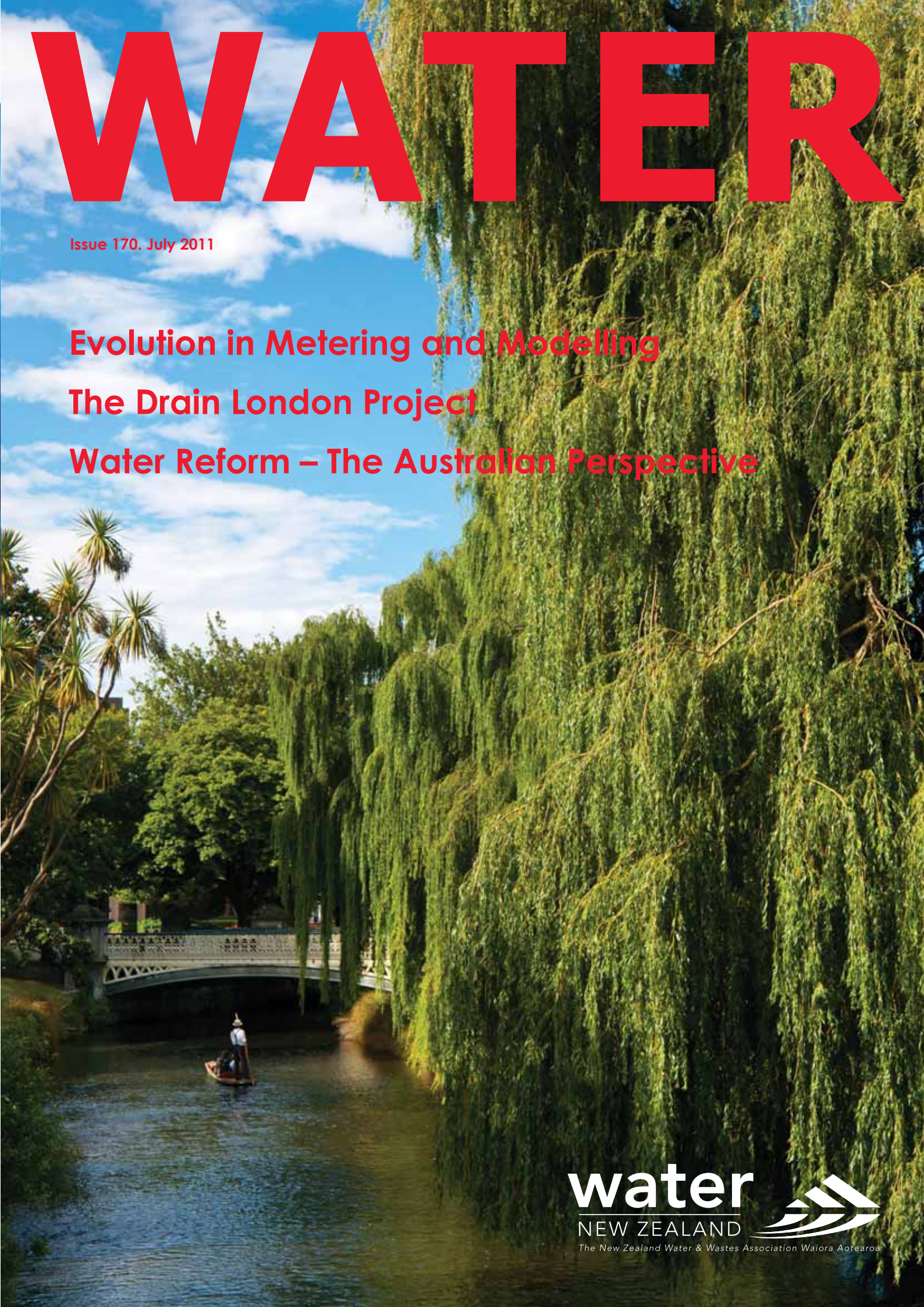
WATER

Issue 170. July 2011

Evolution in Metering and Modelling

The Drain London Project

Water Reform – The Australian Perspective



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On the Cover

Water New Zealand News

Features and Articles

Cover photo: istock.com

The official journal of *Water New Zealand* – New Zealand's only water environment periodical. Established in 1958, *Water New Zealand* is a non-profit organisation.

Clive Rundle

Annual Conference Continues as Highlight in Our Calendar

"Some quite significant changes to the annual conference are being implemented this year and I want to highlight the reasons for these and the benefits we expect to flow."

Our annual conference is the highlight in our calendar as it provides members with the opportunity to gather together to share new ideas, renew relationships and build new ones. It is important that these events are successful, for both our members and those organisations that provide financial support to the conference through sponsorship and the trade exhibition, and for this reason we strive for improvement each year. Some quite significant changes to the annual conference are being implemented this year and I want to highlight the reasons for these and the benefits we expect to flow. Most of these changes have come about through consideration of comments from our conference feedback surveys.

The first change is that the annual conference will be held later than normal to avoid a clash with the Rugby World Cup in September and October. We have rescheduled the conference for Wednesday the 9th to Friday the 11th of November in Rotorua. You may wish to put these dates in your diaries now.

Secondly we have changed the conference format to two full days of papers to be followed by a lecture-free final day. The annual dinner and awards ceremony will be held as usual on the Thursday evening.

There are several benefits associated with this revised format.

Delegates have highly rated the forums we have held at the last two conferences, so we are planning to build on this in 2011. The revised format will allow more time for a forum on a topical issue, scheduled after morning tea on the final day, to avoid clashing with the paper presentations.

Completion of paper presentations by Thursday evening will allow the paper awards to be presented as part of the awards ceremony at the conference dinner, instead of at the lunch on the final day which is not as well attended. Logistically this also allows more time for marking papers and enables us to celebrate the success of our best and brightest at the main dinner.

The technical programme has also been tightened up. There will be five streams of technical papers at the event this year compared with the more usual seven (or eight as occurred last year). The smaller number of papers will enable the technical committee to only select the very best papers that maximise the transfer of knowledge between members. We will also be increasing efforts to exclude papers with a 'commercial' focus.

The Annual General Meeting has also been rescheduled and will be held first thing on the Friday morning. The juxtaposition of annual meetings with the conference programme has often been problematic. This rescheduled time should take pressure off both organisers and delegates.

Our trade exhibitors are very important to the financial success of the event and they extract value through contact time with delegates. A lecture-free final day will allow more time for delegates and exhibitors to interact.

The Board will monitor the success of these changes and we look forward to your feedback on the revised format. We also look forward to seeing you at the event – remember to diarise the 9th to the 11th of November! ■

Clive Rundle
President, Water New Zealand

new members

Water New Zealand welcomes the following new members:

DAVID CROXFORD
WILLIAM LI
CAROLINE CROSBY
LEIGHTON BEARD
SEAN WADDELL
DAVID POWELL
PAUL LOVERIDGE
CHRIS RUSSELL
CHRIS PRICE
TOM LOUTIT
SARAH COMRIE
VIJYANT CHOUDHRY
GREG THOMSON
PRASAD NORY
BRUCE FRANKS
JOHN SMITH
ERICA HOBBS
GARTH SINCLAIR
KURT JONKERS
GRANT LORIMER
NEIL MCCANN
KALLEY SIMPSON
AARON SMYLIE
BRIAN CAUGHLEY
KATHY THIEL-LARDON
SUNG MUN JUNG
EHTESHAM OWAIS

Canterbury Cover

The image used on the cover is of Christchurch's iconic Avon River. This image was chosen as a sign of solidarity to the Canterbury community as they continue to experience ongoing earthquakes.

Water New Zealand would like to extend their thoughts and support for what must be a difficult time with plenty of challenges to overcome.

Many of you involved through the water, engineering and infrastructure sectors will be working tirelessly to get vital systems and structures back up and running again as well as dealing with the damage to your own homes, workplaces and communities.

It is difficult when we cannot be certain when the quakes will end but know that you're providing a vital lifeline for the region to be able to pick itself up, rebuild, recover and once again be the thriving, international city it was.

Murray Gibb

Governance of Water Services Under Review

What would best practice governance of water services in New Zealand look like? This question is likely to occupy the minds of policy makers here over the next two years as a result of two initiatives.

The first of these was a recommendation from the Land and Water Forum that 'the way water services infrastructure is managed and organised should be investigated to consider the potential benefits of rationalisation. This includes the possibility of a national regulator with oversight of pricing and performance issues.'

In response to the LAWF recommendations the Government has agreed to a work programme on the next steps for water reform. Decisions on options for improved water governance will be considered by the Cabinet in February next year.

The second is a decision to initiate a review of the role of local government. The supporting Cabinet paper from the Minister for Local Government entitled *Smarter Government, Stronger Communities: Towards Better Local Governance and Public Services* sets out the purpose of the work programme.

It is to review the structure, functions and funding of local government including the usefulness of unitary authorities for metropolitan areas; as well as the relationship between local and central government, including the efficiency of local government's participation in regulatory systems.

This review is timely, particularly when the future capacity of some smaller local authorities to fund upgrades in serviced rural areas with static or declining population bases is moot.

The aforementioned Cabinet paper advises "DIA has analysed financial performance and demographic data and has identified rural and smaller provincial councils that are potentially vulnerable. The most vulnerable districts have councils with relatively high levels of debt and rates per capita. They are characterised by small populations which are static or declining and have low density. These councils tend to have large road networks and a number of smaller dispersed water networks. Their communities have lower incomes and higher deprivation, and a greater reliance on pastoral farming."

Are there common features shared by the myriad of models for well performing water services employed across the world? Michael Rouse argues that there are. In his book *Institutional Governance and Regulation of Water Services: The Essential Elements*, he presents evidence for the features he believes are common in successful water businesses.

He is well qualified to present the case. Amongst other things he is a former President of the International Water Association, Head of the UK Drinking Water Inspectorate and Managing Director of the Water Research Centre, a large research and consultancy business. A distinguished researcher, he has advised numerous governments and international agencies on water policy and regulation.

At the top level he argues that there should be an integrated approach to policy and planning for water and sanitation services, either within one government department, or at least with a designated department having authority to lead and coordinate.

Secondly he suggests policy, regulation and delivery should be separated to give focus to the required expertise and to provide transparency.

Thirdly he suggests water services operations should be managed on a large enough scale to attract high quality management.

Fourthly, he argues that full cost recovery is essential for the sustainability of water services.

He argues that self-regulation generally fails to produce efficient and sustainable water services – that an independent body with responsibility for economic regulation is required to ensure a sense of realism in the setting of objectives and to oversee the process of turning objectives into deliverables, irrespective of whether service providers are public or private. Politicians are rarely willing to set tariffs at the level necessary for sustainable water services.

He suggests independent drinking water quality and environment regulators are required to ensure transparency.

He argues that there is little point in drinking water standards unless they are monitored and that there is little point in monitoring unless there is enforcement.

Enforcement cannot be effective unless there is a means of paying for improvement programmes, which means that drinking water quality regulation must be part of an integrated planning and tariff setting process.

This point is apt in the New Zealand context.

The Ministry of Health's 2010 Annual Review of Drinking-Water Quality in New Zealand for the period 2008/9 provides a comprehensive overview of the state of our reticulated water supplies. In this period 29% of the population on reticulated supplies was provided with water that did not comply with the protozoal standard and 10% was provided with water that did not meet the bacteriological standard. While 53% of treatment plants were compliant with the bacteriological standard, 8% of plants overall were compliant with the protozoal standard.

More recent data is likely to show an improvement for the 2009/10 year. Nonetheless progress on achieving the standard has been very slow for the many medium and smaller supplies that are not compliant because funding has been and remains problematic.

By way of contrast Scotland's drinking water quality regulator advised that in 2009 overall compliance with the drinking water quality standards at consumers' taps was 99.78%. Like New Zealand, Scotland once struggled to meet agreed standards for water services. Rationalisation of utilities there was a key element in allowing the industry to meet agreed standards.

Water policy and reticulated water services are finally getting some public policy attention in New Zealand. Lessons from the experiences of other jurisdictions will be instructive in charting a way forward. By international standards we have a fragmented system for water management overall. Responsibilities lie with at least eight government departments, 11 regional and 67 local councils. This does not align with what is generally agreed as being international best practice. There has got to be a better way forward.

Decisions on these matters will be made in the next Parliamentary term. Members are encouraged to contribute to the debate. ■

Murray Gibb
Chief Executive, Water New Zealand

Registrations Opening Soon

The Annual Conference will be held 9–11 November. Save this date in your diary now! Registrations will open via www.waternz.org.nz on Friday 22 July. An email and mailout flyer will be sent to *Water New Zealand* members prior to opening.

Conference Themes and Format

This year's core theme is ***'Advancing Water Reform'***. The Conference will have three primary streams plus full Modelling and Operations streams. Also included are IWA Science and Small Water and Natural Systems one day streams. The Format for the 2011 Conference differs from previous years. The sessions will be held on Wednesday 9 November and Thursday 10 November, followed by the Awards Dinner on Thursday evening.

Friday 11 November morning will be an opportunity for Exhibitors to hold appointments with delegates. The Conference will close at 1pm on the Friday.

Call For Nominations For 2011 Awards

Water New Zealand is now calling for nominations for the Awards below to be presented at the Annual Conference this year.

Members are encouraged to nominate suitable candidates for relevant Awards.

- CH2M Beca Young Water Professional of the Year Award
- Opus Trainee of the Year Award
- Orica Chemnet Operations Prize
- Ronald Hicks Memorial Award
- Hynds Paper of the Year: Gold, Silver, Bronze
- AWT Poster Awards: Best Poster and 2 x Highly Commended
- Water New Zealand Board: Certificate of Service
- Technical Committee Certificates
- Exhibition Awards: Best Expo Stand and 2 x Highly Commended

The definition and scope of each award, the criteria for selection, along with the nomination Forms, processes and timelines for submission can be found at www.waternz.org.nz/annualconference_awards.html

Closing Dates for Nominations are:

- 17 August: The Ronald Hicks Memorial Award
- 26 August: CH2M Beca Young Water Professional Of The Year
- 16 September: Opus Trainee Of The Year 2011

The CH2M Beca Young Professional of the Year award, will acknowledge and reward one young water professional who has made a significant contribution to the water industry and the general community, and has demonstrated exceptional achievement in the early stages of their career.

Poster Presentations – Submit Summaries Now

Poster presentations are always a popular component of the Conference. Poster summaries are due Wednesday 7 September. Please visit www.waternz.org.nz for more information and to submit your poster summary online.

Exhibition Sites

We have a record number of sites this year with over 150 sites sold. The Annual Conference Exhibition continues to be the largest trade exhibition for the sector.

Advance Notice of the 2011 *Water New Zealand* AGM and Board Elections Notice

The 2011 Annual General Meeting will be held during the Annual Conference on Friday 11 November 2011 at 9.00am in the Energy Events Centre, Rotorua. Nominations for election to the Board of Water New Zealand will be called by Tuesday 30 August. Members contemplating standing for the Board may wish to discuss the role and responsibilities of directors with sitting members of the Board.

Programme Highlights

A challenging, interesting and future focussed programme has been put together and will be available on the website from Friday 22 July. This year's conference will offer presentations covering every aspect of the water environment and its management. A forum discussion will be included in this year's exciting programme.

advancing water reform 2011

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Key Dates for Your Diary

22 July	**Registrations open**
21 September	**Earlybird registrations close**

Key Diary Dates for Presenters

20 July	**Authors advised of selection**
7 September	**Poster summaries due**
29 September	**Final papers due**
19 October	**Powerpoint presentations due**

The 7th South Pacific Stormwater Conference for 2011 4–6 May at Skycity Convention Centre, Auckland

Over the three day conference more than 270 delegates enjoyed an array of stimulating presentations including topics such as stormwater harvesting, quality and monitoring, urban stormwater treatment, river management and river and stormwater modelling.

Site visits were also part of this year's programme taking delegates around Auckland to a variety of sites, including Lucas Creek Stream, Stonefields Mt Wellington Quarry and Auckland Botanic Gardens.

This year's conference once again saw the Stormwater SIG team up with the Modelling SIG and the Rivers Group to provide an exciting and innovative stream dedicated to the three groups. The stream was complemented by interesting presentations from industry leaders.

Day one of the conference commenced with a welcome from Councillor Ann Hartley from the Auckland Council followed by a welcome from *Water New Zealand* delivered by current President, Clive Rundle.

Professor Tony Wong then presented his keynote address on linking urban liveability to stormwater management – the 'Water Sensitive City'. Professor Tony Wong is Chief Executive and Director of the Centre for Water Sensitive Cities at Monash University, Melbourne, Australia. He is internationally recognised for his research and practice in sustainable urban water management, particularly in water sensitive urban design. His expertise has been gained through national and international consulting, research and academic work and he has led a large number of award winning urban design projects in Australia and overseas.

The afternoon saw a keynote address from Grant Ockleston, the stormwater manager for Auckland Council. As the stormwater manager at Auckland Council Grant has budget and accountability for the $2.5billion dollar network that provides a stormwater service to the new Auckland City. Grant has an extensive knowledge of the water industry and a wide range of skills in environmental work. For the past 10 years he has lead Auckland Council's stormwater department and has received many awards for his contribution to the management of stormwater.

Keynote speaker William (Bill) Hunt from the North Carolina State University opened the second day of the conference with his presentation, 'Applied Research, Informed Regulators, Better Decisions'.

"Over the three day conference more than 270 delegates enjoyed an array of stimulating presentations including topics such as stormwater harvesting, quality and monitoring, urban stormwater treatment, river management and river and stormwater modelling."

Dr. Hunt is Associate Professor, Extension Specialist, and leader of the Stormwater Engineering Group at North Carolina State University in the Southeast USA. An active researcher in stormwater practice, performance and establishing stormwater metrics, Dr. Hunt and his team have published 21 journal articles on these subjects since 2009.

Bill's keynote address was followed by a very interesting feature session from Graeme Smart, Hydrodynamics Group Leader, NIWA and Bill Syme, Flood Risk Management Consultant, Brisbane. Graeme captured the delegates' attention by presenting them with images and details of the aftermath of the Queensland floods, while Graeme went on to cover the lessons learnt and where to from here.

The final day was opened by a keynote address from Hon Nick Smith, Minister for the Environment and Minister for Climate Change Issues. Nick was politically active from a young age and was influenced by a year as an AFS scholar in Delaware, USA. His address covered Government initiatives in the water and climate areas.

The conference dinner was held at the Skycity Convention Centre with the conference MC and comedian Te Radar providing another great show for the Stormwater Conference delegates. Entertainment at the dinner was also provided from two more acts. Yogi Martin, showed attendees an interesting accordion act and Phil Madsen sang a medley of of Queen songs.

Special thanks to Premier Sponsor Stormwater 360 for helping make this another successful event.

Thanks are also due to conference partners Boffa Miskell and Golder Associates, along with Hach Pacific, and Morphum Environmental, for their support as industry supporters.

