

Collaborative Partnerships

The way forward for regional research

Abstracts and Presentations

Presented by University of Ballarat and GWMWater
29 November 2011





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9.00 am	<p>Welcome and introductions David Battersby, Vice-Chancellor, University of Ballarat Jeff Rigby, CEO, GWMWater</p>
9.15 am	<p>Pathways to successful research in Wimmera/rural & regional areas Allan Curtis, Charles Sturt University (sponsored by Wimmera CMA) Sue Brumby, National Centre of Farmer Health, Deakin University</p>
10.45 am	Morning tea
11.00 am	<p>Current Research in the Wimmera – Joint UB & GWMWater projects Chris Perera & Walter Godoy Victoria University – Optimising Water Resources under climate change Michelle Graymore University of Ballarat – Regional sustainability report card Imogen Schwarz University of Ballarat - Farmers attitudes and adaptation behaviours to climate change Christine Hallinan University of Ballarat – Rural Health Policy and Priorities - A pilot study of the practice nurse Pap testing initiatives John Orbell Victoria University – Control of biofouling of water distribution networks</p>
1.00 pm	Lunch
2.00 pm	<p>Current Research in Wimmera – Student projects Kate Morrison GWMWater/University of Ballarat - Hydrogeology of the Laharum Region La Vergne Lehmann University of Ballarat - Sustainable Water management in Tourism Paul Atherton GWMWater/University of Ballarat - The role of the provision of potable water in small town renewal Helena Mala-Jetmarova GWMWater /University of Ballarat – Optimisation of Water Quality in a Large Scale Regional Water Distribution System Romany Witton LaTrobe University - Investigation into aquifer recharge in the Duddo Limestone, western Victoria. Michael Shiell University of Ballarat - Trace: an exploration of alternative means of documenting Ephemeral Environmental Art</p>
3.40 pm	Afternoon tea
4.00 pm	<p>What's next...collaborative research partnerships in the Wimmera</p> <ul style="list-style-type: none"> ○ UB opportunities & facilities (Frank Stagnitti) ○ Student's perspective of opportunities (La Vergne Lehmann) ○ GWMWater research structure, opportunities for staff, GWMWater-UB MoU and GWMWater strategic research plan (Paul Atherton) ○ Research needs in the Wimmera <p>Research Panel: Frank Stagnitti (University of Ballarat), Rob Pyers (Dimboola Memorial Secondary College), David Brennan (Wimmera CMA)</p>
5.00 pm	<p>Close Networking - Drinks and nibbles</p>



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Thanks to our sponsors for supporting The University of Ballarat- GWMWater Regional Research Forum. They are Wimmera Catchment Management Authority, Wimmera Development Association, Wimmera Mallee Sustainability Alliance and the Horsham Rural City Council.

The organising committee for today's Research Forum are:

Michelle Graymore (Chair), University of Ballarat
La Vergne Lehmann, University of Ballarat
Christine Hallinan, University of Ballarat
Andrew Barton, GWMWater
Paul Atherton, GWMWater

Optimising water resources under climate change

Chris Perera and Walter Godoy

Faculty of Health, Engineering and Science, Victoria University

Many water supply systems in Australia are currently undergoing significant reconfiguration due to reductions in long term average rainfall and resulting low inflows to water supply reservoirs since the second half of the 20th century. When water supply systems undergo change, it is necessary to develop new operating rules, which should consider climate, because the climate change is likely to further reduce inflows. In addition, water resource systems are increasingly intended to be operated to meet complex and multiple objectives representing social, economic, environmental and sustainability criteria. This is further complicated by conflicting preferences on these objectives from diverse stakeholders. This presentation describes a methodology to develop optimum operating rules for complex multireservoir systems undergoing significant change, considering all of the above issues. The methodology is demonstrated using the Grampians water supply system in northwest Victoria, Australia. Initial work conducted on the project will also be presented.

