybridization: Genetic evidences and management options

Celine Zaetta (Victoria University)
Screening of Potential Fluorescents for Reverse Osmosis Membrane Integrity Testing

Cecile Prince (Victoria University)
Reuse and recycling of used reverse osmosis elements

Fanny Deschamps (Victoria University)
Surfactants’ impact on membranes

Vincent Le Moigne (Victoria University)
Energy and water savings of dairy processes using pinch analysis

Stephen Gray (Victoria University)
Shear resistant floc’s for rapid solid/liquid separation

Matthew Stewart (Victoria University)
Performance Computing – what is it and how can we harness it

Syed Hussainy (Victoria University)
Harvesting stormwater and utilisation

Dr Harry Ridgway (Stanford University)
Molecular simulation of membrane based separation

John Cary (Victoria University)
Public risk perception and potable use of recycled water

Uchenna Kennedy Kesieme (Victoria University)
Techno economic comparison of Membrane distillation (MD) and Multi effect distillation (MED) methods to understand the potentials for MD in Mining Industry

Elena Zaenglein (Victoria University)
Development of a Pressure Retarded Osmosis (PRO) demonstration unit for energy production

Shobha Muthukumaran (Victoria University)
Overview of Previous Research Studies
VISITORS TO THE INSTITUTE

ISI hosted the WQRA Victoria & Tasmania Node meeting on 16th April at the Werribee Campus. Visitors were given a tour of the laboratory facilities at Werribee Campus.

Dr Matt Chan from the University of Wollongong was attached to the ISI from 27 April to 7th May.

Yaoxin Hu from the University of Technology in China was attached to the ISI to work on a VU Research Development Grant Scheme project with Dr Bo Zhu.

ISI received a delegation from the Ministry of Industry and Trade, Hanoi, Vietnam on 17 November. The delegation was given a brief tour of the ISI lab facilities.

OVERSEAS STUDENT VISITS

<table>
<thead>
<tr>
<th>Name</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vincent Le Moigne</td>
<td>University of Nancy, France</td>
</tr>
<tr>
<td>Elena Zanglein</td>
<td>Georg Simon Ohm University of Applied Science, Nuremberg, Germany</td>
</tr>
<tr>
<td>Cecile Prince</td>
<td>University of Poitiers, France</td>
</tr>
<tr>
<td>Celine Zaetta</td>
<td>University of Poitiers, France</td>
</tr>
<tr>
<td>Fanny Deschamps</td>
<td>University of Poitiers, France</td>
</tr>
<tr>
<td>Karina Rahmawati</td>
<td>King Abdullah University of Science and Technology, Saudi Arabia</td>
</tr>
</tbody>
</table>
Professor Stephen Gray, Assoc Professor Mikel Duke, Dr Lata Ramchandran, Angela Hausmann, Darli Myat and Ludovic Dumée attended the MSA Student Symposium, 18-20 February, Wollongong, NSW.

Assoc Professor Mikel Duke attended the ICIONN 2010 conference, 22-26 February, Sydney.

Professor Roger Jones and Professor John Cary attended the Victorian Centre for Climate Change Adaptation Research – Future Landscapes Research Project Development Workshop, at the University of Melbourne in February.

Professor Stephen Gray, Dr Peter Sanciolo, Dr Nicholas Milne, Assoc Professor Mikel Duke and Noel Dow attended Ozwater 2010, Brisbane, 8-10 March, Brisbane.


Professor John Cary presented a talk Understanding and managing public response to indirect potable reuse water to the Australian Water Association Victorian Branch Technical Seminar, 16 March, Melbourne.

Professor John Cary attended a meeting of Social Science Expert Advisory Group of Food Standards Australia New Zealand (FSANZ) in Canberra. The Social Science Expert Advisory Group advises FSANZ on social science issues and aspects of consumer research related to food and health. John is a FSANZ Fellow. FSANZ currently has eighteen appointed Fellows whose expertise covers topics related to FSANZ activities, 14-15 April 2010.

Professor Stephen Gray, Fifth International Symposium on Probiotics, Departamento de Biotecnología Universidad Autónoma Metropolitana, Iztapalapa, Mexico City, April 22-24, 2010 (keynote speaker).