Lastly many thanks to the *Water New Zealand* Stormwater Special Interest Group Conference Committee who put in a huge amount of time and effort to make this Stormwater Conference a huge success.

The Stormwater Conference Sub Committee:

- John Palmer, Consultant, Tauranga
- Jon Stammers, Waikato Environmental (2003), Waikato
- Peter Carroll, Hynds Environmental Ltd, Auckland
- Peter Hartley, AECOM New Zealand Limited, Auckland
- Nick Simpson, Aurecon New Zealand Ltd, Wellington
- Nick Brown, Auckland Council, Auckland
- Mark Pennington, Pattle Delmore Partners Ltd, Kaikoura
- Bronwyn Carson, Avenues Event Management, Wellington

Planning is already underway for the 2012 Stormwater Conference. The Stormwater Conference Committee will keep you up to date on timing and location as they are confirmed.

We look forward to seeing you at another innovative and stimulating conference in 2012. ■

NEXT ISSUE OF *WATER*

The next issue of *WATER* will be in mailboxes mid-September.

The topic for the September issue will be **Wastewater Design**.

If you wish to contribute an article or photos please contact the editor, Simone Olsen, on +64 4 473 8047 or email simone@avenues.co.nz

The deadline to submit material is 17 August 2011.

The 2011 *Water New Zealand* Backflow Conference 3–4 May at the Rutherford Hotel, Nelson

The two day conference was attended by 48 delegates who heard an array of stimulating presentations relating to Backflow.

Day one of the conference began with a keynote address from Brendon Burns, Labour MP for Christchurch central and opposition spokesperson on water issues. Brendon covered several issues including how water is a very important commodity within our community and a resource that should be protected when ever possible.

The Trade Waste SIG chair, Bruce Collier, then gave a presentation on tradewaste and the effect this has on potable water. Bruce's presentation explained what tradewaste is by definition, who produces tradewaste, why there is a tradewaste bylaw and what this bylaw protects. The presentation also included synergies between the tradewaste and backflow industries and ended in a discussion on how they compare and how they could work together.

Day one presentations also included a two hour workshop from Susie Wood, Cawthron and Wendy Williamson, ESR on Toxic Cyanobacteria, followed by an entertaining practical session on training systems using electronic assistance from Nick Fleckney. The day ended with a presentation from Barry Beaurain on the Auckland Super City, "Backflow transition to one system".

Day two opened with a presentation from John Young, Ecan, about water use and its distribution. This was followed by 10 minutes from each exhibitor on their displays over the two days. The day continued with presentations from Warren Eade, '*Trimble – the future in paperless technology*', and Graeme Mills, '*Developing a backflow policy – The Tauranga experience*'. An interactive presentation from Jon Lewis saw delegates striving to out-do one another. This was followed by an update on the NZ 2845 parts 2 & parts 3 from the committee's Diana Staveley along with a presentation from Brent Manning on the Christchurch earthquake, water issues and contamination of water supplies.

The final presentation of the conference saw Irrigation New Zealand interact with the Backflow SIG. Andrew Curtis presented irrigation issues and ideas – backflow prevention from an irrigation perspective. Andrews's presentation discussed Irrigation New Zealand and what their purpose is and he went on to explain risks in the irrigation industry and the need for backflow and irrigation to be involved together.

The conference was followed by the conference dinner at Petite Fleur where the awards ceremony was held. Congratulations to the following who were awarded the Golden Tap award: Murray Cockburn, Kevin Healy and Murray Ellis. This award recognises outstanding contribution and service to the backflow industry. Congratulations to Richard Aitken who was recognised for services as a member of the Backflow Committee. Congratulations also go to the winner of the highest achiever in the Backflow testers' course, Brad Winkel.

"Day one of the conference began with a keynote address from Brendon Burns, Labour MP for Christchurch central and opposition spokesperson on water issues. Brendon covered several issues including how water is a very important commodity within our community and a resource that should be protected when ever possible."

Special thanks to our premier sponsor Reliance Worldwide and sponsors Hydroflow, Deeco and Master Plumbers for helping make this another successful event.

Thanks are also due to the *Water New Zealand* Backflow Special Interest Group for investing their time to help organise the conference.

Lastly special thanks go to Graeme Mills, the Acting Chairman, for stepping in and making sure the event was able to go ahead.

The next *Water New Zealand* Backflow Special Interest Group conference is scheduled for 2013. We look forward to seeing you then. ■

Clockwise from left: Brad Winkel receiving the test gauge sponsored by Hydroflow for winning the Highest Achiever in the Backflow Testers course, Murray Cockburn receiving the Golden Tap award, Murray Ellis receiving the Golden Tap award, Kevin Healy receiving the Golden Tap award, CPS exhibition stand, Tyco exhibition stand, Premier Sponsor Reliance Worldwide exhibition stand and MacDonald exhibition stand





Manawatu River Action Plan Launched

While visiting Foxton last month Environment Minister Nick Smith launched an action plan instigated by the Manawatu River Leaders Accord for cleaning up the Manawatu River.

"It is no secret that the Manawatu River has been identified as having serious problems. This action plan represents a major milestone in a healthier future for this significant river. The Accord and its action plan build on the spirit of collaboration in dealing with the difficult issue of fresh water management that was pioneered so successfully by the Land and Water Forum. We're now seeing that collaborative model being used elsewhere, such as in the Rotorua Lakes," Dr Smith said.

"It is pleasing to see the Horizons Regional Council, farming community, iwi, industry and environmental groups making a commitment to work closely together to look for solutions to the water quality issues facing the Manawatu River throughout its catchment."

Dr Smith welcomed the plan's focus on reducing the flow of sediment, nutrients and bacteria into the river from industry, farming and erosion as well as protecting native fish and bird habitats, preventing the overuse of water, and reducing the environmental impacts of flood control and drainage schemes.

"The National Policy Statement for Freshwater Management takes effect on 1 July. This is about Government giving clear direction to councils on the importance of improving New Zealand's freshwater management. It increases the onus on regional councils and territorial authorities to put in place better rules to manage pollution and the effects of land use decisions which is what this action plan does," Dr Smith said.

"Consensus on this plan clearly signals broad community support for improved efforts to clean up the Manawatu River." ■

EPA Board Announced

The Board of the new Environmental Protection Authority was announced last month by Environment Minister Nick Smith.

"The new authority is about strengthening New Zealand's environmental management and efficiently bringing together the regulatory functions that were previously across four different agencies," Dr Smith said.

The Board will be chaired by former Wellington Mayor Kerry Prendergast and includes David Faulkner, Anake Goodall, Tim Lusk, Graham Pinnell, Taria Tahana, Richard Woods and Gillian Wratt.

"The new board has the right mix of skills to oversee the new Authority with strong expertise in the environmental sciences, agriculture, infrastructure, renewable energy, tikanga Maori, as well as governance and risk management." Dr Smith said.

The Environment Protection Authority is an independent Crown entity and will be responsible for regulation of hazardous substances, new organisms, national consenting under the Resource Management Act, ozone depleting chemicals, assessment of environmental effects in Antarctica and waste exports and imports. The management of the Emissions Trading Scheme will transfer to the Authority on 1 January 2012, and consenting in the Exclusive Economic Zone and Continental Shelf on 1 July 2012.

"This announcement enables the new Board to appoint a Chief Executive and a smooth transition to the new Authority," Dr Smith said. ■

See page 18 for more analysis.

2011 Green Ribbon Award Winners Announced

Minister for the Environment Nick Smith last month announced the 14 winners of the 2011 Green Ribbon Awards, including the Supreme Winner, Eco Stock Supplies.

"The Green Ribbon Awards recognise the efforts of New Zealanders who are taking action to address environmental challenges such as climate change, water quality, biodiversity, waste, and protecting our coasts and oceans," Dr Smith said.

> "The quality of entries for the awards this year was of a very high standard and I would like to congratulate all the winners and finalists for their outstanding contribution to protecting and enhancing New Zealand's environment."

"The quality of entries for the awards this year was of a very high standard and I would like to congratulate all the winners and finalists for their outstanding contribution to protecting and enhancing New Zealand's environment."

Some of the awards below for the full list of winners visit http://www.mfe.govt.nz/withyou/awards/green-ribbon

Protecting our Coasts and Oceans – Sustainable Coastlines Incorporated (New Zealand-wide)
For its outstanding commitment to improving the New Zealand coastal environment through public education, beach and coast clean ups and removing debris and rubbish that poses a risk to coastal and marine flora and fauna.

Caring for our Water – NZ Landcare Trust (New Zealand-wide)
For its outstanding contribution to improving freshwater management across the country by engaging private land owners in environmental protection work.

Environment in the Media – Emma Heke (Nelson)
For her outstanding contribution to environmental education through her DVD "OURS" teaching children about conservation, sustainability and environmental care.

Environmentally Responsible Large Organisations (joint winners) Downer NZ (New Zealand-wide)
For its outstanding work in setting an example in environmental responsibility by implementing an environmental sustainability programme across its company operations in New Zealand.

AND

Meridian Energy and Department of Conservation, Project River Recovery
For their outstanding commitment to improving and protecting the unique braided river habitat around Twizel, Tekapo and Omarama in Canterbury and Otago.

Supreme Winner Green Ribbon Award Winner 2011 – Eco Stock Supplies (Auckland)
For its development of an innovative commercial operation making a measurable difference to waste minimisation and reducing food waste. ■

Work of the *Water New Zealand* Awards Committee

The water sector makes a huge contribution to New Zealand, with the efforts of those engaged in the sector going largely unnoticed. In an attempt to remedy this, the *Water New Zealand* Board set up an awards committee in early 2010.

The committee advises the Board on the suitability of nominees for wider recognition by the community at large, as well as life and honorary membership of the Association. It also reviews and redefines where necessary, various *Water New Zealand* awards for Board consideration.

The committee has met quarterly since being established. Its first task has been to review all available historical information on current and past Association awards, bringing this information together into one document for publication. The corporate memory of committee members has been invaluable in undertaking this work.

This work has been completed and the document is available on the *Water New Zealand* website. Go to www.waternz.org.nz/awards.html

Its second task has been to review the suite of awards and make recommendations to the Board for implementation. It has made several recommendations.

Honorary Life Membership

The first was in connection with the membership categories specified in the constitution. It suggested that the life membership rule be renamed 'honorary' life membership. This was not accepted by members at the annual general meeting last year.

The committee subsequently revisited the purpose of the Association having life and honorary membership categories. It recommended that the focus of *Water New Zealand* in this context should be on members rather than non-members and that the recognition should be for sustained and significant contribution rather than long service.

These recommendations have been accepted by the Board. At the annual general meeting this year members will be asked to vote to remove the honorary membership category (which is restricted to non-members) and once again consider restyling the life membership category as 'honorary life membership.'

Honorary and Life Membership	
Current Status:	**Two categories** Members – Life Membership Non-members – Honorary Membership
Proposed Status:	**One category** Applies to members only – Honorary Life Membership

In making these recommendations the committee was mindful of the need to retain flexibility to allow for recognition of outstanding contributions from both members and non-members of the Association. Accordingly its next recommendation in connection

with awards was that the Association Medal be reinstated and that the underlying criteria be revised. The Board has accepted these recommendations. The revised criteria are set out in the box opposite.

"In making these recommendations the committee was mindful of the need to retain flexibility to allow for recognition of outstanding contributions from both members and non-members of the Association. Accordingly its next recommendation in connection with awards was that the Association Medal be reinstated and that the underlying criteria be revised. The Board has accepted these recommendations."

The committee's third task has been to review the contribution of members to the water industry with a view to seeking recognition for services rendered, either from within the Association or from the wider community. This subject is an agenda item at every committee meeting. The committee believes that there are many practitioners within the water industry who have made significant and sustained contributions to the betterment of society generally who deserve wider societal recognition (for example via the New Zealand Honours system).

Members are encouraged to review the contributions of their colleagues in this regard and if appropriate bring them to the attention of the committee. The current committee chaired by Margaret Devlin also includes Rob Blakemore, Boyd Miller and Graeme Thacker.

Over the years, a number of members have been recognised for their contribution to the New Zealand water sector. However the opportunities have been limited and the awards committee is a step in the direction of being more proactive. Of course there is more to be done and members are urged to nominate individuals for these awards.

In many cases, those who work in the water sector in New Zealand are the unsung heroes – let's ensure that their contribution is recognised. The full suite of awards, including criteria, processes and timelines for nominations can be found on the *Water New Zealand* website via the hyperlink set out above. ■

Association Medal – Revised Criteria

1. The Association Medal is awarded at the discretion of the Board to a New Zealand citizen who has made an outstanding contribution to the water industry and the Association within their life. It can only be awarded to a single person in any one year and is unlikely to be awarded every year.

2. A submission for an Association Medal would initially be made to the awards committee. The awards committee would make the recommendation to the Board. The final decision the medal would be solely at the discretion of the Board.

3. The following criteria shall be reviewed by the Board in reaching a decision to make the award that appraises the extent of the person's contribution to the protection of public health of communities or the protection of water resources:

   - The person's contribution to the commercial success of industries and businesses that service the water industry in New Zealand and elsewhere
   - The person's contribution to the development and/or application of technology, education, publications and documents that advances the management of the water infrastructure and water resources in New Zealand
   - The person's contribution to leadership and advocacy that advances water resource and water infrastructure management in New Zealand
   - The person's voluntary contribution outside their working life to the protection of public health and water resources for communities in New Zealand and/or overseas
   - The person's contribution to the activities of the Association

4. In order to retain the exclusivity and esteem of this award, there will only be a very limited number of living holders of the Association Medal at any one time.

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Wai or Water – Cultural Intellectual Property, Rights and Interests

Rahui Katene – MP, Environment Spokesperson for the Maori Party

Rahui Katene MP

Anticipation is building within Maori communities as we await the impending release of the Waitangi Tribunal's WAI 262 report on the indigenous flora and fauna and cultural intellectual property claim.

I have a deeply personal interest in this report, as my late father, John Hippolite of Ngati Koata, was one of the six original claimants. The claim was lodged with the Tribunal in 1991 on behalf of Ngati Koata, Ngati Wai, Te Rarawa, Ngati Porou, Ngati Kahungunu and Ngati Kuri. Twenty years later, the only claimant still here with us is the kuia, Haana Murray of Ngati Kuri. The report cannot come soon enough.

The crux of the claim is around the ability of the claimants, as kaitiaki, to exercise tino rangatiratanga over identified taonga. Rangatiratanga involves a spectrum of rights over taonga, including authority, control, decision-making, protection, preservation, conservation, regulation, use, development, enhancement and/or transmission of taonga.

This spectrum of rights applies just as fully as any other rights and interests that Maori have under Te Tiriti o Waitangi when it comes to the protection, management and ownership of water.

Maori perceive water as a taonga of central significance. We see the wellbeing of our rivers, lakes and streams as an invaluable treasure which has been gifted by our tupuna for the benefit and use of the descendants. Tangata whenua take responsibility for the protection, care and conservation of the water resource as implicit in our respect for kaitiakitanga.

Kaitiakitanga can be interpreted as the exercise of custodianship by an iwi or hapu over taonga within the tribal rohe. Upholding the value of kaitiakitanga encompasses obligations and responsibilities related to guardianship, custodial protection and advocacy.

The question confronting us all is how best the resource can be conserved and handed on to future generations in a similar or better condition.

The understanding that tangata whenua have around wai or water, as a taonga of paramount importance is consistent with perspectives shared with indigenous peoples the world over.

In April 2010, the Maori Party was successful in our negotiations for the New Zealand Government to sign up to the United Nations Declaration on the Rights of Indigenous Peoples.

While the Declaration recognises the urgent need to respect and promote the inherent rights of indigenous peoples, there are also two specific articles which provide explicit guidance around water.

Article 25: Indigenous peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard.

Article 32: States shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free and informed consent prior to the approval of any project affecting their lands or territories and other resources, particularly in connection with the development, utilisation or exploitation of mineral, water or other resources.

The Maori Party has been very pleased to see the commitments made to ongoing engagement between Ministers and the Iwi Leaders Group on the rights and interests of iwi in relation to water. We believe it is crucial that discussion on water management issues, on water ownership issues, on sustainability of our water resources be held rangatira-to-rangatira.

Iwi have told us very clearly that they want to be involved in setting strategic priorities at the national level. The Maori Party supports this intention, and considers that meaningful, Treaty based engagement with mana whenua should be central in the policy process.

It was a matter of great significance, that the report from the Land and Water Forum (A fresh start for freshwater) released in September 2010 promoted the need for improved structures and processes over the national direction and coordination of water to better reflect the Treaty relationship with iwi.

The report was put together by a forum of more than 180 groups which included five iwi: Ngai Tahu, Te Arawa, Tuwharetoa, Waikato-Tainui and Whanganui.

The report, and the process of developing it, promotes an environment in which iwi are invited and encouraged to participate, through an open relationship with regional councils and local authorities.

Co-Management and the Waikato-Tainui River Settlement

A prominent concept in these discussions will be around co-management.

The Land and Water Forum recommended that a national Land and Water Commission should be established as a co-governance model with iwi. The report also gave explicit encouragement to regional councils to engage with iwi about the way in which their water bodies are valued. There was also recognition of a key work stream driven by the Iwi Leaders Group which focussed on water rights and interests.

Subsequent to this report, whanau, hapu and iwi have been carefully watching the developments that evolved out of the Waikato River Settlement.

But first, some context for how the people of Waikato Tainui view the Waikato River. The relationship between the people and their ancestral river is summed up in the concept, te mana o te awa – the river being considered to have its own mana (prestige) and its own mauri (spiritual energy). In this respect, therefore, the river itself takes on its own identity – an identity which is interconnected with the tribe. The Waikato River sustains the people physically and spiritually. It is a place for healing, for cleansing, for karakia and prayer. The people go to the river at times of difficulty, or to seek relief from illness and pain. To Waikato Tainui, the Waikato River is constant, enduring and perpetual.

The Kingitanga Accord, appended to the Waikato-Tainui Raupatu Claims Waikato River) Settlement Act 2010, is a fascinating model which other iwi have grasped as a precedent for subsequent claims related to rivers and water management.

The Accord states that the Crown and Waikato-Tainui have committed to enter into a new era of co-management in respect of the Waikato River. The principle of co-management includes the highest level of good faith engagement and consensus decision-making as a general rule while having regard to statutory frameworks

and the mana whakahaere of Waikato-Tainui and other Waikato River iwi.

But the Accord is more than just a statement of principle. It is distinguished by its detail, describing how effective co-management must be achieved across a range of management agencies, bodies and authorities.

Co-management is further defined as being realised in developing, amending and implementing strategies, policy, legislation and regulations that may potentially impact on the health and wellbeing of the Waikato River.

Implementation of a co-management approach would also be demonstrated in the processes for granting, transfer, variation and renewal of consents, licences, permits and other authorisations for all activities that potentially impact on the health and wellbeing of the Waikato River.