Regional Sustainability Report Card: A tool for building sustainable regional communities

Michelle Graymore

Horsham Campus Research Precinct, University of Ballarat, Horsham, Victoria

The vision of many regional plans across Australia is to build a 'sustainable region for the future'. Yet there is little information available about the sustainability of our regional communities to inform local government policy, individual or collective action to enhance regional sustainability. What is needed to fill this gap is an easy to use framework for developing locally relevant sustainability report cards that can inform regional managers and provide information to community to help direct change to build a sustainable region. In South West Victoria, the Great South West Community Report Card is being developed to report on the sustainability of the region (including its community and environment) to Local Governments and community. The Community Report Card will be based on a set of locally relevant indicators of sustainability, which were agreed to by the community and its stakeholders. The project will develop a template for the Community Report Card and protocols for on-going use in South West Victoria. Once developed, the template and protocols will be presented to other regions across Victoria to encourage other regions to adopt sustainability reporting.

Farmers attitudes and adaptation behaviours to climate change

Imogen Schwarz

Horsham Campus Research Precinct, University of Ballarat, Horsham, Victoria

In 2009, the Victorian Farmer survey on Climate Change was conducted as part of a collaborative partnership between DPI and the University of Ballarat. The aim of the survey was to capture the views of farmers in relation to climate variability, greenhouse gas emissions and climate change. Over 1500 farmers participated in the survey from seven farming sectors (Grains, Mixed, Dairy, Livestock, Horticulture, Forestry, and Periurban) and eleven regions across Victoria. The Wimmera and Mallee were two such regions covered in the data analysis. Study results include a profile of each region according to farmer attitudes and adaptation behaviours related to climate change. This presentation reports on the major findings of the Wimmera and Mallee regions. In particular, it will highlight the ways in which Wimmera and Mallee farmers are adapting to a changing climate.

A pilot study of the practice nurse Pap testing initiatives: An evaluation of their impact on cervical screening activity in Grampians general practices.

Christine Hallinan

Horsham Campus Research Precinct, University of Ballarat, Horsham, Victoria

Over the past two decades, strategies have been put in place to promote a sustainable primary care workforce which is equipped to provide preventive services across the Australian population. Included in these strategies was the delivery of a coordinated cervical screening program for the early detection and treatment of pre-cancerous cervical cell changes. At the same time, measures in the form of general practice macro-reforms also ensured that workforce, which included practice nurses, had the skill base and capacity to undertake these services in an environment that was burdened with unsustainable patient loads. These reforms were delivered across general practices in both rural and urban environments. Of concern, and in spite of these reforms, is Victorian cervical screening data that indicates the rates of cervical screening (Pap test participation) in the Grampians region is consistently the lowest in the State. The recorded rates of Pap test participation in the Grampians region ranges between 50% and 55%, which is almost 20% lower than the overall participation rate, and is about 30% lower than the highest recorded participation rate for Victorian women aged between 18 and 69.

The study incorporates a mixed method evaluation of Pap nurse incentives to enable a better understanding of the factors embedded in the practice nurse (PN) Pap initiatives that have influenced cervical smear screening in Grampians general practices from 2005 to 2011. The mixed method evaluation comprises two major evaluatory stages, a clarificative stage followed by a summative stage. During the clarificative stage quantitative and qualitative data is gained from a literature review and data set analysis. The information gained at this stage is used to test assumption validity, inform early theory development and facilitate program logic model development. Throughout the summative stage, qualitative data collected from key informant interviews (n=14) will be collected, coded, analysed and synthesised. This qualitative data will be scrutinised for repeating and emergent themes that align with the theories developed in the clarificative stage. At this stage the data will also be explored for anomalies that may indicate flawed assumptions or unintended outcomes which were not made explicit in the clarificative stage.

It is intended the research will test the evaluation methodology and also provide feedback into future evaluation research and policy development. Publication will facilitate the dissemination of the pilot outcomes to general practice stakeholders, policy makers and governments.