Professor Stephen Gray attended the opening of the Australian Water Recycling Centre of Excellence and industry workshop for the water utilities and retailers, 24-25 March 2010.

Prof Stephen Gray gave a lunch time presentation at the Municipal Association of Victoria (MADV) Conference on 13th May, Melbourne. Dr Nicholas Milne manned the ISI booth.

Prof Stephen Gray gave a talk at the Sir Mark Oliphant Conference Cleantech Science and Solutions – mainstream and at the edge 4-6 May 2010, Melbourne.

Professor Stephen Gray and Assoc Professor Mikel Duke had written a green paper for treatment technology issues for the National Centre of Excellence for Water Recycling and attended their launch in Brisbane on March 24.

Professor Stephen Gray participated in the Smart Water “Think tank” to help set the future research agenda for Smart Water.


Dr Nicholas Milne attended the National Water Recycling and Reuse Conference at Rendezvous Hotel, Melbourne, 26 May 2010.

Assoc Professor Mikel Duke visited Coombabah State High School on the Gold Coast in Queensland on 28th May to give a talk on water quality and treatment followed by a live demonstration of ultrafiltration of dirty canal water and salt water desalination. The visit was sponsored by the CSIRO Scientists in Schools program (www.scientistsinschools.edu.au). With the help of the class teacher, Ms Heather Neilson, he gave the talk to a year 11 chemistry class and the students were very interested in the topic and discussed their ideas and participated in the demonstration. The talk fitted well with the current activity in water quality that Ms Neilson had been teaching the students. They learnt about the issue of water in Australia, the roles of scientists and engineers in addressing such problems as well as setting up the separation experiment, calculating membrane area and flow rate, measuring water quality, adjusting flow and pressure as well as assessing results. Mikel plans to continue to deliver similar classes to schools in Melbourne’s Western Suburbs as part of the CSIRO program.

Professor Nagendra Shah, 3rd Symposium on Propionibacteria and Bifidobacteria: Dairy and Probiotic
Applications, Oviedo, Spain, June 1–4, 2010 (invited speaker).

Dr Peter Sanciolo attended the Membranes in Drinking and Industrial Water Treatment Conference (MDWV), Trondheim, Norway, 27–30 June 2010.

Professor Nagendra Shah, 1st China International Conference on LAB and Technological Innovations of Fermented Dairy Products, Huhhot, China August 06–08, 2010 (keynote speaker).

Professor Paul Boon travelled to Canberra, Hobart and Warrnambool in August to give a number of presentations and met with NRM staff. In Canberra he delivered a lunchtime seminar on how to assess the value of environmental watering trials, to the Commonwealth Environment Water Holder and the Department of Environment, Water, Heritage the Arts. He followed up that morning seminar with afternoon discussions with a number of the staff in both Departments as to how (and where) they can most effectively invest in buying water for the environment. While in Canberra he also visited CSIRO’s Division of Land & Water, to continue discussions with Dr Phillip Ford and Ian Webster on estuarine modelling.

In Hobart, Paul gave a presentation to the Department of Primary Industries, Water, Environment and Parks, on the salt marsh project he recently completed for the National Heritage Trust. He also gave a departmental seminar to the Geography Department at the University of Tasmania on the Gippsland Lakes rehabilitation project he recently completed, as well as a 2hr lecture to their 3rd year Environmental Management students on environmental waterings trials. Afterwards he went on a 3 day inspection of coastal salt marsh sites with two geography staff from the University.

After the Canberra and Tasmania trips, Paul went to Warrnambool, where he met with staff from DSE and the Glenelg-Hopkins CMA to finalise a forthcoming ARC Linkage grant proposal on the management of coastal salt marsh in south west Victoria. He presented a lunch-time seminar on the salt marsh project to staff from both agencies, along with some from Parks Victoria and Deakin University.

Dr Marlene Cran attended and presented her paper on Non-Isothermal Non-Arrhenius Kinetics in Polymer Degradation and Degradation of rubber in the presence of chloramine or hypochlorite, MoDeST 2010GR, 6th International Conference on Modification, Degradation and Stabilization of Polymers, Athens, Greece, 5–9 September 2010.