Importantly, the Accord explicitly provides for effective Waikato-Tainui input and participation by engagement at an early stage in statutory and management processes. The Accord explains such detail as encompassing a 'positive obligation to provide for early and effective input from Waikato-Tainui, rather than simply an obligation to consult'.

The Maori Party believes that the Waikato-Tainui Accord establishes a new era of Crown-iwi co-management, which includes within its scope, mechanisms to govern and manage the river in partnership with central and local government. The Accord has set in train a number of strategic developments, including the establishment of a co-governance entity, the Waikato River Authority; the Waikato River Clean-Up Trust and joint management agreements with local authorities.

The Whanganui River Report

The precedent established by the Waikato Settlement, will of course be revisited when the Whanganui River Report comes before Cabinet.

The 1999 Waitangi Tribunal report on the Whanganui River made specific reference to the view from the people of Te Atihaunui-a-Paparangi, that the river was respected as a taonga of central significance, a whole and indivisible entity, a living being, an ancestor with its own mauri, mana, tapu.

The Tribunal also found that hapu hold "the right to manage and control in accordance with tribal preference and to be left in quiet possession". They concluded that the guardianship, the 'possession' 'and control' of the river, exercised by the local hapu, is able to be recognised by English law as including ownership – an ownership protected by Article II of the Treaty of Waitangi due to the river's status as a taonga.

This, of course, challenges another view, that of the Government that the concept of water ownership is a non-argument. Government has claimed that because water cannot be owned in its natural flowing state (according to English common law), rivers cannot be owned by anyone.

These assumptions were examined at length in the Waitangi Tribunal's 1999 *Whanganui River Report*, which stated that there is no legal basis for the view that rivers are public property.

Water Ownership

More recently, Justice Taihakurei Durie presented a paper to the Iwi Leadership Forum held at Hopuhopu in Waikato. He suggested in that paper:

"While there may be no objection to negotiations about water access as a matter of public interest, the Crown's assertion of ownership as of right is unprincipled and should be stoutly opposed. It is founded upon a dated, mono-cultural premise and is inconsistent with the Treaty of Waitangi".

> "It was a matter of great significance, that the report from the Land and Water Forum (A fresh start for freshwater) released in September 2010 promoted the need for improved structures and processes over the national direction and coordination of water to better reflect the Treaty relationship with iwi."

I don't think you can get much clearer than that!

The core of the issue is the nexus between two distinctive and unique worldviews.

On one hand, there is the nature of New Zealand law derived as it is, from English sources. On that basis, English legal theory has provided the presumption by which the Crown has assumed a right to control, manage and allocate water uses.

At least from the passage of the Water and Soil Conservation Act 1967 the Crown has presumed that it owns all water. And earlier, from the mid-late 1800s, a host of legislation pertaining to ports, bridges, wharves, harbours, mining, conservation, recreation and industrial development has introduced rules and associated rights governing water use. In other words, assumption of ownership by another name.

On the other hand, in terms of Article II of Te Tiriti o Waitangi, the primary assertion is that Maori held territory, or areas over which they had influence or mana – through the agreement that the Queen would protect the chiefs, the subtribes and all the people of New Zealand in the unqualified exercise of their chieftainship over their lands, villages and all their treasures.

The Maori version of Article II guaranteed "te tino rangatiratanga o o ratou wenua or ratou kainga me o ratou taonga katoa". In this sense, Professor Hugh Kawharu has explained taonga as having a broad interpretation of all dimensions of a tribal group's estate, material and non-material heirlooms and (wahi tapu) sacred places, ancestral lore and whakapapa (genealogies).

It comes back to the concept of kaitiakitanga – the obligation of iwi to be responsible for the wellbeing of the landscape including water and waterways. This is a responsibility which is inter-generational in nature and has been and may be expressed in a variety of ways.

The dialogue between the Crown and iwi around water management, ownership, co-governance and co-management arrangements and the relationship to kaitiakitanga, is one of the most significant debates that we expect to proceed with over the next few years. It must be a debate in which the Crown is able to recognise that iwi have interests across cultural, economic, environmental and social spheres.

Government must be open and transparent about any issues that inevitably impact on the Treaty relationship. Matters such as water consent allocation, the setting of limits for water quality and flows, water privatisation, the transfer/trading of excess water are all issues which are open to exploitation and matters which iwi will have a keen interest in watching out for.

The Maori Party sees our key role in opening up the door, enabling whanau, hapu and iwi the opportunity to engage in the Treaty conversation that must be had as we grapple with water management. There is so much at stake. ■

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Pride and Satisfaction – Characteristics of the Industry

Simone Olsen – Editor, WATER

The satisfaction of seeing people achieve and create further opportunities for themselves is what motivates Cliff Tipler to use his extensive knowledge of the water engineering field to contribute to the industry's future.

As the son of teachers it was inevitable that Cliff would describe the role of education and training as a core personal value. As a water engineer he has been in the industry for more than 30 years and as such has gained broad experience across the sector. This provided valuable insight and experience for his roles as Chairman of the Agriculture Industry Training Organisation and the Water Industry Training Committee.

"Personally, it's very satisfying to know that you've contributed something to people's future, to watch them achieve and realise their own potential" says Cliff.

It's this kind of pride and satisfaction that is evident across the water industry, says Cliff, a Senior Principal with URS New Zealand Ltd and currently the Business Development Manager.

"I've found that across the water sector, there seems to be a sense of pride and passion for the work that people do. I think it's because people know whatever their role they're contributing to a very important, essential public good."

"For me, over the thirty years I've been involved in this industry, I'd say that this is true of the projects and organisations I've been involved in. What stands out for me now when I look back is the projects that have led to construction of something."

"When you can be involved in a project that begins with understanding a need or problem, moving through to conceptualising and designing a solution, and then constructing something that ends up as an operational asset that serves the community – that I would have to say is the most satisfying for me personally."

"I think a particular highlight was my involvement in the Christchurch ocean outfall project. It took 12 years, from start to completion, and there were many ups and downs in terms of the political, social and resource consenting processes, so I was pleased to have the chance to see it through to the end."

Cliff has been involved in a wide variety of aspects of the industry. This wasn't intentional, but just the way it turned out, and water engineering has remained the common thread throughout.

"I'm pleased to have had the opportunities and experiences I've had, this is particularly so for the interesting experiences I've had through my involvement in industry training."

He got involved in the training side of things while on the Board of *Water New Zealand* (NZWWA at the time) about 10 years ago. The Board had identified shortages in skills and training and because of his personal interest in education he took it on as a portfolio and started looking into it further.

"Through our investigations we realised there was no Industry Training Organisation specifically for water so we looked into establishing one. At the time the governing body, Skills New Zealand – what is now the Tertiary Education Commission – had oversight of this process."

"Each time we followed the prescribed processes to establish a water specific ITO, only to find at the last hurdle the criteria would change. After many attempts we found the rules continued to change until finally it became such a stumbling block we decided to change tack and join up with an existing ITO."

"In my view one of the major successes that we should acknowledge as an industry is the value we place on continuing education and training. Employers across the industry really do see the value proposition in offering quality higher level training to their employees."

"In choosing which ITO to collaborate with our principal factor was who we could work with that would allow us to maintain our industry identity. This was paramount, we needed the systems and support from an established ITO but we could not lose our way in terms of what was going to be the right way forward for our industry, so we weren't willing to compromise on that."

Eventually an agreement was made to collaborate with the Agriculture ITO and even if it might be seen as an unlikely bedfellow the partnership has been a successful one with plenty of gains being made over the years for our industry according to Cliff.

At the time of establishing the partnership, the Agriculture ITO co-opted Cliff as a water industry representative onto its Board to ensure the water industry was involved at the governance level. The need for a co-opted representative has now fallen away over time as the partnership has integrated successfully and Cliff has now been elected Chairman.

"In my view one of the major successes that we should acknowledge as an industry is the value we place on continuing education and training. Employers across the industry really do see the value proposition in offering quality higher level training to their employees."

"We're talking thousands of dollars spent on upskilling an employee – it's a big investment for some organisations but they really understand the benefit to themselves as organisations and the wider industry and recognise the need to contribute to that."

"I'd say this universal acceptance makes our job easier because of the support we get from the industry, especially as we look to the future and the challenges ahead."

As the Government looks across all public spending for areas to provide efficiencies and savings, it has indicated the need to increase the performance of the ITO sector, and this may result in a reduction in the number of ITOs.

"We enjoy phenomenal support from companies and organisations in our sector for industry training: City Care and OPUS in the early days are two that stand out for me, there's also a suite of contractors who are behind us 100%. This support means that we can offer pan-industry training aligned with their needs, the companies and the wider industry benefit greatly and this means a bright future."

This lays down a challenge for ITOs to provide an increase in the level of achievements at higher levels of training, to more people, for less funding. An impossible task you might say but Cliff remains confident of the industry's ability to meet it.

"It's simply a question of scale, we will have to work more closely with other ITOs to be able to deliver training to more people for less. We'll have to create new mechanisms to be able to do this – it actually can mean positive things for the kind of training we want to offer."

"ITOs will be working towards providing a suite of qualifications that will have greater transferability or transportability between industries, so that people can move between industries much more easily."

For the water industry this will mean that people will be able to leave and work in other sectors using the skills they've gained but it also means that people will be able join the water sector with relevant qualifications. With core skills the investment in further training has a solid foundation to build on.

Cliff says the Government has made it clear that it is working in a range of ways to increase the standards of literacy, language and numeracy across the board. This will be part of what is addressed in establishing training in the core skill areas.

Like many other industries the water industry has an ageing workforce reflecting the ageing population. There is however a challenge in addressing the gap that will grow as the existing workforce retires. The Modern Apprenticeship Scheme has gone some way to addressing this in the short term but Cliff says we need to continue to work to ensure people currently choosing career paths consider the water industry as a viable and appealing option.

"I think we need to be more visible as a career option to our young people. We need to show the kinds of technology and outcomes involved in the various roles on offer. It is my belief that the variety of technology we utilise could be a drawcard to young people looking for a skilled, interesting and satisfying career path."

"The industry has evolved significantly over the last generation, we're using much more technology, requiring a higher level of skill, we working towards much better environmental outcomes such as safer standards of drinking water and I think this gives a greater sense of pride and satisfaction – so I think raising awareness of these characteristics will make it more appealing."

"We enjoy phenomenal support from companies and organisations in our sector for industry training: City Care and OPUS in the early days are two that stand out for me, there's also a suite

of contractors who are behind us 100%. This support means that we can offer pan-industry training aligned with their needs, the companies and the wider industry benefit greatly and this means a bright future."

Demand for a highly trained, highly skilled workforce is going to be huge in the next 5–10 years as we rebuild Canterbury. Thinking of the lateral infrastructure affected and the urgency for the work to be completed, the people currently trained for these areas are going to be highly sort after.

"We need to ensure that there are more trained people to work alongside them to get the rebuild completed promptly and so that other projects aren't sidelined because of a lack of people able to do the job," says Cliff.

The greater the skills utilised the better the asset as an end result. The experiences of Canterbury show the need to build resilience to earthquake and natural disaster as far as possible.

"This can be the opportunity to showcase the industry and what its contribution is to the community and hopefully inspire young people to consider our industry as a fulfilling career path." ■

Background – Cliff Tipler

A Senior Principal of URS, Cliff has over 30 years experience in the environmental engineering field. This has included leading multidisciplinary teams for resource consent applications, for municipal discharges such as the Christchurch City wastewater discharge, as well as industrial discharges including meat and dairy processing plants. Cliff has presented expert evidence before the Environment Court, and District and Regional Councils on numerous occasions. He has been the Project Director for the Design and Construction of the Christchurch City 3.0km ocean outfall and associated micro-tunnelled pipework as well as the 1.5km ocean outfall for Waimakariri District Council and associated pump stations and pipelines. He has been the technical lead consultant for the Central Plains Water Enhancement Scheme. Cliff has worked on many sewage treatment plants around New Zealand. In addition he has acted as a Commissioner for Environment Canterbury on many resource consent applications as well as for the Natural Resources Regional Plan. Cliff is a Past President of the New Zealand Water and Waste Association and the Chairman of the Agricultural Industry Training Organisation. He is also on the Water Industry Training Committee.

Water Regulation

Helen Atkins – Partner and Vicki Morrison – Senior Associate, Atkins Holm Majurey

Introduction

This article provides comment on a number of current policy and legal matters which may be of interest to the water sector. This article commences with an update to the arrangements for Environmental Protection Authority (EPA). A brief outline is then provided of the new Canterbury Earthquake Recovery Act which provides the detail of the powers and functions of the Canterbury Earthquake Authority. It then provides an overview of the recently released Freshwater Policy and concludes by providing comment on a recent Environment Court case regarding priority of competing resource consent applications for water.

Environmental Protection Authority

We provided a bit of background on the EPA in the May 2011 issue of WATER. The Environmental Protection Authority Act 2011 has now been passed and it received royal assent on 17 May 2011.

The Act establishes the EPA as a separate standalone crown entity. The 'new' EPA has been tasked with providing advice and carrying out functions under a number of "Environment Acts", which are listed and include the Climate Change Response Act 2002; the Hazardous Substances and New Organisms Act 1996, the Imports and Exports Restrictions Act 1988; the Ozone Layer Protection Act 1996; and the Resource Management Act 1991. The Minister for the Environment has also recently announced that the EPA will have responsibility for administering environmental legislation in the exclusive economic zone once that legislation has been drafted.

The EPA is set to have other functions and these will occur by Order in Council along the way. The Act is largely administrative. However, one key policy component of the Act is that it has quite a different Treaty section than what we are used to in the RMA or LGA context. This Treaty section (section 4) specifically links the establishment of the Maori Advisory Committee as being a means of recognising the Crown's responsibility to take appropriate account of the Treaty. The clause also requires that the EPA comply with the requirements of an Environment Act (ie those Acts listed above) in relation to the Treaty when exercising functions or powers.

The Board of the EPA is ultimately responsible for setting the terms of reference for the Maori Advisory Committee. In this regard the Committee is not unlike Nga Kaihautu Tikanga Taiao, which is a Maori advisory committee to the Environmental Risk Management Authority (ERMA) that currently administers the hazardous substances regime. The new EPA is due to start business (or more correctly continue the business of ERMA and the old EPA) on 1 July 2011. The brand new functions including those relating to climate change will not be dealt with by the EPA until October this year and beyond.

The Minister has announced the membership of the EPA Board and the members are: Kerry Prendergast (former Wellington Mayor) David Faulkner (previous Managing Director of Fulton Hogan), Anake Goodall (former Chief Executive of Ngai Tahu), Tim Lusk (Chief Executive of Meridian Energy), Graham Pinnell (former electricity commissioner and Federated Farmer leader), Taria Tahana (Maori business executive and advisor), Richard Woods (Chair of ERMA) and Gillian Wratt (Chief Executive, Cawthron Institute).

Canterbury Earthquake

In the May 2011 issue of *WATER*, we noted that the Government had recently announced the creation of a new authority, the Canterbury Earthquake Recovery Authority (CERA) and had introduced a Bill to establish CERA's role, functions and powers. The Bill has subsequently been passed and on 19 April 2011 the Canterbury Earthquake Recovery Act 2011 came into force.

This Act replaces the Canterbury Earthquake and Response and Recovery Act 2010 and is to be in place for up to five years. Its purpose is to enable the Minister for Earthquake Recovery and/or CERA to facilitate and direct Christchurch to respond to, and recover from, the Canterbury Earthquakes, in a timely and coordinated manner; whilst at the same time allowing for some (limited) community involvement.

The Act provides for the Minister to develop a recovery strategy to set the overall direction for the recovery effort (within nine months of the date of enactment of the Act, ie January 2012) and recovery plans to implement the strategy. While there is a public consultation process for the Strategy there is not generally such a process for the Recovery Plans. In terms of status, the Recovery Plans sit above other council policies, plans and strategies (RMA and Local Government) and can require changes to these council documents (without going through the normal council consultation processes) so that they are not inconsistent with the recovery plans.

> "There was much controversy over similar powers (so called "Henry VIII powers") which were enacted in the wake of the 2010 Canterbury earthquake. This is because they allow Orders in Council made by one person (the Governor General) to enactments without going through the normal legislative processes. To address these concerns some additional checks and balances were included in this new Act to temper the use of such powers."

Perhaps the most controversial aspects of the Act are the wide ranging powers that it gives the Minister and CERA. These include (but are not limited to):

- The ability to obtain or require information from any source
- Powers to enter onto land, remove fixtures and fittings, demolish structures, perform work on land and construct and maintain structures on land
- The power to compulsorily acquire land
- The power to suspend, change or cancel any council plans and policies
- The power to suspend or cancel resource consents
- The power to override and cancel resource consents

In addition, the Act gives the Governor General the power, (upon receiving a recommendation from the Minister), to grant exemptions from, modify or extend any provisions of any enactments, including (but not limited to):

- The Building Act 2004

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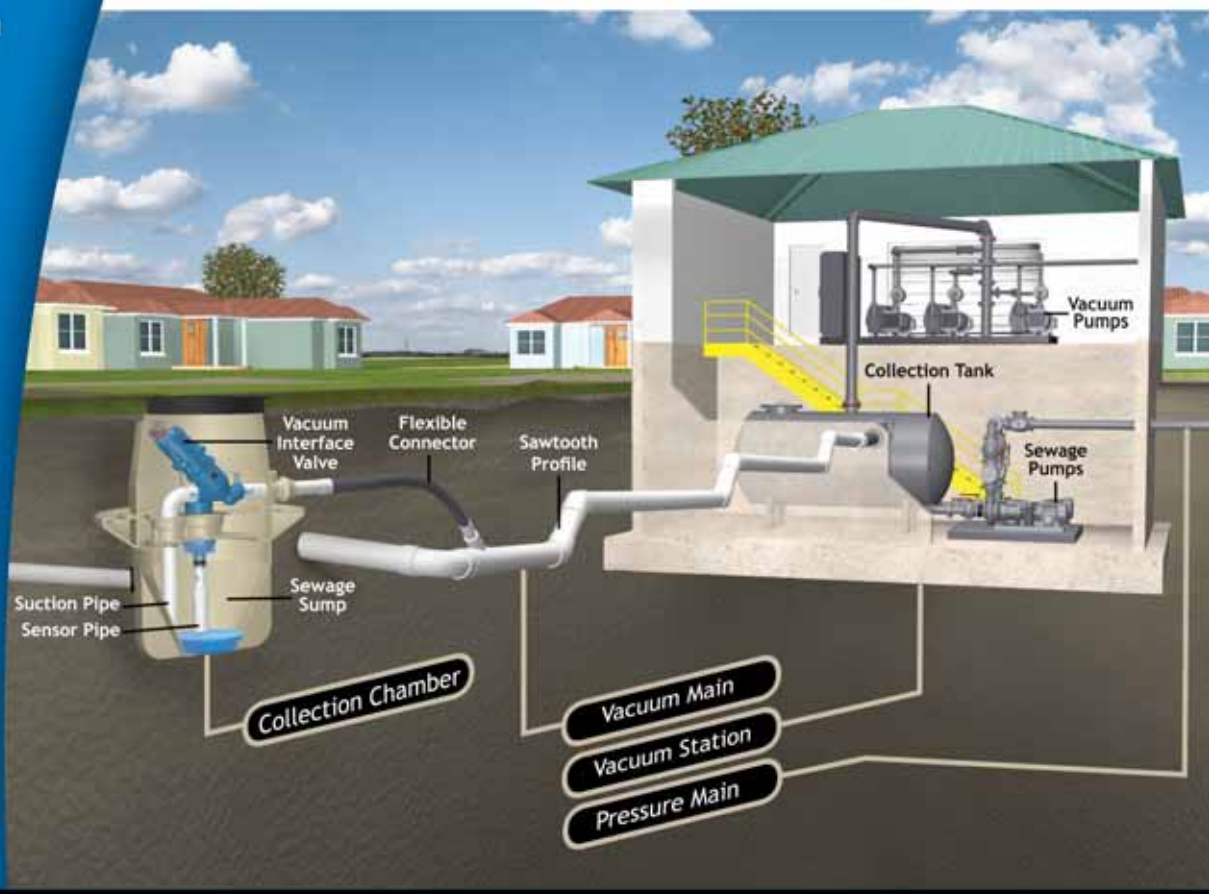

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- The Public Works Act 1981
- The Resource Management Act 1991

There was much controversy over similar powers (so called "Henry VIII powers") which were enacted in the wake of the 2010 Canterbury earthquake. This is because they allow Orders in Council made by one person (the Governor General) to enactments without going through the normal legislative processes. To address these concerns some additional checks and balances were included in this new Act to temper the use of such powers. These include:

- A requirement that the powers only be exercised for the purposes specified in the Act, ie, rebuilding and recovery
- A requirement to report on the exercise of powers quarterly
- The appointment of a review panel which will be required to review and provide advice on all proposed Orders in Council before they are made

The review panel is to be headed by former senior High Court Judge Sir John Hansen, and has as other members, former Prime Minister Dame Jenny Shipley, former chief executive of Ngai Tahu Anake Goodall and current Canterbury Earthquake Recovery Commission chair, Murray Sherwin.