Control of Biofouling in Water Distribution Networks

John Orbell and Robin Mitra

School of Engineering & Science/Institute for Sustainability & Innovation, Victoria University

Paul Atherton, Andrew Barton and Steven Briggs

GWMWater

One of the more resilient and problematic biofoulers in water distribution networks are Bryozoans, the colonies of which are sometime referred to as “pipe moss”. These ancient organisms are aquatic invertebrate animals with complex life cycles. A large number of both freshwater and marine Bryozoan species are distributed across the world and around 60 different freshwater species are known to exist. The sponge-like colonies of these microorganisms are notorious worldwide for clogging pumps and filters in water distribution systems. The freshwater species have evolved a resting-stage mechanism in which asexual buds known as statoblasts serve as efficient agents for asexual reproduction, dispersal and overwintering. A statoblast consists of two sclerotized chitinous valves within which the yolky mass, the regenerative cells and the genetic material for the propagation of the next generation are enclosed.

The highly evolved statoblasts make Bryozoans difficult to control and almost impossible to eradicate. Notably, the valves of a statoblast often bear minute micro-ornamentations that are distinctly species specific. To date, the topography of these hard parts is the primary diagnostic feature for species identification – usually via scanning electron microscopy (SEM). For the development of more sophisticated and targeted ways of controlling these organisms, species identification within a particular system is important since the detail of the biofouling mechanism is also species specific.

A three year collaborative project between Victoria University and GWMWater has been aimed at the characterization of Bryozoan infestation in the Northern Mallee Pipeline (NMP) system. At the start of the project in 2008, although the problem of biofouling by these organisms had been recognized for some time, no species had been definitively identified. Over the last three years, this project has established a research platform for systematically addressing the issues associated with Bryozoan infestation, both in the NMP and generally. Thus a fully comprehensive literature database has been established, protocols for field trips and sampling have been developed, five extensive field trips have been conducted and samples collected from selected locations, sample preparation and SEM identification procedures have been refined and applied to the identification of ten different species. Furthermore, cultivation facilities have been established at the St. Albans Campus of Victoria University (VU) and one species has been successfully germinated in the laboratory from statoblasts. In addition, a “field laboratory” has been set up at Ouyen to allow whole colonies to be harvested and transported to the cultivation facilities at VU. These are important steps towards cultivating colonies in the laboratory for carrying out systematic chemical and physical control experiments.

Hydrogeology of Laharum region

Kate Morrison

School of Science, Information Technology and Engineering, University of Ballarat and GWMWater

Groundwater resource management is crucial in western Victoria as many rural communities rely solely on groundwater, especially in times of low rain fall. Undertaking detailed investigation of a groundwater system, including visualisation consisting of 3D mapping and modelling, greatly improves the understanding of the groundwater resource. This research aims to map and model the groundwater systems of the Laharum area enabling the unique hydrogeology to be visualised in 3-dimensions. To produce the visualisation the research will adopt the current Victorian framework for describing aquifers and use MapInfo/Discover computer programs. The research so far has collected important data to produce the conceptual model which will then be used in producing the map and model. This consists of pumping test to determine capacity of the aquifer and information from a project where exploratory drilling was used to gain first hand lithology information. The research will assist in groundwater management and refining the best approach for better understanding of these types of small scale groundwater systems and to better target future studies and methods.

The water challenge! Can tourism accommodation operators sustain current water use practices?

La Vergne Lehmann

The Business School, Horsham Campus Research Precinct, University of Ballarat, Horsham

It has been recognised around the world that there is an increasing need to improve the management practices for water use in tourism accommodation developments. Water issues have become even more critical when considering the number of regions that are now impacted by increasingly dry conditions. Evidence presented at the Climate Change and Tourism Conference held at Djerba in 2003, brought to the attention of researchers the complexity of the interrelationship between fresh water and tourism in dryland regions.