Professor Chris Perera presented the paper on Drought Forecasting Using an Aggregated Drought Index and Artificial Neural Networks at the IWA World Water Congress and Exhibition in Montreal, Canada, 19–24 September 2010. When he was in Montreal, he was invited to McGill University to present Victoria University’s research work on climate change and water resources at the 9th Annual Symposium of the Brace Centre for Water Resources Management.

Professor John Cary attended and presented his paper on social benchmarking to improve river ecosystems, IWA World Water congress, 19–24 September, Montreal, Canada.

Professor Paul Boon attended the 3 day conference on practical responses to climate change, hosted by Engineers Australia in Melbourne in late September. He presented a paper on the likely impacts of sea-level rise on the fringing vegetation of Western Port, 28 September 2010.


Professor Stephen Gray attended the Intelligent Networks workshop, Melbourne, 30 September 2010.

Professor Jun De Li and Jianhua Zhang attended the Euromed 2010 conference on Desalination for clean water and energy. Jianhua presented on Researching and modelling the dependence of MD flux and energy efficiency on membrane dimension for scale up purpose, Tel Aviv, Israel, 3–7 October 2010.

Professor Stephen Gray attended the Committee for Economic Development of Australia (CEDA) workshop Creating sustainable and liveable cities in Australia, Melbourne, 13 October 2010.

Assoc Professor Mikel Duke gave a talk to Professor Zhao’s group at the Laboratory of Advanced Materials, Fudan University entitled Tailored functionality and phenomena in advanced inorganic membranes: How can these solve our energy and water issues? 26 October 2010.

Adjunct Professor Syed Hussainy attended a 2 day conference on the ecology and management of the Gippsland Lakes and other coastal lagoons in south-eastern Australia, Lakes Entrance, Melbourne, 27–28 October 2010.

Professor John Cary attended the Water Reuse and WSAA Speciality Conference, Sydney, 14–17 November.


Dr Marlene Cran presented case studies in membrane autopsy at Victoria University, IMSTEC/AMS6 Pre Conference Workshop, 22 November 2010.

Dr Marlene Cran, Mr Jianhua Zhang, Miss Jessica Lai, Dr Peter Sanciolo, Professor Stephen Gray, Assoc Professor Mikel Duke, Dr Lata Ramchandran, Miss Angela Hausmann, Dr Bo Zhu, Miss Yaoxin Hu, Ludovic Dumée and Darli Myat attended the AMS6/IMSTEC10, Sydney, 22–25 November.

Assoc Professor Mikel Duke chaired the IMSTEC workshop with Dr Simon Smart of UQ Tailored advanced materials for major energy and water applications and gave a talk on Ceramic membranes in water treatment, IMSTEC/AMS6 Pre Conference Workshop, 22 November 2010.

Dr Bo Zhu, Research in Water Treatment with Inorganic Membranes at VU, 3rd International Symposium on Inorganic Membranes, 26 November 2010, Melbourne, Australia.

Dr Matthew Stewart attended and co-authored a poster presentation at the MW2010 – Advances in Biomolecular and Materials Modelling conference, Monash Institute of Pharmaceutical Sciences (MIPS), Melbourne. The poster was entitled Can multiple OH moieties act in concert in polyphenolic antioxidants? 28 November to 1 December 2010.


Assoc Professor Mikel Duke attended the Water recycling workshop at the Australian Water Recycling Centre, Brisbane, 9 December 2010.
BOOK CHAPTERS


JOURNAL PUBLICATIONS


Salter J, Morris K, Read J & Boon Pi (in press), Effects of drying, salinity and temperature on seed germination of the submersed wetland monocot, Vallisneria australis. Fundamental and Applied Limnology. 177 (2): 105-114


Burn, S., Marlow, D. and Tran, H. D., Modelling Asset Lifetimes and Their Role in Asset Management, Journal of Water Supply: Research and Technology - AQUA. [On line as per email dated 06/sep/2010].


Jing He, Yanchun Zhang, Yong Shi, Guangyan Huang: Domain-Driven Classification Based on Multiple Criteria and Multiple ConstraintLevel Programming for Intelligent Credit Scoring. IEEE Transaction on Knowledge and Data Engineering. 22(6): 826-838 (2010).