While the effects arising from the use of such powers have yet to be seen, they are to be far reaching and (potentially) long lasting. This authoritarian approach, which follows on from the replacement of Environment Canterbury with Commissioners, makes one consider whether democracy is alive and well in Canterbury or has been buried in a mire of legislative documents! Watch this space for further updates.

Fresh Start for Freshwater

On 9 May 2011, the Government announced its 'Fresh Start for Fresh Water' reform measures. These measures include specific funding for freshwater clean-up ($15m over two years) and water infrastructure ($35m over five years), a further work programme for 2012 and beyond (including a formal response to the Land and Water Forum Report) and a revised version of the National Policy Statement for Freshwater (Freshwater NPS).

On 12 May 2011 the Freshwater NPS itself was released. The NPS contains objectives and policies which require Councils to manage water resources in an integrated and sustainable way while providing for economic growth, within set water quantity and quality limits[1]. There are specific objectives and policies in relation to water quality, water quantity, integrated management, tangata whenua roles and interests and implementation. In relation to the latter, the Freshwater NPS recognises a progressive approach to implementation (refer Policy E1), with Councils being required to have fully implemented the policies in the NPS "as promptly as is reasonable" and in any event by 31 December 2030.

It is however apparent that some practices are to be amended earlier than others. For example Objective B2 clearly indicates that further over-allocation is to be avoided but that existing over-allocation can be phased out.

The Freshwater NPS is to take effect from 1 July 2011 and is to be reviewed within five years. The government has acknowledged that the statement is just the "first step" in the process of improving freshwater management and has described the policy as reflecting the "bluegreen emphasis of [the] government balancing economic growth with improved environmental management."[2]

There have been criticisms at the NPS is "toothless", it doesn't go far enough in providing national direction so that there will still be inconsistencies between regions and that it will take too long to fully come in to effect. In the short term, the degree of change will largely depend on the approach adopted by the regional councils and the priority accorded by those councils to implementing the change.

Case Law – Priority of Competing Water Resource Consent Applications

A recent Environment Court case, *Bay of Plenty Regional Council v Fonterra Co-operative Group Limited*[3], is of interest as it raises an issue of priority between two applications for renewals of water take consents.

In this case, both Trustpower and Fonterra had applied to the Council to renew their resource consents for the Rangitaiki River, TrustPower, in May 2009, for its Matahina Hydro Electric Power Scheme and Fonterra, in December 2009, for its dairy manufacturing site in Edgecumbe. Both applicants applied within the required time period (set out in section 124 of the RMA) and both applications were essentially for a renewal of the same types of activities, despite seeking a variation to some of the terms and conditions.

The Council indicated that it intended to set the Fonterra application down for

hearing first. TrustPower objected (on the basis that its application had been lodged earlier in time) and the parties agreed that the Council should seek a declaration from the Court as to which application had priority.

In determining the issue of priority, the Court considered a number of issues raised by the parties. These included:

- Whether the principle of non-derogation of grant is relevant – the Court said no as:

  [41] In short, non-derogation seems particularly difficult to assert against an upstream user for a different type of allocation not specified in the Fonterra consents. Certainly there was no evidence to satisfy us that the Fonterra consent would be frustrated.

- Whether the existing environment includes consents continuing under section 124 – the Court said it did but that it did not include any future possible consents arising out of the renewal applications:

  [48] ...(b) Our conclusion is that the Court of Appeal in Hawthorn deliberately limited the extent of the future environment to avoid a series of unknown possible scenarios from being addressed. If it was the intention that possible future consents and/or expiry thereof was to be relevant, then there would be little point in obtaining priority for hearing, given that that application would need to consider all potential future uses in any event. Such issues would then become circular and serve no purpose.

  (c) In our view, the better interpretation, in light of the Ngai Tahu and Synlait decisions, and the decision of the Court of Appeal in Hawthorne, is that a pragmatic approach is made as to hearing priority based on the first in time to file, unless there is disentitling conduct. In considering any application with hearing priority, the consent authority must have regard to existing consents and the existing environment, but the future environment is only relevant to a limited extent.

- Whether as a matter of law a review condition or a condition purporting to impose some new state of affairs once a future event had occurred could be imposed – the Court found that a review condition was lawful but that condition in relation to a future state of affairs was not:

  [53] We conclude that a power of review is permissable but not a new condition prescribing an outcome based on an assumption as to the state of affairs i.e. lesser residual flow on the expiry of the consent. This is because the actual state of affairs is not known and the existing environment may have changed i.e. a new consent may be granted.

The Court concluded that as TrustPower's application was lodged first in time they were entitled to priority and that their application should be heard and determined prior to the Fonterra application. The Court issued a number of declarations to give effect to its findings. ■

Footnotes

[1]Freshwater National Policy Statement, page 3.
[2]Ministerial Statement of Nick Smith, 9 May 2011.
[3]Unreported, Environment Court Auckland, 28 March 2011, Smith J.

Evolution in Metering and Modelling

Edgar H Johnson – Global Service Line Leader, Water Efficiency, GHD

GHD's Global Service Line Leader for Water Efficiency, Edgar H Johnson, examines how metering and modelling have evolved since their theoretical conception, and considers how their technology and application must further evolve for continued improvements in operational efficiencies of urban water distribution networks.

Evolutionary Developments

Water Meters

Bronze Roman adjutages were developed prior to the first century AD to limit the quantity of water drawn for use by its citizens. Officially stamped by the Roman authorities, these adjutages were manufactured in 15 different diameters, about 230 mm in length. The diameter and installation were decreed by the Senate to make sure the downstream pipe was kept the same diameter as the adjutage for approximately 15 metres (AWWA, 1986). With the rapid growth of Rome's population, the adjutage orifice flow limiter was developed to reduce water demand. This installation was subject to fraudulent modifications by some citizens, an issue that is still prevalent 2,000 years later.

Developments in water metering technology historically take an incremental and innovative approach as new knowledge is gained. This is illustrated in the evolutionary development of differential pressure, turbine, oscillating-piston and electromagnetic meters.

The 18th century witnessed the development of Daniel Bernouilli's theory, which was the basis for the measurement of flow in pipes utilising differential pressures. Using a device for sensing velocity that provided a practical demonstration of Bernouilli's theory, Henri Pitot then conducted experiments on the River Seine. Towards the end of the 18th century a horizontal axis turbine 'water wheel' was developed by a German, Reinhard Woltmann, to measure the velocity of flowing air and water. Consequently all turbine or mechanical inferential meters are still to this day known by the generic name of 'Woltmann' meters (Stauss, 2006).

Further development of differential pressure and mechanical meters took place in the 19th century, with the first patent for a mechanical meter for measurement of water-flows in closed conduits awarded in 1825 (Linford, 1949). The proportion of pressure differential meters sold in the market declined in the middle of the 20th century, as they were replaced with a growing number of electronic, turbine and mechanical meters (Furness, 1991).

The first reaction-type meters, manufactured by Siemens in 1850, provided reasonably accurate measurements, although the hydraulic laws governing their operation were not fully understood at that time. The first practical oscillating-piston meter patent was issued to Lewis Nash in 1884, and is essentially the same as the oscillating-piston (e.g. volumetric) meters that are used today (AWWA, 1986).

Following its development in 1936, electromagnetic (e.g. magmeters) meters became more popular as a way to measure water flow in pipes. These meters operate on a magnetism based principle that was discovered by Michael Faraday in 1832.

What is evident about the ongoing development of water meters is that, in some cases, they can take over 200 years from theoretical concept to become fully developed for practical application. Many small evolutionary steps are then taken to reach their current levels of efficiency. Pragmatic experimentation and rigorous testing of a theoretical concept are critical to the process, before metering technology will be universally accepted and applied.

Water Network Modelling

The analysis of water networks was restricted to the use of the Hardy Cross approach for over 40 years, which was initially developed in the late 1930s. The Hardy Cross approach uses as a boundary condition, either that the algebraic sum of flows at any node is zero (e.g. balancing flows associated with conservation of mass), or that the algebraic sum of the pressure head loss around any node is zero (e.g. balancing heads associated with conservation of energy).

It took 20 years for the finite-element method of analysis, which was used in other fields of engineering, to be applied to the modelling of water distribution networks. This application provided an improvement in the speed of convergence compared to the Hardy Cross approach (Collins & Johnson, 1975).

A linear programing method was first developed for the optimal design of water distribution networks in 1977, which enabled optimization for multiple loadings and explicit inclusion of operational decisions (Alperovits & Shamir, 1977).

From Left to Right – Mechanical Meter Circa early 1900s, Positive Displacement Composite Meter with and without Radio Transmitter (source: Sensus), Intelligent Remnant-magnetism Meter (source: Sensus)

The nodal formulation of the matrix equation, using the Newton-Raphson method, provided efficiencies in electronic processing capacities of early digital computers (Dodge et al, 1978).

With the exponential growth in computer technology and water network analysis software there is still a need to ensure that these virtual models accurately replicate the actual water distribution network both statically and dynamically.

Challenges in the Application of Current Technology

Current technology and its application introduce errors in metering data, and often result in misinterpretation that can adversely affect decision making in the planning, design, management, operations and maintenance of water supply and distribution systems.

There are two notable challenges in addressing metering errors including (Johnson, 2011)

- A lack of an independently verifiable process for the in situ calibration of large water meters through the implementation of an accredited metrological system, ensuring confidence in the volumetric data derived by large meters. Errors in large meters also introduce errors in the determination of volumetric imbalances that tend to mask the true effect of apparent losses in the calculation of real loss indicators.
- Water meters are generally incorrectly sized and selected because the actual weighted error of measurement is not established. Typical weightings that are applied can exclude changes in usage patterns resulting from water restrictions, smaller dwellings, and the substitution of potable water with recycled water.

Without the correct determination of the weighted error of measurement of customers' meters in the distribution system, volumetric imbalances used to calculate leakage indicators will be incorrect. A reputable Spanish research project carried out the testing of a 2,000 meter sample, with diameters from 13 to 40mm, and found that the volume of water not registered, or under-registered, by domestic meters was -14%. The weighted metering error value was -8.4% of the total volume of water supplied to Madrid in 2006 (Guzman & Cabeza, 2010).

There appears to be gaps between the development of optimisation models for the design and operation of water networks, and the universal regular implementation of these models by the water industry (Goldman et al, 2004). This reflects a technological growth trend of an incremental innovative approach as new knowledge is assimilated in a time-lagged manner that is characteristic of the water industry. Designing water distribution networks according to high peak (loads) factors that do not replicate actual conditions is uneconomical and could provide excess capacity just to accommodate short intervals of peak demand (Johnson, 2009). Actual field measurements can identify anomalies in using default peak hour demand rates stipulated in design codes resulting in over or under-estimation of flows (Chapman & Watt, 2011).

The changing land use patterns caused by urban densification (e.g. landfill), the introduction of water demand management measures (e.g. water restrictions), operational requirements, and policy changes for sub-metering of tenancies can result in changes in flows within the distribution network that differ from its original design or its previous operating regime.

Innovative Developments

Metering

Recent innovative developments in metering technology have improved the flow range and accuracy over which the meter can operate. These advancements have also increased the amount of readily available demand data, while reducing the carbon footprint during their manufacture.

Modification of the smooth-surface oscillating-piston to a grooved piston for volumetric meters has improved the low flow capabilities and reduced the adverse influence that small particles in the water will have on the decay in measurement error. The use of industrial composite materials for meters has achieved a lower carbon footprint in the manufacturing process, as well as provided a material that is stronger and more durable than metals previously used.

The development of a new rotor bearing system for Woltmann turbine meters, known as Floating Ball Technology, has reduced bearing friction to almost a negligible level. This has resulted in a greater flow operating range than the previous generation of Woltmann meters.

Recent progress of the electromagnetic meter has produced the remnant-magnetism excitation method. This method provides benefits including reduced power consumption, improved accuracy through the increase in sampling rates, ability to measure lower flow rates, and has no moving parts. This type of meter can also be categorised as a static electronic meter with built-in intelligence.

The combination of flow, pressure and acoustic instrumentation, and integrated analysis of these data has the potential to improve efficiencies in the detection of leaks in association with network modelling software.

Modelling

The latest developments in network modelling have improved efficiencies in management and operation, with the relationship between energy and water losses beginning to receive more attention. Eau de Paris has developed tools for the detection and analysis of historic and real time information to reduce water losses from the water network. The real time detection of leaks is carried out using pressure and flow sensors, as well as a virtual model developed from measured trends (e.g. demand patterns), day of the week, temperature and specific large water usage events that are compared to historic thresholds (Montiel & Nguyen, 2011).

A pressure control algorithm that learns the relationships between head-loss, flow rate, time of day, day of week and seasonal effects has been developed

to optimise the control parameters of a pressure reducing valve (PRV) so that the critical point pressures do not drop below a target critical point pressure within a 99.5% confidence level. Together with an Advanced Pilot Valve for the PRV the system adapts to changes in the characteristics of the network, such as new, or changes in, water demands, to ensure that the optimal pressure is maintained to minimise water losses (Trow & Payne, 2009).

The modelling of leakage in distribution systems has been carried out using EPANET based software. This software has been found to be most suitable when the data available is limited in order to provide preliminary estimates of leakage and its impact on overall demand and pressures (Trifunovic et al, 2009).

Cobacho et al (2011) related energy losses to water losses in a hypothetical water distribution network using EPANET and found that if real losses (e.g. leakage) was reduced by 18.5 litres per capita per day, there would be an annual energy saving equivalent to approximately 0.18 kWh/m3. This reduction in real losses from 50 to 31.5 litres per capita per day related to a reduction in losses as a proportion of supply volume from 22.6% to 15.6% respectively.

An energy consumption of less than 0.1 kWh/m^3 of revenue water for an adequately maintained pressure supply and distribution system is considered 'good' where as values greater than 0.2 kWh/m^3 are considered as 'bad' (Souza et al, 2009). Power usage rates would appear to be dependent upon the configuration, layout and extent of the water supply distribution system.

Calibration of Networks

The application and development of hydraulic network models require calibration so that the conceptual and mathematical model is tuned to accurately simulate actual conditions within the network at a particular time. The theoretical model requires calibrating so that it matches measured data through an iterative process until specified tolerances are reached. Model calibration should be undertaken for various operating conditions to eliminate errors, such as compensating for an incorrect high estimate for water use by using incorrect high pipe friction coefficients. If the model is calibrated for only average conditions there is a likelihood that it will not truly simulate peak flow conditions.

The sensitivity of the pressure difference in the analysis of a distribution network relates to the uncertainties in the parameters involving the basic modelling equations for flow. Field-test programs are warranted when there is uncertainty in the estimation of the pressure drop across a pipeline, particularly when details of the condition of the assets are unknown, or consumption patterns may have changed.

> "Recent innovative developments in metering technology have improved the flow range and accuracy over which the meter can operate."

It is important to note that accuracy requirements for pressure measurement sensors, that their distribution and elevation must be considered when used for field calibration of hydraulic models. The performance capabilities of sensors and logging equipment also directly relate to the level of accuracies that can be achieved in calibrating the network model.

Measured data is usually obtained from permanent monitoring achieved by telemetry systems, or through the temporary monitoring of a sample of sites throughout the network. Critical flow monitoring points include the supplies into the network, outflows from service reservoirs (e.g. tanks), pump stations, districted metered/pressure management areas, large trunk mains, and connections to large water users. Pressure monitoring locations would generally coincide with the flow sites, as well as include high elevation sites in the network (e.g. low pressure) areas with known hydraulic limitations. Temporary pressure logging surveys should include evenly distributed sites equivalent to approximately 0.25% of the connections in the network.

Calibration of a network model therefore involves the use of real-time data and historic data gathered from special logging exercises at a sample of sites. Real-time data is usually restricted to permanent sensors situated on large supply points such as treatment works, reservoirs and pump stations. Current metering technology and meter reading practices (e.g. walk-by, drive-by, park and walk) precludes the use of this as real-time data for modelling and limits the application of historic data for a large portion of the network. The inaccuracy of network models to replicate actual operating conditions is also related the limitations of current equipment and practices.

Future Trends

The future trends in metering and modelling of water distribution networks will be towards improvements in efficiencies of energy and water use. The adoption and application of new technologies will most likely be subject to further incremental steps in improvement before they are universally accepted and applied. A proviso is that political and organisational obstacles will also be overcome to allow implementation of these measures that improve efficiencies.