The focus for this research has been the dependent and independent variables associated with freshwater use in tourism accommodation enterprises. The dependent variable is the consumption of freshwater at each tourism accommodation enterprise and the independent variables are the intrinsic and extrinsic factors that have the greatest impact on the enterprise operator. The key variables that are likely to influence how operators manage their water resources were identified through the literature.

A case study involving tourism accommodation operators in the Australian western Victorian region of the Grampians and Wimmera Mallee regions has been developed. These regions have been in a prolonged drought situation there has been limited research to assess the impact of an increasingly water constrained environment on the tourism accommodation sector or on how these enterprises are managing changes to their freshwater resources. A survey of one hundred accommodation enterprises to establish which water management strategies have been implemented or planned was undertaken. Identified from the survey, this was followed up with six comprehensive interviews with operators who have undertaken significant changes to water management practices.

While the main focus of water management is on the supply side, this research has also recognised that guests influence how operators manage their water resources. The demand side has been addressed through a content analysis of marketing materials, thereby providing an indication of what accommodation operators think their potential guests are seeking when they choose their accommodation.

Through identifying the extent to which these factors influence freshwater use in different styles of tourism accommodation enterprises it has been possible to identify the relationship between the dependent and independent variables and if this relationship varies between different styles of tourism accommodation businesses. This has informed the development of a range of strategies to guide sustainable fresh water use across tourism accommodation enterprises in dryland regions.

The role of potable water provision in assisting small town renewal in western Victoria.

Paul Atherton

The Business School, Centre for Regional Innovation and Competitiveness, University of Ballarat and GWMWater

Many small towns and rural areas in dryland broadacre regions of Australia have undergone population decline since the 1970s. In some instances these towns have undergone subsequent renewal and hence provide possible examples of how small towns and rural areas may undergo renewal and growth. This study sought to examine whether or not providing potable (drinking) water to small towns has assisted in renewal of towns. The study focussed on the towns of Lake Bolac, Underbool and Willaura which have all been in decline and have been converted from a non-potable to a potable water supply in the last five years.

Residents and businesses owners in each of the study towns were asked to consider whether they believed providing drinking water to their town had improved town liveability, attracted new residents, attracted new businesses or had encouraged visitors to stay longer in the towns. The findings suggest there is great uncertainty among residents and businesses about whether providing drinking water has improved liveability, attracted new business, resulted in visitors staying longer or attracted new residents. When comparing the examined features against cited examples of small town renewal, the study indicated that providing drinking water to small towns is more likely to have a positive impact on small town renewal through improved liveability. Positive impacts on attracting new residents and encouraging visitors to stay longer were less likely, while attracting new businesses was least likely.

For drinking water service providers, the results of the study provide no further evidence that is likely to encourage significant investment in infrastructure to stimulate growth within small towns. It will need to be recognised that provision of water to small towns is likely to be at a significant cost, and in order to meet health and essential service obligations only.

Multi-objective optimisation of the operation of complex water distribution networks using genetic algorithm: tradeoffs between pump operation and water quality

Helena Mala-Jetmarova

School of Science, Information Technology & Engineering, University of Ballarat and GWMWater

Operation of water distribution systems (WDS) represents a large portion of expenditure for water corporations. In recent years, there has been substantial research focused on the optimisation of WDS in order to minimise costs for their operation especially for pumping, water treatment and disinfection. Additionally, there has been research on the optimisation of water quality to assure that water delivered to customers complies with water quality requirements. These research objectives were mainly considered as single objectives and so consequently, tradeoffs between optimal operation and water quality, which is important for decision making, is not fully understood.

The Wimmera Mallee Pipeline (WMP) is a unique large scale WDS recently completed in Western Victoria to supply water to variety of customer groups including towns, rural properties, and other agricultural, industrial and environmental water users. The WMP, which comprises 8,800 kilometres of pressurised pipelines and covers an area of 20,000 square kilometres, sources its water from several different locations each with different water qualities. These system characteristics make the WMP an ideal case study for research of optimal operation and water quality.