CONFERENCE PAPERS

S. Muthukumaran and K. Baskaran, Integrated Water Management and Reuse in Poultry Processing Plant, A Case Study, EWRI International Conference Jan 5-7, 2010 - Chennai, India

C. Subramaniam, S. Muthukumaran and K. Baskaran, Reduction of Sodium Loadings in Waste Water Streams from Food and Beverage Industries, EWRI International Conference Jan 5-7, 2010 - Chennai, India

Peter Sanciolo, Eddy Ostarcevic, Paul Atherton, Greg Leslie, Tony Fane, Yoram Cohen, Marrack Payne, Stephen Gray. Crystallisation to enhance reverse osmosis recovery. AWA Ozwater10, 8-10 March, 2010, Brisbane, Queensland, Australia, paper 005

Noel Dow, Mikel Duke, Jianhua Zhang, Tom O’Rielly, Jun-de Li, Stephen Gray, Eddy Ostarcevic, Paul Atherton. Demonstration of solar driven membrane distillation in remote Victoria. AWA Ozwater10, 8-10 March, 2010, Brisbane, Queensland, Australia, paper 036


Bo Zhu, Stephen Kennedy, Gayle Morris, Il Shik Moon, Sam Ryed Yang, Do Mun Choi, Stephen Gray, Mikel Duke. Application of ceramic membrane and novel ozone cleaning for reuse of secondary effluent in Melbourne. AWA Ozwater10, 8-10 March, 2010, Brisbane, Queensland, Australia, PD15.02


Nalin Sharda. Integrated Water Management: Models for Integrating rainwater, greywater and freshwater use in Australian homes with digital ecosystems. AWA Ozwater10, 8-10 March, 2010, Brisbane, Queensland, Australia, paper 057


M. Yusuf, M. Millikan, Shelf life studies of oranges stored at a series of low temperatures, AIFST 43rd Annual Conference., Albert Park, Melbourne, July 2010

H. Trevean, H.Xu, M. Millikan, Analysis of Chinese herbal tea used for women’s health, AIFST 43rd Annual Conference, Albert Park, Melbourne, July 2010
A. Kolasisani, H. Xu, M. Millikan, Analysis of the metal content of some Chinese herbs from different parts of the plant, AIIFST 43rd Annual Conference, Albert Park, Melbourne, July 2010

M. Yusuf, G. Thorpe, M. Millikan, Determination of the rate of decay of several pesticides on fresh fruit, RACI, 13th National Convention in conjunction with the 12th IUPAC Congress of Pesticide Chemistry, Melbourne, July 2010


J.D. Orbell, S.W. Bigger, L.N. Ngoh, K.T. Munaveera, R. Jessop, M. Healy and P. Dann, The development of prototype magnetic particle technology (MPT) equipment for providing a ‘quick clean’ to oil contaminated wildlife, 29 Aug – 4 Sept 2010, 7th International Penguin Conference, Boston, USA

Stephen W. Bigger, Marlene J. Cran, John Scheirs and Norman C. Billingham, Non-Isothermal Non-Arrhenius Kinetics in Polymer Degradation, MoDeSt 2010GR, 6th International Conference on Modification, Degradation and Stabilization of Polymers, 2010, 5-9 September, Athens, Greece

Marlene J. Cran, Stephen R. Gray, Stephen W. Bigger, John Scheirs, Degradation of rubber in the presence of chloramine or hypochlorite. MoDeSt 2010GR, 6th International Conference on Modification, Degradation and Stabilization of Polymers, 2010 5-9 September, Athens, Greece


Angela Hausmann, Membrane distillation as an energy and water saving solution for dairy processing, AMS6/IMSTE10, 22 – 25 November, Sydney

Marlene Cran, Effect of concentration and exposure time on the chemical degradation of polyamide reverse osmosis membranes, AMS6/IMSTE10, 22 – 25 November, Sydney

Ludovic Dumée, Controlled porosity and pore size of metal reinforced carbon nanotube membranes, AMS6/IMSTE10, 22 – 25 November, Sydney