Considering the current challenges together with the recent innovative developments in metering and modelling, it is envisaged that the following generalised trends will be required if there is to be an improvement in efficiencies in the management and operation of urban water distribution networks:

- Intelligent static electronic meters (e.g. remnant-magnetism excitation) manufactured from composite materials will need to replace mechanical meters manufactured from metals, such as brass, for monitoring smaller urban water users. These intelligent meters have the potential to provide various usage data for the largest portion of the network and with greater frequency than at present
- Woltmann meters with Floating Ball technology and conventional electromagnetic meters will need to replace pressure differential meters for the monitoring of flow in larger diameter pipelines
- Cost effective meters to measure flow in large diameter pipes will need to be developed, which will most likely consist of a hybrid of technologies and metering methods
- Real-time network modelling to improve efficiencies in the operation and maintenance of distribution systems will be required through direct data linkages to intelligent meters at customer connections, in addition to the application of multifunctional sensors together with self-learning algorithms
- The provision of readily available data will be required to help customers manage their usage while simultaneously assisting the utility to improve efficiencies in the operation of the network
- Noticeable improvements in energy and water loss efficiencies in water distribution networks will only be evident if there is the successful integrated application of innovative metering and modelling technologies
- Water loss key performance indicators will require an evolutionary change

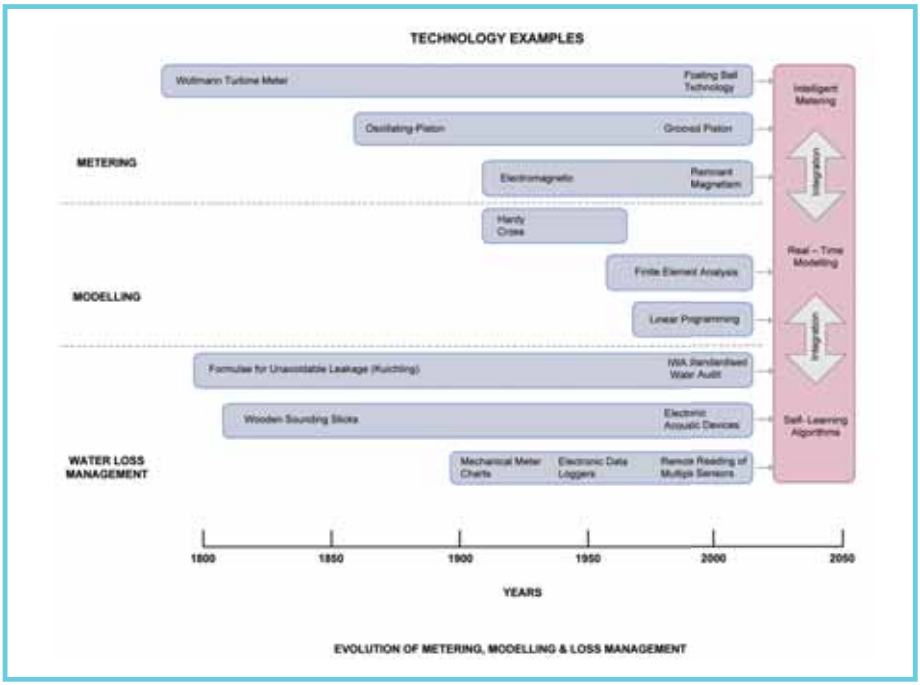

Diagram 1

so that they reflect the true influence of apparent losses on volumetric imbalances while also accounting for energy usage

An illustration of the requirements for integration of intelligent metering, real-time modelling and self-learning algorithms as a prerequisite for improved efficiencies in distribution networks is provided in Diagram 1.

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Water Meter Classifications

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OIML Water Meter Classifications What is it and Why do we Need it?

New Zealand does not have any national water meter standards in place to protect water suppliers and consumers against water meter quality standards or accuracy. This can lead to problems resulting from incorrect meter readings where water consumers are being charged on the basis of volume consumption.

If their water supplier has not clearly defined their meter specification, a dispute process and can provide independent traceability of meter accuracy to a verifiable standard, then our industry is not likely to be in a defendable position to charge or calculate a uniform rate change for water, based on use customer consumption.

Both water suppliers and central government have acknowledged their concern that water meters were specifically exempt from previous Consumer Affairs weights and measures legislation. To try and address this for the protection of the industry (water suppliers and consumers), Water New Zealand (then NZWWA) with the support of Consumer Affairs issued the Water Meter Code of Practice in September 2003.

Even back then the Government was adamant that our industries commonly specified meter standards of British Standard 5728 and ISO 4064 (based on the original European Council 1975 Measuring Instruments Directive 75/33/EEC), were outdated and inadequate.

New Zealand is a signatory member to the Organisation of International Legal Metrology (OIML) therefore Consumer Affairs insisted that the New Zealand water industry adopt the Water Meter Standard of OIML R49 based on the new Measuring Instruments Directive (MID), EC/2004/22, issued on April 30th 2004. This European Council directive came into force on October 30th 2006.

As a result of the directive from the European Parliament and of the Council (EC) this Measuring Instruments Directive (MID), Directive 2004/22/EC, had the key objectives of removing barriers to trade in measuring instruments, which had become apparent through old directives restricting the compliance and use of new mechanical and electronic static metering technologies.

This directive applied to measuring instruments for trade purposes well beyond water meters and includes taximeters, dimensional measuring instruments, heat meters, electricity, gas and many more. For relevance to this issue of WATER, this article will focus on urban water meters and how this OIML R49/1 2006 standard relates to the New Zealand water supply industry's previously adopted common standard of BS 5728/ISO 4064.

It does not take much imagination to believe that a 35 year old ISO or British standard, which classified all water meters into only three set metrological performances classes (A, B and C) was very out of date and inadequate in representing today's metering technologies. Combination meters, manifold meters, magnetic flow and sonic meters, were all yet to be conceived as common solutions to water supply metering needs back in 1975 when this first directive was given. The passage of time resulted in different metering technologies well exceeding the abilities of these old standards metrological performance classes, with approval to this standard appearing to be a limitation to modern meters true performance capabilities.

Despite this MID 2004/22/EC directive being issued, it was found that for it to enable equipment manufacturers and water suppliers to clearly define a product to the new directive, it lacked specific detail on metrological and technical requirements, and test methods and equipment. To address this, a detailed European Standard (EN14154) and conformity testing assessment MID MI001 and accompanying International Standard (OIML recommendation R49 2005) was issued to European and international member countries including New Zealand.

These replace all standards previously used including BS5728 and ISO4064 (1993) and others. In fact the International Standards Organisation (ISO) has also embraced this new standard by releasing a new version of ISO4064 2005, which follows the same methodology of OIML R49 and EN14154, allowing for the first time all these bodies to adopt the same recommendations and product conformity assessment testing of MID MI001 certification.

This allows the following commonality between all three standards (OIML R49 2006, ISO 4064 2005, EN14154);

- Metering that is non technology specific to allow current and future advances in technology
- Electronic based metering products with tests and requirements for these technologies
- Ensure that meters work as advertised through the manufacturers setting the performance to which they wish their product to be tested, (rather than three preset performance levels Class A,B,C)
- Allows meters performance to be defined by its true flow range ability and then for them to be defined and marked with the appropriate designations accordingly (assessment certification to MID MI001)

MID MIOO1 certification

All meters tested and certified to MID MI001 must satisfy the following comprehensive essential requirements to gain certification.

- Allowable error of registration
- Reproducibility
- Repeatability
- Suitability
- Protection against corruption
- Information to be marked on the meter
- Indication of result
- Further processing to conclude transaction
- Conformity evaluation

The MID MI001 meter performance certification testing includes:

- Orientation – accuracy and endurance in all orientations
- Water temperature – accuracy of minimum and maximum rated temperature
- Water pressure – accuracy of minimum and maximum pressure
- Reverse flow – accuracy in reverse or non return valve integrity
- Static magnet – accuracy affects when applying a large magnet
- Flow disturbance – accuracy with specific upstream and downstream disturbers
- Extended endurance – at elevated flow rate

MID marked register

For the first time OIML R49 2006/ EN14154/ ISO 4064 2005 standards have brought both electronic metering and mechanical metering under one common MID MI001 conformity testing certification. With electronic products including the additional tests of:

- Specific EMC tests
- Environment affects (humidity, vibration and freezing)
- Digital display specifications
- Software considerations (tamper and access to metrological setting etc)
- Tamper (access to verified software metrological settings)
- Meter data (battery life and voltage requirements etc)
- Ancillary equipment (pulsers, outreaders and transmission etc)

Below – Mechanical large meter;
Bottom – Electromagnetic large meter

As a national industry, we are all yet to adopt suggestions contained within the water meter Code of Practice and specify meters certified to MID MI001 / OIML R49 2005 with minimum meter performance specifications.

This needs to be done within the water suppliers water meter specifications, procurement and customer protection policies. It all too often can be found suppliers that do specify a meter standard, do so by specifying the superseded ISO 4064 1993 Class C meter rating.

Both our industry association and central Government through the Ministry of Consumer Affairs have made clear recommendations that "all water meters shall comply with the international OIML R49 standard by 1 July 2005."

Given the passage of time, surely such use of a superseded standard, for a product used for establishing consumption use, is still difficult to justify. It may take a court finding over a disputed meter consumption charge to test whether a recently supplied meter with the previous Class C certification rather than an OIML R49 conformity certificate to MID MI001 is still acceptable as a verification of accuracy.

It is important to note that this Directive specifically applies to meters manufactured from October 30th 2006 and does not have standing to any meters purchased or installed prior.

The good news is it would appear that many urban/domestic water meters now purchased by New Zealand water suppliers from reputable international manufacturers do appear to be supplied with OIML R49 MI001 certification markings.

"Meters should also be capable of being fitted with future smart metering technology which is developing at a rapid pace. Most importantly, because of our relatively safe society and temperate climate, outside "in ground" installations are our common installation method."

The OIML R49 MI001 verification specification used by New Zealand meter suppliers, appears to be a specification that most closely matches the performance rating of the old Class C ISO 4064 standard. While it can be argued that this interpretation is the closest available between the old and new standards, it has most likely occurred through the meter suppliers choosing this rating to match the councils previous Class C specification. Many new models of meters are now not available with the old Class C standard because from October 2006 pattern approval to this old certification is no longer carried out under official MID testing.

Meter register with ISO 4064 Class "C" certification markings

Meter register with OIML R49 R160 certification markings

If water suppliers and consumers do not have an understanding of how to correctly specify the current meter standards to meet their needs, then they must continue to rely on the good will of meter manufacturers and meter suppliers to do the right thing. This may not be a realistic position to take, when increasingly meters are being used to charge for water consumption and it is the water supplier that is accountable to their customer for the meter they use.

Here is my attempt to provide an abbreviated explanation and comparison between ISO 4064/1 1993 certified Class C meter and the OIML R49 2006 MI001 certified Q1/Q3 R160 meter in the popular nominal flow rates of 1.5 and 2.5 m^3/hr or 15mm/20mm nominal bore for connections using an inline or meter manifold configuration.

Under 1975 EEC73/33 recommendations on which the old standard was based, ISO 4064 1993 pattern approved meters were classified under meter metrological classes A, B, C (and D in the UK). The meters had to operate within these specified flow range of the class with a +-5% accuracy in the "minimum flow (Qmin)" up to the "transitional flow (Qt)" and +- 2% accuracy from the Qt to the maximum flow rating (Qmax).

These flow terms under the new standard have changed their name to:

- Qmax = Q4
- Qnorm = Q3
- Qt = Q2
- Qmin = Q1

Under EC/2004/22 recommendations, metrological classes are no longer a consideration, with the meter metrological performance being specified as a ratio between the meters "permanent flow rate" (Q3) and "minimum flow rate" (Q1) ratio Q3/Q1. The range of Q3/Q1 ratios a manufacturer can ask to be compliance assess against is set out in a specified list within the standard.

Previously it has been mentioned that where councils have specifications for a Class C meter under ISO 4064 or BS 5728, meter suppliers are supplying an OIML R49 meter of the same nominal bore with a R160 Q3/Q1 ratio.

As a comparison example, a Class C meter of a 15mm/20mm nominal bore and a maximum flow Qmax rating of 3m^3/hr, against an OIML R49 meter with the same 3m^3/hr overload flow rate Q4 rating and an R160 Q3/Q1 ratio of R160 of the same nominal bore can appear as follows under each standard.

ISO 4064 Class C Qmax 3m³/hr rating specifies:

- Qmax – 3m³/hr
- Qnorm – 1.5 m³/hr
- Qt – 22.5 l/hr
- Qmin – 15 l/hr

The ratio of Qmax to Qn under the old standard was set at 2:1

The ratio of Q4 to Q3 under OIML R49 is 4:3 which allows an increase in permanent flow rate (Q3) value over the pervious Qnorm value to recognise the improvements made in meter performance and wear.

OIML R49 2006 certified MI001, Q3=2.5m³/hr, Q3/Q1 ratio of R160, specifies:

- Q4 = 3 m³/hr
- Q3 = 2.5m³/hr
- Q2 = 25 l/hr
- Q1 = 15.625 l/hr (R160 x Q 1 15.625 = Q3 2.5 m³/hr)

Performance of existing domestic ISO 4064 Class C meters can be catered for under OIML R49 2006 by specifying the same Qnorm to Q3 flow rates as previously used and the Q3/Q1 ratio of R160 or better.

By specifying new meters to the new standard in this this way, it allows the meter to have a similar performance rating of the old Class C standard, to do so does not take into account the ability to take advantage of the many improvements in meters measuring range for which the new standard was devised.

As an example, if a meter with the same Q3 of 2.5 m³/hr was specified with a higher Q3/Q1 ratio, then you can be sure to secure meters which have a better ability to measure low flows such as leaks.

Given long established meter brands in New Zealand, such as the Sensus and Elster, have models available with starting flows of less than 1 l/hr and minimum flows of 6 l/hr, it shows that the industry is already capable of providing product that achieves measuring performance well beyond that of a Class C meter or a Q1/Q3 R160 meter.

Water suppliers and consumers should request and expect new metering product with the comformity certificate to MID MI001 under OIML R49 2006 as recommended by our industry body and central government.

Performance of existing domestic ISO 4064 Class C meters can be catered for under OIML R49 2006 by specifying the same Qnorm to Q3 flow rates as previously used and the Q3/Q1 ratio of R160 or better.

When reviewing different meters MI001 conformity certificates, it is advantageous to select a meter with the same Q3 permanent flow value but a greater Q3/Q1 ratio than R160, as this will provide a meter with a greater measuring range and ability to register lower flow. Meters with ratio's of R200, R300, R400 and greater are readily available.

Consideration must also be given that any cost premium of a larger measuring range available from these greater ratios does not outweigh the benefits.

Meters should also be capable of being fitted with future smart metering technology which is developing at a rapid pace.

Most importantly, because of our relatively safe society and temperate climate, outside "in ground" installations are our common installation method. It is therefore critical the meter register totaliser design does not fog under New Zealand field conditions and is easy to read accurately by meter readers, or all these standards and technology in measurement will have been in vain! ■

Meter in the ground

"If water suppliers and consumers do not have an understanding of how to correctly specify the current meter standards to meet their needs, then they must continue to rely on the good will of meter manufacturers and meter suppliers to do the right thing. This may not be a realistic position to take, when increasingly meters are being used to charge for water consumption and it is the water supplier that is accountable to their customer for the meter they use."

Craig Scott Ramsay

As Managing Director of Deeco Services Craig has an active involvement with the New Zealand water industry and water meters going back more than 30 years. This includes submissions on a joint AS/NZ water meter standard in the late 1990s and committee appointment for the establishment of the NZWWA Water Meter Code of Practice in 2003.

Urban Metering – Is There a More Cost Effective Solution to Reducing Water Demand?

Richard Taylor – Principal Engineer, Water, Thomas Civil and Environmental Consultants

There are many advantages and arguments in favour of universal metering, but before proceeding with a proposal to meter all properties I believe the following questions need to be addressed:

- What is the objective of the metering programme?
- Is there a more cost effective solution to achieving the objective?

If reducing demand is the primary objective of introducing urban metering, then alternative more cost effective measures may be available to achieve the objective, and this is discussed below. The social aspects associated with metering are not addressed in this article, but it is acknowledged that they are significant in relation to the issue of metering.

When it comes to the supply of water to a community, the main components in terms of water quantity are: water supplied (i.e. delivered from the treatment plant/source into the network), water consumed (i.e. water used by customers) and water loss (i.e. water lost from the network in the process of transferring the water from treatment plant to the customer). If there is a current or predicted shortage of water to a community all of these three components need to be considered in addressing the issue.

"Experience in New Zealand has shown that demand can be reduced by over 20% by introducing urban metering, so it is a proven means of effectively reducing demand over a relatively short time frame. However, is it the most cost effective means of solving a water shortage issue?"

Increasing water supplied by augmenting or upgrading existing water sources/treatment is generally the most expensive option (depending on the availability of water and the treatment process required) and only acceptable from a consenting perspective if demand management initiatives addressing the other two components (water consumption and water loss) are put in place. The options of reducing water consumption and reducing water loss in order to meet future demand and to address a water shortage are examined in more detail below, and a hypothetical simple cost benefit analysis is provided to support the argument.

My experience is that reducing water consumption long term is a challenge without structural changes. Advertising and media campaigns generally result in only short term reductions in water use, and in order to lock in long term reductions, the installation of low water use fittings and equipment is generally required. Water audits can be carried out to identify where the opportunities are in this area. However, it is unlikely that these types of measures alone will be sufficient to solve an impending water shortage to a community, and if properties are not metered, moving to user-based charging by introducing metering is an effective means of reducing demand. Experience in New Zealand has shown that demand can be reduced by over 20% by introducing urban metering, so it is a proven means of effectively reducing demand over a relatively short time frame. However, is it the most cost effective means of solving a water shortage issue?

The third main component in the water supply equation is water loss. Reducing water loss is a third alternative option to increasing the volume of water available for consumption. But how significant is the potential to reduce water loss? And is it a credible alternative to reducing consumption by introducing urban metering?

To illustrate the potential and cost effectiveness of reducing water loss as an alternative (or priority over) metering in an urban context, consider the following hypothetical (yet typical) example. Take a large town with 20,000 connections, 2,500 of which are non-residential metered connections, and 17,500 unmetered residential connections. For the 17,500 un-metered residential connections, typical water use can be assumed at 240 litres/person/day, or, at an occupancy rate of 2.7, 648 litres/connection/day. Introducing metering would likely cost $350 per property (x 17,500) or a total of $6.125m. If a 20% reduction in average residential demand was achieved, this equates to a reduced water use of 518 litres/property/day (or 192 litres/person/day). This represents a reduction in residential consumption of 130 litres/property/day from 17,500 connections = 2,268 m^3/day (or 2.27 ML (megalitres)/day) at a cost of $6.125m.

For the same town, assuming there have been limited initiatives introduced to reduce water loss (which is a realistic scenario), the level of water loss will likely be in the order of 250 litres/connection/day (this represents approximately 25% loss).

(Note: Litres/ connection/ day is the recommended performance indicator for water loss from urban networks). For this network, water loss could realistically be reduced by half to 125 litres/connection/day by implementing a range of measures to manage water loss, including setting up District Metered Areas (DMAs), telemetry monitoring systems, pressure management and on-going active leak detection. The capital cost of implementing these measures would likely be in the range $1.5 to $2.0m.