This research project aims to identify the tradeoffs between the two objectives of optimal pump operation and optimal water quality. Work completed to date has shown the software EPANet (<http://www.epa.gov/nrmrl/wswrd/dw/epanet.html>) as a suitable simulation package for the simulation of both hydraulic and water quality behaviour of the WMP. The optimisation model will be constructed using the Nondominated Sorting Genetic Algorithm NSGA II which is available within the software GANetXL (<http://centres.exeter.ac.uk/cws/technology/ganetxladdin>). Integration between the simulation and optimisation model will be developed through Visual Basics for Applications (VBA) of which there is previous work to draw experience from. This integration approach will enable the iterative solution process between the two models to be automated in order to obtain a set of optimal solutions (Pareto-optimal solutions) or tradeoff curves.

This research requires knowledge and understanding from a range of disciplines including pipeline hydraulics, water quality, optimisation techniques, and integration skills between the two modes of hydraulic and optimisation modelling. An outcome of this work of relevance to the water industry will be a more sophisticated means to consider the problem of achieving more efficient pipeline operations.

Investigation into aquifer recharge in the Duddo Limestone, western Victoria

Romany Witton

La Trobe University, Bundoora

The Duddo Limestone aquifer, in western Victoria, is a valuable groundwater resource. There is concern that the aquifer contains only fossil groundwater and so is not viable as a town water supply for the town of Edenhope, whose normal water supply, Lake Wallace, was reduced to very low levels during the recent drought. Investigations were also conducted into managed aquifer recharge (MAR) into the Duddo Limestone aquifer.

Major ions and stable isotopes were analysed and used to characterise the groundwater chemistry and date the groundwater. Data from this study was compared with that from Dogramaci & Herczeg (2002) and Leaney & Herczeg (1999) on the same aquifer, to show that salinity and groundwater age vary due to the differing influences in the Duddo Limestone.

A plot of strontium isotope ratio against ^{13}C of the dissolved inorganic carbon for groundwater in the Duddo Limestone distinguished five groups of differing compositions.

Group 1 is characterised by a Sr isotope ratio similar to rainfall (~ 0.7095), low salinity (average 1100 RS.cm^{-1}) and a S^{13}C signature of -10‰ to -16‰ , which is due to input from both recharge under a previous climate and point source recharge. One sample (#20) shows an enrichment of Ca^{2+} and Mg^{2+} relative to rainfall, and a young uncorrected radiocarbon age of ~ 3500 years BP due to rapid recharge by dolines. The remaining three samples show a depletion of Ca^{2+} and Mg^{2+} and older radiocarbon ages ($> \sim 13\ 100$ years BP), and were recharged under a past wetter climate.

Group 2 has the highest salinity of the five groups (average ~ 9000 RS.cm^{-1}). The recharge of this group is low (up to 0.4 mm/yr), and is impeded by the Loxton Sand clay layers.

Groups 3 and 4 have similar strontium isotope ratio compositions (0.7087 – 0.7094), reflecting influences from both limestone and rainfall. They differ in S^{13}C and uncorrected radiocarbon age (~ 3500 years BP and $\sim 10\ 000$ years BP, respectively) and recharge influences. Groups 3 and 4 represent a mixture of current recharge and recharge under a previous climate; a past arid climate and wetter climate, respectively. Two samples within Group 4, like sample #20 in Group 1, show an enrichment of Ca^{2+} and Mg^{2+} relative to rainfall and are currently being recharged by dolines.

Group 5 is composed of a small number of samples with $^{87}\text{Sr}/^{86}\text{Sr}$ ratios and S^{13}C values that resemble those of the Duddo Limestone and represent incongruent dissolution of high-Mg calcite. They were recharged under a previous climate.

The groundwater of the Duddo Limestone at the managed aquifer recharge (MAR) site is of a good quality, and the artificial recharge into the aquifer needs to be of a similar quality. The MAR site is a lake where low leakage rates into the aquifer occur, so it can maintain the water quality and hold the water prior to injection into the Duddo Limestone aquifer.

Trace: an exploration of alternative means of documenting Ephemeral Environmental Art

Michael Shiell

Arts Academy, University of Ballarat

Environmental Art is the post 1960's practice of sited creative interaction with the land. Of specific interest for this research is the sub-branch of this practice that focuses on works made with natural indigenous materials of the site used to create ephemeral forms that are intended to retrogress back into nature. The ephemeral intent of these works results in their forms often being documented through secondary processes, most frequently photography. This research considered the notion of documentary appropriateness, in relation to the original conceptual intent for the onsite interaction, and therefore the method and materiality of the created record.

The regional focus for this research was necessitated by the onsite nature of the original artistic interaction. As maintaining the directness of connection between the onsite work and the creation of the record was considered as a point of concern, the regional basis was vital.

Research Panel Discussion

Frank Stagnitti, PVC Research UB

The University of Ballarat aims to provide knowledge transfer for rural and regional communities and play a role as a knowledge broker for these communities in areas where UB lacks the expertise.

UB also strives to work with industry and community partners to deliver better outcomes for rural and regional Australia in particular the communities we serve, including the Wimmera.

Need to define what the problems and research needs are for the region.

Paul Atherton, Manager Research and Regional Development GWMWater

GWMWater has a focus on applied research that provides benefit to the business and its customers.

Provides opportunities for staff to carry out further study in a field related to their work through PhD, Masters and Honours as an incentive to stay at GWMWater.

Rob Pyers, Principal Dimboola Memorial Secondary College

Developed the Wimmera Virtual School with other schools in the region to provide greater course choice to their VCE students, which has expanded to 13 schools providing 30 VCE subjects. Deakin University currently investigating the effectiveness of this project.

Challenges for small towns and their schools are:

- Student/family occupation index is increasing
- Retention of students and the transitional nature of the population
- Changes in technology places pressure on the school
- Lack of other professionals in the school population/town population (the school staff make up the majority of professionals in town and are involved in/drive many organisations in these towns – issue with loss of schools for these towns)
- Dependence of small towns on schools and the professionals associated with them
- Change in rural communities

David Brennan, CEO Wimmera CMA

Vision for the WCMA is “people are living sustainably and profitably within the landscape and where our natural resources flourish”

Regional Catchment Strategy provides opportunities for research particularly around what the community wants the Wimmera to look like in the future. The drivers, needs and aspirations of the community.

Have the largest landholder database of market based instruments which could be used for benchmarking the use of these instruments for Australia

Open Discussion

Chris Pittock DPI suggested that strategies are required to tap into all the information in the archives of all the agencies and organisations in the region, as well as what is in the knowledge staff have to prevent loss of what we already know.

The knowledge of the large network of retired people in the Wimmera need to be utilised.

Helen Thompson UB suggested that the National Broadband Network provides some opportunities to help with the archived information and other rural issues.

Peter Dahlhaus UB suggested that partnerships between university and other organisations allows access to a wider range of grants for both partners. He suggested that we need to determine what the problems need to be solved and then look for funding.

Researchers need to play a larger role in policy advocacy and determining what knowledge needs there are for policy and lobbying for these gaps to be filled. Also need to make a difference in the community we are in. Look for the moral purpose or need and develop a project to address that need or purpose.

What is needed? *Gil Hopkins WDA* suggested that we need to look at what impacts increasing global population, climate change, extreme events, energy pricing, and global financial issues are going to have on the region. In particular, immigration and population shifts likely to happen, disease rates and health issues, heat stress, food security, etc.