The savings achieved would be 125 litres/connection/day x 20,000 connections equating to 2.50 ML/day. There will be on-going maintenance costs associated with both options, but the additional opex costs associated with metering will be far higher, considering the meter reading, billing, account enquires and processing and meter maintenance required. Even at say $30pa per meter x 17,500 connections = $525,000pa compared with typically less than $150,000pa for on-going water loss reduction). Providing there is a continuing commitment to water loss management, there is no reason why the reduced level of water loss cannot be maintained at less than 125 litres/connection/day. As an example, in Waitakere City the 2009–2012 Long Term Council Community Plan (LTCCP) included a performance measure to maintain water loss at less than 75 litres/connection/day, which was achievable. It should be noted that the calculation of water loss for a network where residential connections are not metered has a much higher level of uncertainty than for a network which is universally metered, however, this does not undermine or diminish the robustness of the cost analysis outlined above.

Hence to summarise: For the hypothetical example given above for a large town of 20,000 connections, metering residential properties will likely cost $6.125m and result in savings of 2.27ML/day. Water loss initiatives will cost $1.5–2.0m and save 2.50 ML/day. Ongoing opex costs will be higher for the metering option, reflected in higher overall water charges.

The reality is that if there is an impending water shortage to a community, in my view both water loss reduction and the introduction of metering should be implemented prior to supply augmentation. However, this article has demonstrated that in terms of cost effectiveness, it is likely that water loss reduction will be far more cost effective than the introduction of metering in terms of reducing total water demand requirements for a community. ■

"The reality is that if there is an impending water shortage to a community, in my view both water loss reduction and the introduction of metering should be implemented prior to supply augmentation. However, this article has demonstrated that in terms of cost effectiveness, it is likely that water loss reduction will be far more cost effective than the introduction of metering in terms of reducing total water demand requirements for a community."

Modelling the Whangarei Wastewater Treatment Plant for Optimised Design Planning

Tom Joseph – Hydraulic Modelling Team Leader, AWT Water Ltd

The Whangarei Wastewater Treatment Plant (WWTP) is owned and operated by Whangarei District Council and services a population of approximately 45,000 people from Whangarei urban area and surrounds.

Historically wet weather inflow to the WWTP was limited to approximately three times the average winter dry weather flow by the four terminal pump stations location within the sewer network. Recently the largest terminal pump station, Okara Park, was upgraded with an increase in capacity from approximately 600 L/s to 1200 L/s. This significant upgrade has eliminated risk of a major overflow at the Okara Park pump station and by nature results in a significant potential increase in wet weather flow to the WWTP. Further to the pump station upgrade, the wet weather peaking factor at the WWTP is predicted to increase from approximately three to seven times the average winter dry weather flow with these peaks anticipated to occur several times during the winter season.

As Figure 1 shows, the WWTP has three levels of treatment depending on the scale of incoming flow. Traditionally storm flows exceeding a preset limit are diverted to the equalisation basin and/or storm clarifiers during storm events. The upgrade to the Okara Park pump station has intensified the need to investigate upgrades to the WWTP to handle the additional flow. In addition, the Regional Authority has indicated that all flows are required to meet an equivalent E. coli disinfection standard of 1,000 CFU/100 mL.

Figure 1 – Whangarei WWTP Flow paths

Understanding the Hydraulics First

As a first step in planning the upgrade it was essential to understand the hydraulics of the WWTP. In order to derive a detailed understanding of the hydraulics it was necessary to model the WWTP using a standard hydraulic model. The model included all of the WWTP processes units, hydraulic structures, connecting pipes and pumps. This data was obtained from as-built drawings and supplemented by a site survey.

Figure 2 – Aerial of WWTP and key process units

The model was used to simulate the plant hydraulic performance across the range of expected flows and identify areas where hydraulic constrictions existed under various peak flow scenarios. Once the restrictions were identified the model was then used to examine "what if" scenarios for various plant upgrades.

The use of a standard hydraulic model in a WWTP requires the input data, like any model, to be as accurate as possible. This includes validating head losses through process units, hydraulic stability of short pipe spans and their entry and exit losses and simulating real time controls. Limited calibration data was available, however, data at various key points was available and model "calibration" using informal operator's knowledge and experience was indispensable.

Linking Sewer Collection System to the WWTP for a Complete Performance Picture

The model was then linked to the upstream network hydraulic model so that system wide solutions of prolonged storm events could be developed. This also allowed quantification of the total discharge of treated, semi-treated and not-treated water to the environment for various storm event scenarios. The model identified potential upgrade options such as storage or pump controls in both the upstream network and at the WTTP. Options were further quantified using extended time series storm events.

Presenting Results Using a Web-Based Platform

All of the results have been presented to project stakeholders through a web-based platform. This enables a true multi-user platform where any number of interested stakeholders can remotely view model results and interrogate highlighted constrictions.

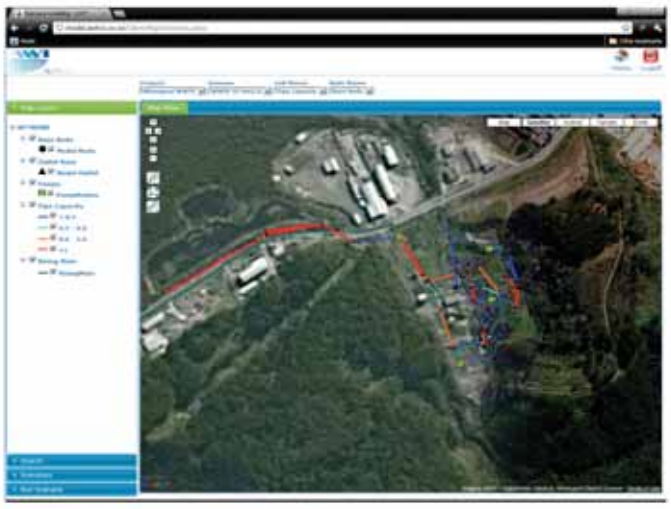

Figure 3 – Web Based Platform

Linking Flow and Predicted Wastewater UVT

Another part of the project was to model water quality (wastewater load) and in particularl, related biological processes through the plant. The hydraulic model has been linked to utilising the OpenMI modelling interface standard. This is a simple spreadsheet water quality model which is used to simulate UV Transmittance (UVT[1]) through the various process units.

OpenMI allows multiple models to be linked during runtime through an open source standard interface. Several proprietary models have subscribed to the OpenMI standard which allows linking of these models to customised logic and other proprietary models.

The UVT model was developed on the basis of grab sampling throughout the plant during a single storm event. Further validation is recommended through similar sampling, to provide a higher degree of confidence in its process replication accuracy.

The model predicts increases in UVT as the wastewater is progressively treated through the plant. The primary goal of the UVT model was to determine when the water would meet an acceptable level for effective UV disinfection. Typically, secondary treated wastewater UVT is 30–40% however UVT's as high as 55% have been recorded at the proposed point of disinfection.

Integrated Collection System and WWTP, Modelling Flows and Loads in a single Dynamic Simulation Model

The final stage in the project was linking the hydraulic model to a biological model of the plant through the same interface. These linkages allow the team to understand the integrated plant hydraulics, biological processes, and disinfection potential within a single model run, allowing the identification of an optimal design solution. Having a complete hydraulic model of both the upstream network and the WWTP allows planners and engineers access to a full catchment model to assist in planning appropriate catchment wide improvements.

> "The hydraulic model has been linked to utilising the OpenMI modelling interface standard."

What Now

Having delivered the model, we are currently helping our client with engineering design options to meet the goals set. ■

Tom Joseph – Hydraulic Modelling Team Leader, AWT Water Ltd
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Client contact – Andrew Carvell, Whangarei District Council
Email: acarvell@wdc.govt.nz, Ph: 09 430 4230

Footnote

[1] UVT is an indicator parameter which correlates the quantity of dissolved organic material and solids which absorb and scatter UV light, expressed as a percentage. The higher the UVT value, the greater the capacity to 'transmit' UV light under the prevailing environmental conditions. If the UVT is too low, then the UV light is not able to penetrate the water as effectively. This can reduce the microorganism kill and inhibit the effective disinfection potential.

Selecting the Right Modelling Approach and Tool – Experiences of the Transportation Sector and Application to the Water Sector

Ian Garside – Technical Director, Environmental Engineering, Beca Infrastructure Ltd

In recent years there has been significant expenditure on increasing the capacity and upgrading sections of New Zealand's state highway network. The construction of major transportation projects can have a significant impact on the surrounding drainage and conveyance systems and users of these systems. Understanding the fate of runoff using modelling techniques has become an integral part of the highway design process in recent years, as it has in the municipal water sector.

These techniques are applied in the design of new highway drainage systems and diversion of existing drainage networks to accommodate new highway alignments. In many circumstances, the highway horizontal and vertical alignments can affect the proposed and existing drainage networks and vice versa. This is particularly true when the design needs to be within the constraints of the affected council's requirements or land designation.

At present, there are many types of drainage modelling packages available that can be used to incorporate the varied transportation design challenges into the model, assess the drainage impacts of the project on the surrounding environment and optimise the mitigation solution. The key to overcoming these transportation design challenges is to select the correct approach and modelling tool to support the design solutions.

In rural areas, the effect of increased flooding frequency and flood levels on properties or floodplains are due to the increased runoff generated that overwhelms the rural standard stormwater system, and to the loss of floodplain storage because of the highway footprint. Embankments can also act as a barrier to the natural overland flow paths. These changes to the drainage system can have impacts further downstream and the mitigation extent becomes required catchment-wide.

In urban areas the increased flooding frequency and flood levels to surrounding properties and public areas are largely attributed to the undersized existing conveyance system that may have been in place for the last few decades. The design capacity of this existing system more often than not does not account for flows from transportation projects. In highly urbanised catchments, any increase in stormwater runoff can easily overwhelm downstream conveyance systems and cause flooding to a large number of surrounding properties due to increased development density.

Negative effects on the surrounding area and entire catchment need to be assessed in the design of a highway. Localised assessment of the drainage system at project level at the location of the highway alignment only is inadequate, as the runoff usually travels a considerable distance in the downstream drainage network and interacts with other systems (e.g. sewer overflows) before discharging into water bodies.

Careful consideration of these potential effects and desired outcomes prior to undertaking the modelling work is essential in defining the scope of work and approach to be adopted. There are instances in New Zealand and beyond where, because this careful thought has not been applied, the modelling work has been driven by the interest of the modeller and the outcome seems an afterthought.

The selection of the appropriate tool or modelling software is part of this process and should take into account the following:

- The functional capability of the modelling software to consider and be able to replicate and reproduce the issues or features around which the desired outcome is required
- End user requirements and capability to support the model by having, for instance, the appropriate software available for the end user to use. It should be noted however, that despite arguments to the contrary, models once developed for a specific task are rarely used or maintained to be re-used for other tasks
- There can be no favourites. Often software is selected not for the suitability for the task that it is to be used for, but based on the fact that the people or persons who are going to carry out the work are familiar with a 'favourite' software package. There is often resistance on the part of the modeller to try something new, which is a little surprising given that the usability and transferability of these packages has distinctly improved over the years

The following table demonstrates some specific projects recently carried out by Beca, where the approach and the tool selection process were carried out prior to the project being commenced.

In summary, careful planning of the approach and the tool to be utilised prior to commencing work is essential in an efficient modelling and design process. Many software packages are currently available on the market and knowledge of their features, functions and limitations greatly assists in the selection of the right tool. ■

Project	Issue	Approach	Tool Used
Construction of urban motorway	Need to divert an existing drainage culvert whilst maintaining current level of service in existing culvert and associated drainage system.	Review suitability and use of existing model. Modify model to reflect desired culvert changes including consideration of additional hydraulic features. Representation of hydraulic features confirmed by hand calculations and engineering judgement.	Mike Urban
Arterial road in rural area	Need to design a drainage solution that does not exacerbate current flooding, permits the use of existing drainage pumping stations and mitigates the damming potential of the new road.	Current model deemed unsuitable due to lack of detail in key areas. Initial desktop exercise carried out to determine key issues and key hydraulic structures prior to modelling being carried out. Detailed modelling carried out in and around key features. Simplified modelling used elsewhere.	HEC – HMS – Hydrology HEC – RAS Hydraulics
Drainage of developing catchment in a tidally affected area and the need to accommodate major new highway	Need to accommodate increased imperviousness due to road and increased development and yet mitigate potential flooding.	Model developed to consider boundary conditions, to accommodate and design culverts for adequate drainage beneath new road and to have an accurate representation of flood plain storage.	Infoworks CS

Drain London: A Summary of Challenges and Solutions for Delivering 33 Surface Water Management Plans

Michael Arthur – Senior Consultant, Flood Risk and Water Management, Capita Symonds, London and Matthew Graham – Principal Consultant Water, Environment & Natural Resources, Scott Wilson, URS, London

An initial high level assessment of surface water flood risk across greater London indicated that approximately 680,000 properties may be at risk of surface water flooding. The main objective of Drain London is to better manage and reduce surface water flood risk in London.

The project will develop individual strategic level Surface Water Management Plans (SWMPs) and Preliminary Flood Risk Assessments (PFRAs) for each of the 33 London Boroughs. This paper aims to describe the methods and solutions developed to overcome the technical and political challenges encountered during the project to date within context of the SWMP process:

i. Phase 1: Licensing, obtaining, collating and reviewing a wide range of datasets from a multitude of London Boroughs and other stakeholder organisations.
ii. Phase 2: Delivery of consistent and comparable Flood Risk/Hazard Maps and Preliminary Flood Risk Assessments (PFRA) to achieve compliance with the Flood Risk Regulations 2009.
iii. Phase 3: Development of local and strategic level flood mitigation solutions, then selection of the highest priority projects for further investigation.
iv. Phase 4: Define the way forward for surface water flood risk management within each Borough by clearly describing a timeline of actions with agreed responsibilities amongst the relevant stakeholders.

The paper concludes with a summary of key lessons learned and important factors for others to consider when undertaking similar scale surface water flood risk studies.

1. Introduction

1.1 Background

The severe flooding that the UK has experienced in recent years, together with the challenges of climate change, population growth and increasing urbanisation, has prompted a wide-ranging debate about the future management of flood risk and urban drainage. There is consensus on the need for more holistic approaches to surface water management, that require closer coordination between drainage stakeholders, including the sharing of data on drainage assets as well as an assessment of all sources of flood risk, to support more effective land use planning, flood risk and drainage infrastructure investments and improved emergency planning.

London has been identified as an area at high risk of flooding, both in terms of likelihood and the scale of the consequential damage. An initial high level assessment of surface water flood risk across greater London indicated that approximate 680,000 properties may be at risk of surface water flooding. In common with many large conurbations, London presents many challenges to managing the risk, owing to its size, population and the complexity of its landscape, infrastructure and institutional structures.

"The severe flooding that the UK has experienced in recent years, together with the challenges of climate change, population growth and increasing urbanisation, has prompted a wide-ranging debate about the future management of flood risk and urban drainage."

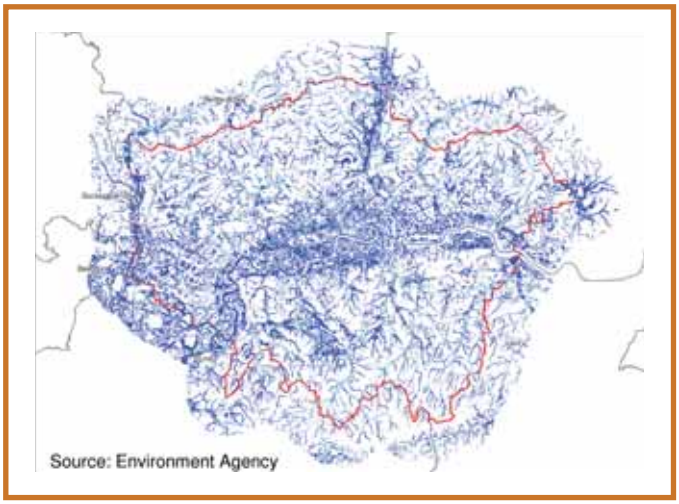
Surface water flooding in Motspur Park (South West London – July 2007)

London is divided into 33 separate boroughs, with a total population of 7.63 million and 3.2 million homes. In addition to the Thames, it has 13 major rivers, most of which span, or form Borough boundaries. For example, the Thames flows through 17 London Boroughs, the River Lee flows through six Boroughs and the River Brent through five.

1.2 Drain London Forum

In 2007, the Drain London Forum was established to bring together representatives from organisations with the information and/or responsibility for managing surface water drainage in London. The Forum has developed into a committed and effective partnership, which has delivered a Scoping Study into the data holdings of all its members and recommended strategies for sharing the data among them. The Greater London Authority (GLA) on behalf of the Drain London Forum has been granted funding by Defra to deliver the Drain London project.

The Forum includes representation from each London Borough, Defra, Environment Agency, Government Office for London, GLA, London Councils, London Development Agency, Thames Water and Transport for London. There are also links to thematic borough groups such as the Association of London Environmental Health Managers (ALEHM) and the London Transportation Technical Advisors' Group (LoTAG). The Forum meets approximately 4 times per year and is an important mechanism for engaging stakeholders for the project, alongside a regular newsletter.



1.3 Drain London Programme Board

The Programme Board advises the GLA (as accountable body for the Defra Grant and contracting body with the consultants) on the expenditure of the Defra Grant. The Programme Board is composed of representatives from the Environment Agency, Greater London Authority, London Councils and Thames Water. Defra have been invited to observe the Programme Board.

1.4 Objectives

The goal of the Drain London project is to manage and reduce surface water flood risk in London. This goal will be delivered through the following objectives:

a) Use a risk-based approach to identify and prioritise surface water flood risk and flood risk management in London
b) Create partnerships of key stakeholders to 'own' both the flood risk and the delivery and maintenance of the identified risk management measures
c) Build the capacity within London to manage flood risk – across different physical scales (regional, local, neighbourhood, community and individual), sectors (public, private, voluntary, community) and disciplines (spatial planning, emergency planning, development control, public realm management, engineering, highways management, public health, communications and community engagement)
d) Maximise the potential for multifunctional solutions that provide multiple benefits (e.g. offsetting the urban heat island effect, improving the quality of life for local residents, placemaking etc)
e) Take account of the changing nature of the risks, due to climate change, population and demographic change, public awareness and acceptance
f) To deliver change on the ground, not just reports and models

1.5 Project Delivery

The Drain London project is broken down using a 'tier' based approach as shown below.

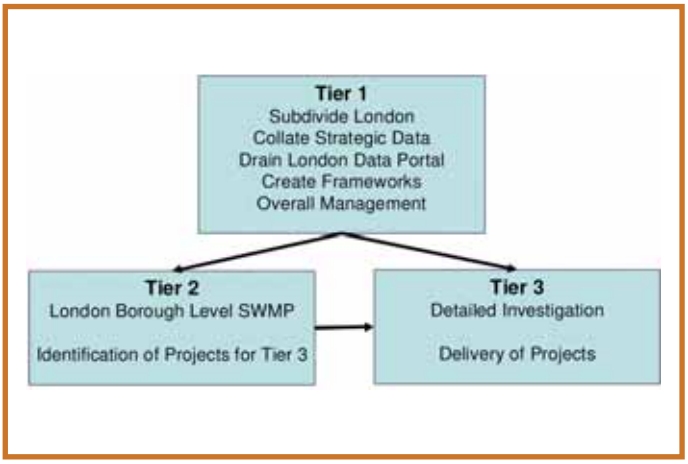


Figure 1 – Drain London Project 'Tier' Structure

Table 1 below further describes the activities undertaken in each of the Tiers. The management groups are shown in Figure 2. Tier 2 of the project has been procured and will be delivered using these groups as the main management mechanism.

Tier	Summary
Tier 1	a) A high level strategic investigation to group the 33 separate boroughs into a smaller number of more manageable units for further study under Tiers 2 and 3. b) Development of a web based 'Portal' to provide data management, data storage and access to the various data sets and information across the 'Drain London Forum' (DLF) participants and to consultants engaged to deliver Tiers 2 and 3. c) Develop technical framework documents and prioritisation tools to guide delivery of Tiers 2 and 3.
Tier 2	a) Delivery of 33 Borough-level Surface Water Management Plans (SWMPs) within the management groups to further define known flood risk hotspots, high vulnerability areas as well as map new areas of potential flood risk. These SWMPs must also meet the Flood Risk Regulations 2009 requirements for Lead Local Flood Authorities (LLFAs) to producing Preliminary Flood Risk Assessments (PFRAs), Flood Risk Areas and Flood Hazard Maps to June 2013. b) Define a list of prioritised Flood Risk Areas for potential further detailed study or capital works in Tier 3, using the Prioritisation Matrix.
Tier 3	a) Detailed investigations into high priority Flood Risk Areas to further develop and prioritise mitigation options. b) Development of cross-organisational action plans that include a costed list of identified flood risk management mitigation measures and community level flood plans.

Table 1 – Drain London Project 'Tier' Structure

Figure 2 – London Borough Groups

2. Methodology

The overall size of the project and the number of parties involved creates a need to ensure that all outputs result from a consistent technical approach, are of a high technical quality and are communicated in the specified formats. To facilitate this, the initial stage of the project has delivered several framework documents and tools.

The Defra SWMP Guidance (Defra, 2010) has been interpreted for Drain London to deliver a strategic level SWMP and a PFRA (Flood Risk Regulations 2009) for each London Borough. A summary of the Tier 2 SWMP process is shown in Figure 4 below.

The SWMPs delivered by this project will cover the majority of the elements of an 'Intermediate Assessment' Phase 2 Risk Assessment with parts of Phases 3 and 4 at a 'strategic level'.

2.1 Framework Documents and Tools

It is essential for the Drain London project that all outputs are consistent and comparable across Greater London. This is to facilitate:

- Fair, transparent and rapid allocation of funds to identified high priority flood risk areas within London
- Collaborative working practices between consultants and LB groups
- Building of local capability (Council officers and consultants doing work in the future will be able to make use of outputs regardless of who produced them for each Borough)
- Efficiency in review by the Environment Agency and subsequent submission of results to the European Commission

The two framework documents and the prioritisation tool were developed to achieve these aspirations and are described in the following sections.

2.1.1 Data and Modelling Framework

The aim of the Data and Modelling Framework is to establish a consistent format and set of standards for SWMPs delivered under the project. The document sets out an over-arching framework for the management of data and modelling to:

- Ensure SWMPs are delivered in a consistent way across Greater London
- Encourage cross-authority and cross-boundary data sharing
- Provide firm direction to guide the delivery of Tiers 2 and 3
- Allow cost savings through efficiencies
- Allow strategic decisions to be made on a consistent evidence base

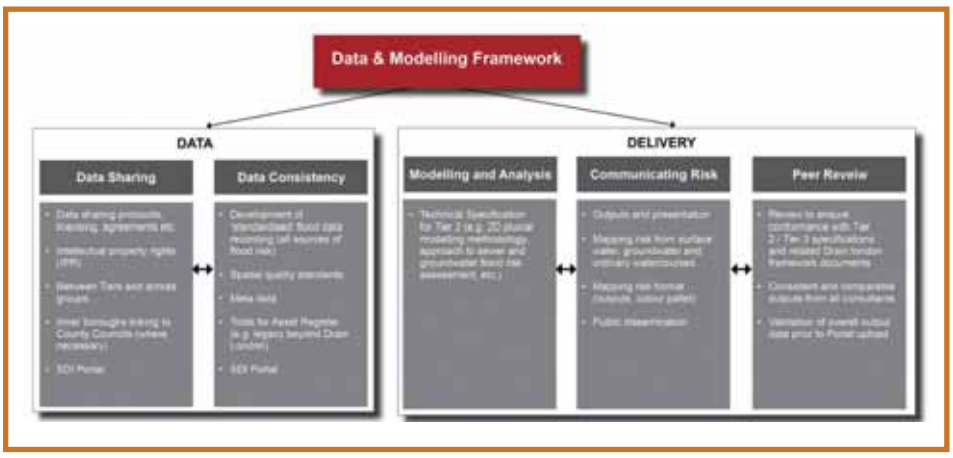
2.1.2 Collaborative Working Framework

This document sets out a Collaborative Working Framework to help the Drain London Forum ensure the efficient and successful production of 33 Surface Water Management Plans (SWMPs) for all 33 London Councils. This requires cooperative working arrangements principally between Thames Water, Transport for London, the Environment Agency, the London Councils and the Greater London Authority and the framework consultants employed to assist in the process. The need for collaborative working in the context of Drain London is two-fold:

1) Promote cross-organisational collaboration between the relevant authorities in flood risk management in order to:

- Ensure that future investments are co-ordinated across the key organisations responsible for flood risk management in London
- Avoid ad-hoc arrangements for flood incident response
- Avoid overlap in routine maintenance of essential flood risk infrastructure
- Set out what is expected from each of the key partners in flood risk management and what actions each authority will take forward

Figure 3 – Data and Modelling Framework Structure



2) Promote a partnering ethos across the engineering consultants undertaking Tiers 2 & 3 of the Drain London project in order to:

- Facilitate the transfer of knowledge and expertise and to ensure best value for money is achieved
- Help ensure good practice is adhered to
- Ensure that the efficiencies of scale are achieved and the money available delivers tangible flood risk improvements in London
- Ensure appropriate sharing of methods, techniques and tools, that will help ensure a consistent approach and comparable outputs

The framework sets out an approach by which successful partnerships can be built between the organisations tasked with the production of the SWMPs based on common requirements, similar issues and shared goals. This is achieved by giving all parties an understanding of the project's collaborative working protocols and formalised channels for clear communications.

2.1.3 Prioritisation Matrix

The need for an equitable process for prioritising capital investments that deliver the greatest benefits on the pan-London scale necessitated the development of a bespoke Prioritisation Matrix. A multi-criteria analysis (MCA) was produced to evaluate the benefits delivered by the individual projects against a range of criteria.

Key factors driving the development of the tool were the need to keep the multi-criteria analysis simple, utilising readily obtainable information and existing definitions. Five quantitative criteria were identified during workshops with the Drain London Programme Board:

1. Number of Affected Households (Vulnerable/Non-Vulnerable)
2. Number of Commercial/Industrial Properties
3. Infrastructure (Critical/Non-Critical) – Based on PPS25 Criteria
4. High Level Cost Estimate
5. Deliverability (Preference for certain types of works)

Potential capital projects will be identified and high level cost estimates produced during Phases 2 and 3. Once the information for the prioritisation matrix is collated for all potential projects within the Drain London framework they can be used to produce a ranked project list according to the multi-criteria analysis. This ranked list is a guide to enable the selection of projects which deliver the most benefits according to the criteria identified.

Figure 4 – Prioritisation Matrix

Due to the complexity of the London urban environment and the number of unique features a moderation criteria was also used to account for qualitative criteria. For example, a project may impact an asset of strategic or national importance which may not be fully reflected within the multi-criteria analysis and therefore the project may not get prioritised. When a project is moderated it has an override against it in the prioritisation list, further evidence as to why the project is moderated is submitted. This allows the Programme Board to consider inclusion of the project during the selection of capital projects to be taken forward. Project moderation can be proposed on the following topics:

- National or strategic asset
- Health and safety
- Deliverability (potential for 'quick wins')
- Synergy (delivery may compliment other projects)
- Environment

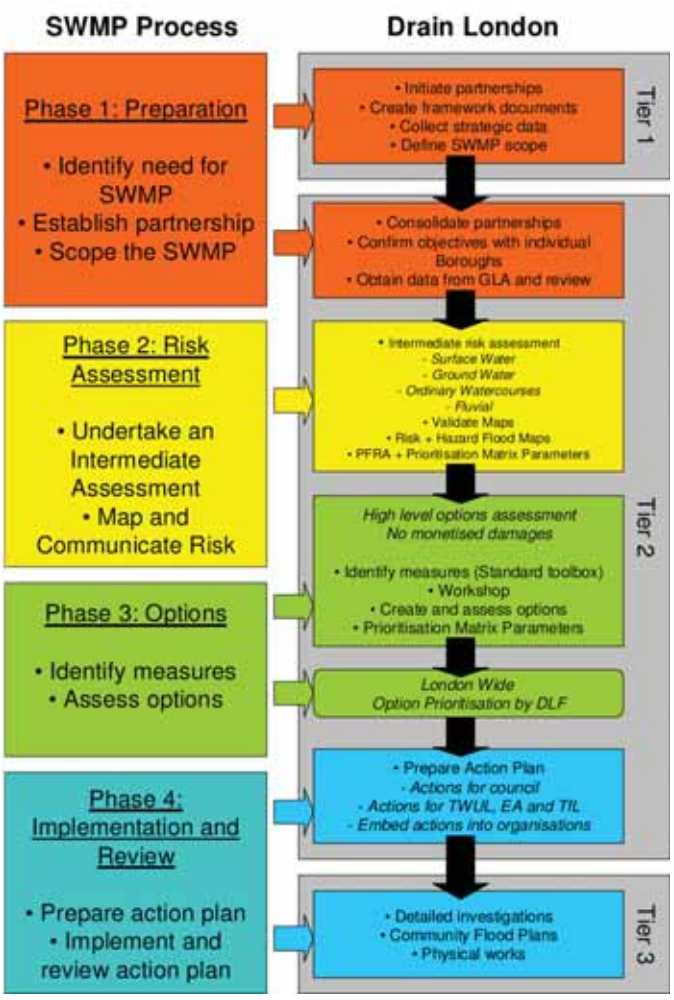


Figure 5 – SWMP Process (Adapted from Defra SWMP Guidance, March 2010)

2.2 Phase 1: Preparation

The SWMP Technical Guidance suggests the following steps within Phase 1:

- Identify the need for a SWMP study
- Establish partnership
- Scope the SWMP study
- Collect strategic data

Drain London completed these stages as part of Tier 1 with the collection of strategic data proving to be the most complex task. Data was collected from each of the following organisations:

- All London Boroughs
- British Airports Authority
- British Geological Survey
- British Waterways
- Environment Agency
- Greater London Authority
- Highways Agency

"This phase consists of completing an 'Intermediate' Level Risk Assessment at the London Borough scale, then mapping and communicating risk in accordance with the Flood Risk Regulations 2009."

- London Underground
- Network Rail
- Thames Water
- Transport for London

Challenges encountered during this process and adopted solutions are detailed in the table below. The project has collected, collated and indexed more than 2000 individual data sets relating to flooding and its impacts on London.

Challenges	Solutions
Identification of appropriate contacts within organisations and subsequent participation in project.	Programme Board uses political contacts and influence to highlight the benefits of participation in the project at senior management / executive levels within identified organisations.
Collection, collation and management of a wide range of datasets – including varying conditions of use, security classifications and licensing	INSPIRE[1] MetaData standard applied during collection process and overall management of data. MetaData is a summary document describing the characteristics of a dataset. Characteristics include information on the content, theme, quality, source, publisher, creation date and spatial extent of a dataset.
Negotiation of data use licences between individual organisations	Negotiate single licence for use of data on project level basis that includes all organisations within the project brief.

Table 2 – Data Collection

2.3 Phase 2: Intermediate Risk Assessment

This phase consists of completing an 'Intermediate' Level Risk Assessment at the London Borough scale, then mapping and communicating risk in accordance with the Flood Risk Regulations 2009. This phase will provide sufficient information for the preparation of a Preliminary Flood Risk Assessment report. Challenges encountered during this process and adopted solutions are detailed in the table below.

Challenges	Solutions
Delivering 33 SWMPs to a comparable technical standard	Development and implementation of the Data and Modelling Framework (Refer Section 2.1)
Managing ongoing technical issues raised by the four consultant teams consisting of eight different companies	SWMP Practitioners Forum – A regular meeting of the technical leads from each of the consultant teams to discuss and resolve technical issues as they are raised.
Coordination of 33 SWMPs developed on the basis of political rather than hydrological boundaries	Collaborative Working Framework – Ensures that cross boundary issues are identified early in the project and are managed effectively by neighbouring consultant teams and related Boroughs (Refer Section 2.1)
Quality Management	Peer Review process is integrated within overall project. Consultants are required to review each others work in neighbouring delivery groups in accordance with a common review framework.
Delivering realistic surface water flood extent predictions that are understood and 'owned' by each Borough	Model validation processes and consultation with relevant stakeholders within the Borough Councils are integrated within the project via the Modelling and Data Framework.

Table 3 – Risk Assessment

2.4 Phase 3: Options

It is anticipated that numerous Flood Risk Areas will exist in each borough. Therefore, Phase 3 consists of a high level option assessment for each of the Flood Risk Areas identified in Phase 2. To streamline the process, no monetised damages are calculated and flood mitigation costs are determined using engineering judgement with no detailed analysis.

Above and Top – Surface water flooding in London
Source: bbc.co.uk

The option investigation process generally follows that described in the Defra SWMP Guidance, but is focused on highlighting areas for further analysis and immediate 'quick-win' actions. Further analysis and investigation may occur for high priority Flood Risk Areas as defined by the Prioritisation Matrix during Tier 3 works. This process has not yet commenced, therefore, anticipated challenges and proposed solutions are summarised in the table below.

Anticipated Challenges	Proposed Solutions
Wide variety of similar but slightly different mitigation measures proposed by the four consultant teams	Use a 'toolbox' of standard measures as a starting point for each investigation. Consultants are required to use the same basic toolbox of measures to develop flood mitigation solutions to allow direct comparison of solutions. Non-standard measures are still encouraged – but only after exhaustion of standard approaches.
Prioritisation of mitigation solutions across the Greater London area	Use Prioritisation Matrix tool (Refer Section 2.1) to rank solutions using a common basis.
Different and competing agendas and goals for flood mitigation throughout Greater London (e.g. differing preferences for mitigation solutions)	Establish the option prioritisation methodology at beginning of study, and then ensure process is transparent and fair.

Table 4 – Options

2.5 Phase 4: Action Plan

The purpose of this phase is to clearly identify actions and responsibilities for ongoing management of surface water flood risk within the Borough. This provides the early stages of the 'Flood Risk Management Plan' as required by the Flood Risk Regulations 2009. This process has not yet commenced, therefore, anticipated challenges and proposed solutions are summarised in the table below.

A key point of difference in this stage of the SWMP process for Drain London is a London Wide option prioritisation process undertaken by the Programme Board. This process will occur between Phase 3 and Phase 4. Once all options have been identified in Phase 3, a standard set of parameters are fed into the prioritisation matrix to create a ranked master list for Greater London. This list is then used to prioritise

spending of the remaining parts of the Drain London funding grant from Defra. Decisions are then fed back to the individual Borough level SWMPs for inclusion in the Action Plans.

Anticipated Challenges	Proposed Solutions
Implementation of options that cross organisational boundaries (between individual boroughs)	As noted in Table 3 – The Collaborative Working Framework ensures cross boundary issues and solutions are identified early in the project and are managed effectively by consultant teams and related Boroughs
Implementation of actions within organisations other than the LLFA (e.g. EA, Thames Water or third party asset owners)	Identify mechanisms within the 'other' organisation by which actions will be implemented and tailor action plan for inclusion within appropriate capital investment programmes.
Variability in Action Plan formats and acceptance by individual Borough (as LLFA)	Use a standard template for Action Plans to ensure they all include key aspects. Acceptance by Borough is facilitated through direct support and promotion activities undertaken by consultant teams.

Table 5 – Action Plan

6. Conclusions

- Drain London provides a good model for delivery of multiple SWMPs / PFRAs across a large urban area
- Group negotiation of licences and data collection provides significant financial and programme advantages
- High level political backing facilitates participation of relevant organisations outside the conventional core SWMP partnership (LLFA, Water Company and EA)
- Consistency in delivery of outputs enables:
  - » Effective cross political boundary cooperation
  - » Fair and transparent allocation of funds
  - » Strategic management of surface water flood risk across the study area

"Once all options have been identified in Phase 3, a standard set of parameters are fed into the prioritisation matrix to create a ranked master list for Greater London ...This list is then used to prioritise spending of the remaining parts of the Drain London funding grant from Defra."

7. Acknowledgements

The authors would like to thank Kevin Reid and Alex Nickson of the Greater London Authority for their input on this paper. ■

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Drain London: http://www.london.gov.uk/drain-london

Defining the Flood Hazard in Takaka: A Town at Risk

Nick Simpson – Executive, Water, Aurecon New Zealand Ltd

The key to the successful implementation of any flood modelling project is the establishment of a framework or structure that best meets the objectives within prescribed budgets. This involves the selection of modelling tools that are deliberately tailored and specific to the characteristics of the catchment with an appropriate level of detail. This article overviews a recent project undertaken by Aurecon New Zealand Ltd and Tasman District Council (TDC) looking at the township of Takaka and profiles some valuable lessons learned.

Background

Located adjacent to the confluence of the Takaka and Anatoki Rivers, the township of Takaka has an extensive history of flooding. Within the past 30 years there have been two significant return period events where the Takaka River has breached its banks and inundated the town centre. The existing flooding risk causes issues relating to:

- future planning within the township
- the protection of existing assets
- establishment of appropriate strategies for emergency response

Throughout the years there have been numerous formal and informal attempts to train the river in the vicinity of the township. Debate on the relative effectiveness of various options has been a source of contention within the community.

Modelling works were commissioned by TDC in 2010 to better define the flooding risk within Takaka and provide a basis for future community decisions that are affected by these issues.

The main flooding risk to the township is from the Takaka River. The total contributing catchment is approximately 844 km^2 and extends from the Cobb Valley, deep within Kahurangi National Park to the South, Aorere Peak in the West, and Takaka Hill to the East. Data from existing gauging sites have been used by TDC to establish input hydrograph shapes, timings and peak inflow relationships.

With multiple issues and the above inputs a modelling framework was required that delivered output on a number of aspects, including: confirmation of flooding extents, risk, real time prediction, hazard assessments, and input on potential mitigation options.

The Modelling Framework

In establishing the framework for any flood modelling project objectives need to be defined, target levels of detail established and a methodology developed utilising appropriate tools to best achieve results within prescribed budgets.

Detail of the flooding hazard was required in the vicinity of the township. The preferred modelling methodology was established so as to best align with the catchment characteristics:

- Flows in the area are dominated by flows from the two main contributing catchments (Takaka and Anatoki)
- There is gauging on both of these rivers relatively close to the boundary of the unconfined floodplain
- Flows on the main Takaka river are effectively confined until just upstream of the Takaka township
- The unconfined floodplain area is relatively small in comparison with the main contributing catchments

"The key to the successful implementation of any flood modelling project is the establishment of a framework or structure that best meets the objectives within prescribed budgets."

- Flowpaths through portions of the township are not clearly defined
- The hydraulic grade through the area is relatively steep
- Storage has minimal influence within the floodplain

Prescribed modelling outputs included the inundation extent, flood depth, timing, velocities and duration of inundation for a range of design flood events.

Sensitivities were established looking at the impact of possible modifications to an existing informal stopbank, changes to the riverbed over time (believed to have lowered approximately 1m since the early 1980s), raised building platforms and proposed new dwelling footprints to be utilised for the future planning of the Takaka township.

Several modelling tools were used to achieve the objectives outlined and enable a real time assessment of risk.

Given the characteristics of the existing Takaka catchment it was impractical and unnecessary to develop a full two-dimensional model of the entire region. A three tiered modelling approach was established, utilising three discrete packages:

FLOOD Watch (DHI)

There was a Rainfall Runoff Model previously established by TDC and DHI Ltd. This included provision for rain gauges in the upper catchment to be integrated into a real-time forecast of runoff and predicted flows at downstream gauging points.

The model incorporated a hydrological runoff tool with the routing of resulting flow hydrographs via a simplified MIKE 11 model of the upper catchment, data management and forecast modelling.

The system is used by council engineers to provide real-time forecasts and to issue early warnings to flood response managers and the public. The system is used to forecast model inflows at gauging locations.

MIKE 21 (DHI)

Modelling of the floodplain in the vicinity of the Takaka township was established using MIKE 21, a two-dimensional hydraulic model.

The selection of this package was considered to be the most suitable given the following:

- The wide unconfined nature of the existing topography adjacent to the township
- A two-dimensional hydraulic model is best suited to calculate the inundation extent, maximum flood depth, flood velocity, duration of inundation and establish animations of flooding behaviour (a specific client request for future community liaison)
- Potential compatibility with the existing "FLOOD Watch" software and outputs

The resulting model is fully compatible with existing models, enabling future coupling as required. Additional runs will be used to assess the input of specific upgrade options.

Water RIDE (Worley Parsons)

Water RIDE interpolates water levels and flow conditions for specified boundary conditions (between modelled events).

For this project the modelled water levels from the various 2-dimensional runs were used by Water RIDE to interpolate flood extents for predicted inflows.

While relatively new to New Zealand this package has been used extensively with success throughout Australia and in this application brings the following aspects to the project:

- A common graphical interface designed to accept input from various calculation techniques (potential both 1D & 2D simulation results)
- Enables rapid interpolation of events (removing the need for extended run times)
- Advanced provision for interrogating data
- Assistance in establishment of hazard maps and associated Flood Damage Analysis

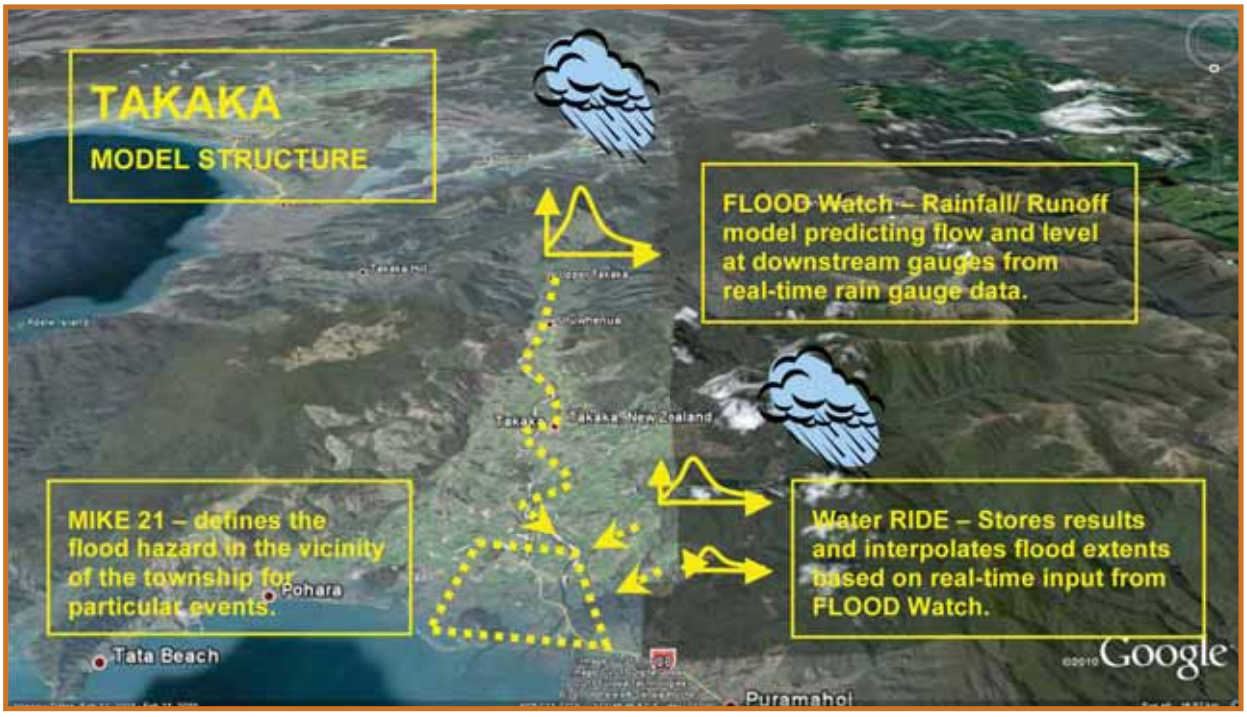


Figure 1 – Schematic of existing model components and structure

Model Build

For all model builds the level of detail the tools used and how they were used is always a judgement decision and is related to the outputs required, the limitations of the input data, and the appropriateness of the tools used. For the Takaka project, given the hydraulic grade across the catchment and the relatively small contributing area it was suitable for the localised runoff contributions and reticulated drainage effects to be ignored (as these would have minimal impact on the model outputs in larger design events).

A two dimensional Mike 21 model of the wider Takaka floodplain was established, utilising a 6m grid. Grid size and shape for the model was established to minimise run times but still meet the required level of detail and maintain integrity of calculations. The associated model area was 1155 cells (6.7km) x 910 cells (5.5km). Roughness and associated losses at key hydraulic structures were established in the model.

The grid size selected is considered the smallest acceptable size providing hydrostatic flow distribution and maintaining manageable simulation times. Key hydraulic structures were incorporated into the model by locally modifying roughness. This justified the use of 2D modelling software without the need for modelling the river in a 1D environment.

Another decision required for modelling projects are the interaction with boundary conditions.

For this project static tidal boundaries were established in the model for design events. To validate the suitability of this assumption associated sensitivity runs were undertaken and confirmed that the tidal ranges did not have any effect within the township.

With a large portion of the upper catchment being either national park (Kahurangi) or rural land, the future development in this area is assumed negligible.

A simplified scaled rainfall and fixed tidal increase has been used to establish the impact of Climate Change in associated scenario runs (in line with current Ministry for the Environment Guidelines – MfE, 2008).

Depth and velocity surfaces were able to be established for numerous sensitivity and design scenarios that suit the proposed purposes of the model.

The MIKE 21 hydraulic model was validated against the historic flooding events (July 1983 and November 2008) through comparison of recorded flood levels and extents with the numeric modelling outputs. Boundary conditions were established with event gauging data at Kotinga and Happy Sams and tidal information.

When undertaking validation against historical events it is important that the model replicates the topography and physical characteristics that occurred at that time. For the 1983 event the Digital terrain Model (DTM) was modified to account for changes in the Takaka river bed (due to local erosion) and recent informal flood protection measures (base and revised model).

Event hydrographs from the Kotinga Bridge and Happy Sams gauges along with recorded tidal levels were established as boundary conditions for the model; similarly topographical features modified to best replicate conditions for the events.

Predicted flood extents, associated debris lines and recorded level locations are outlined in Figure 2 below.

Real-time Flood Forecasting

The output from the MIKE 21 modelling was used to create the WaterRIDE flood forecasting model for the Takaka Township. The WaterRIDE model uses the predetermined MIKE 21 results for various return period events to create a library of digital flood surfaces. Flood extents for each of these events are equated to a peak flood depth at the Kotinga Gauge.

Rain gauges in the upper catchment feed in real time into the FLOODWatch rainfall runoff model which routes inflows so as to predict flow and level at downstream gauges.

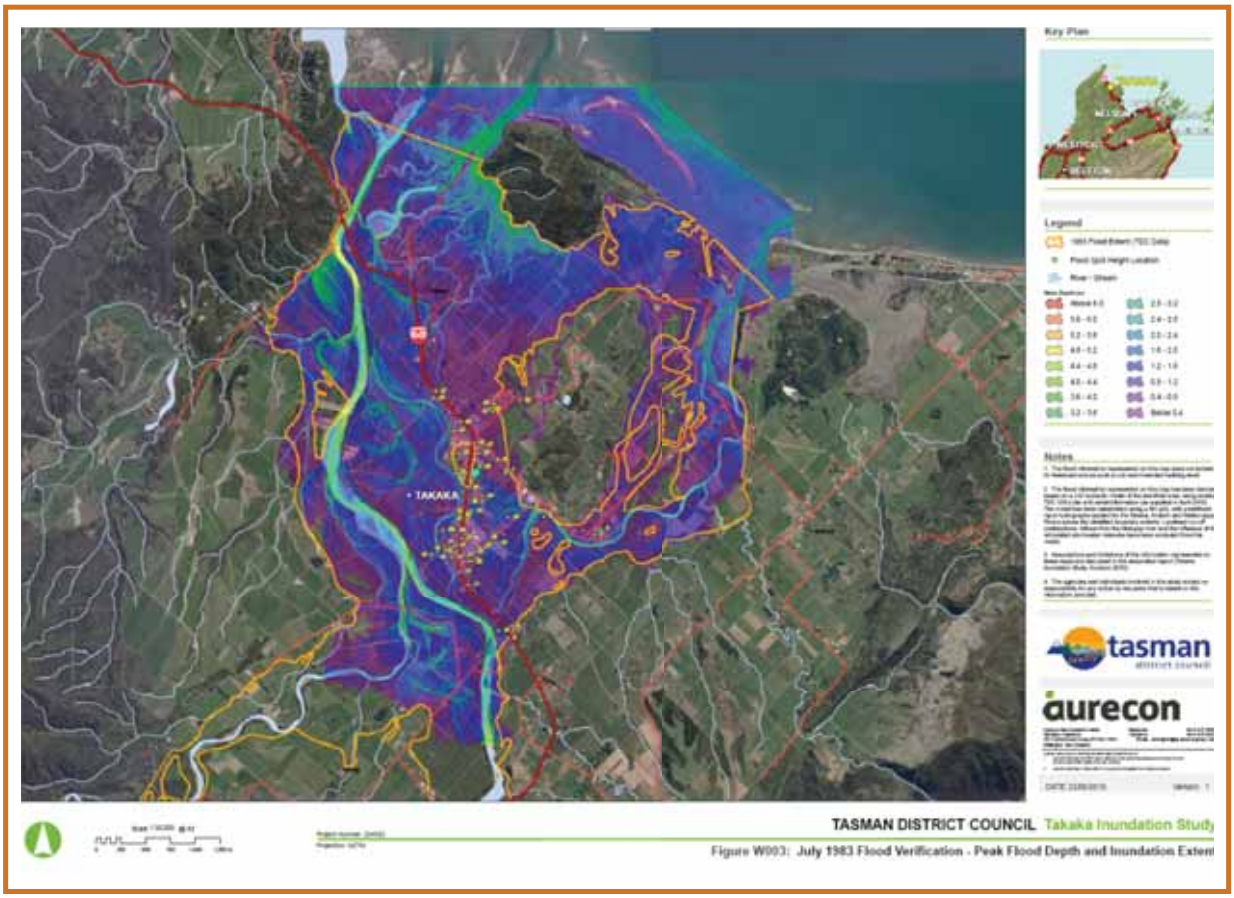


Figure 2 – Mapping of flood validation results for the 1983 event outlined below

The WaterRIDE model uses a predicted peak flood level at the Kotinga Bridge gauge from the FLOODWatch programme and defines a predicted flood surface by interpolating between two known surfaces predetermined from the hydraulic modelling. This interpolation enables a rapid assessment of risk without extensive simulation times. Review of the associated flood levels, velocities and timing on the interpolated results can be undertaken in WaterRIDE, including the extraction of associated time series, profile plots and hydrographs. This information will assist TDC and emergency services make early decisions regarding the need to evacuate, available routes, school closures, placement of emergency response vehicles, and safe evacuation points that residents can get to during a flood event.

Modelling Outcomes and Lessons Learnt

Modelling outputs enabled Tasman District Council to assess the impacts and timings of flooding and quantify the associated risks. Outputs from this process enabled cost effective establishment of:

- A validated, detailed, two-dimensional model of the associated floodplain
- Real-time flood forecasting
- A tool enabling a rapid predictive assessment of associated hazards
- Annual Average Damage curves for various mitigation options

The multi pronged approach has provided clarity on the influence of associated structures, indicative Flood Damage Assessment estimates (and associated Annualised Average Damage Curves), and a preliminary review on the effectiveness of potential mitigation options.

The following considerations were critical in the successful execution of this project:

Selection of the Appropriate Modelling Tool

Significant flooding of the Takaka township is dominated by flows from the upper catchment and associated Takaka river. The elements used in the modelling exercise were selected to best align with the characteristics of this catchment. Gauging and the associated rainfall/ runoff model develops provision to assess the real-time response of the catchment. MIKE 21 is used to define the flood risk in the unconfined floodplain (adjacent to township) for specified events. In WaterRIDE, GIS based tools look to utilise the outputs from both processes to best effect.

The level of detail in each of these components was targeted to best meet client needs within associated budgets.

Understand Sensitivities

WaterRIDE in particular is not a hydraulic modelling tool. Interpolating results from existing modelling surfaces has its limitations. Understanding where the sensitivities in area this process is key to assessing the appropriateness of the result.

Understand Uncertainties

A number of scenario runs were undertaken looking at the impact on modification to topography and associated parameters. While outcomes are indicative, caution is urged in the interpretation of results, where greater uncertainties may sit elsewhere in the modelling assumptions/inputs (e.g. rainfall/runoff model, gauging).

Appropriate Gauging/Model

Gauging levels at Kotinga were used to drive the interpolation tool within WaterRIDE. The existing model indicates the limited flows from the main river break-out prior to the gauge at Kotinga. This led to issues at high flows and impacted on the appropriateness of using level as a parameter to control the Flood Forecast model at this location.

At the time of model development WaterRIDE applications in New Zealand were limited. For the purposes of this project this software performed well. However it is emphasised that this application was a GIS and not a hydraulic modelling tool. While the level of presentation was high the following aspects need to considered when interpreting results.

The accuracy of the flood surface is limited by the base assumptions in the original modelling:

- Interpolated surfaces are just that, and interpolations will be limited by the similarity of model results and proximity to nearest design run
- The shape of the input hydrograph will impact the inundation extent and associated interpolation (not just peak levels at flow gauges). This will be of particular importance where storage is a critical element (not so in the case of Takaka)
- The effectiveness of the predictive tool will be conditional on operating range (this was not great for the Kotinga Gauge)
- It is emphasised that WaterRIDE outputs are not a substitute for modelling, more an effective tool for collating and interrogating outputs

While there are numerous areas for future development, the outputs from the existing project meets the interim objectives of Council. Specifically, the models serve to define the flood risks in Takaka, provide a basis for engagement with the community on appropriate mitigation options, while predicting potential associated hazards in a cost effective tool so as to guide emergency response.

An appropriate modelling outcome for a specific project, targeted to the prescribed objectives. ■

Water Reform – The Australian Perspective

Andrew Speers – National Manager Policy, Australian Water Association

"There is nothing more difficult to take in hand, more perilous to conduct or more uncertain in its success than to take the lead in the introduction of a new order of things." – Niccolo Machiavelli

Perhaps Machiavelli was right – if the frequency with which he is quoted is a measure of truth, he often was.

Yet we do make progress and water policy is a great example of progress. Whereas once the sector was heavily subsidised and water consumption per capita an ever rising trend, it is now better managed and more sustainable than ever.

That said, significant challenges still exist, not least of which is to promote the efficiency of the sector. In Australia, the Productivity Commission, an independent government body charged with responsibility for providing research services and advice on a range of economic, social and environmental issues affecting the welfare of Australians, has recently completed a draft report into the urban water sector. While the report is released only as a draft – and comment has been called for – the Commission has proposed significant reforms, at least some of which are likely to be taken up.

To achieve efficiency improvements, the Commission has argued for a focus on improved governance. By that term is meant the objectives of the industry, the way it is regulated, the way it prices services and the scope for competition and the industry's structure.

In common with New Zealand, Australia in the mid-to-late1980s embarked on major economy wide reforms, exposing industry to competition, reducing the role of government as a funder of infrastructure and privatising or corporatising formerly government owned enterprises, among other things.

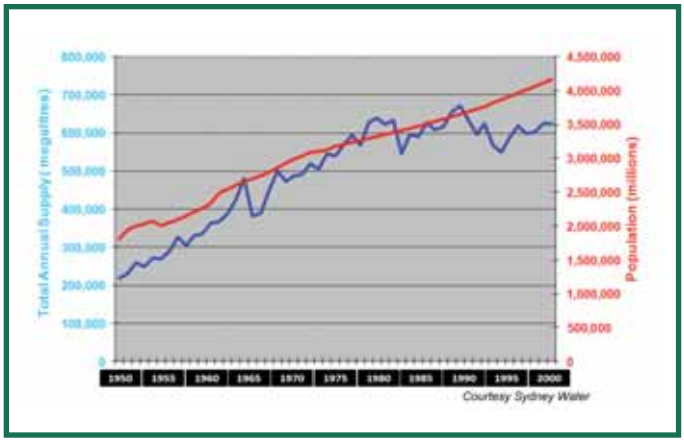
In 1994 the Council of Australian Governments (COAG), which includes the federal government, the governments of all states and territories and the head of the Local Government Association, agreed to a major package of water reforms. Simply described, these reforms established most utilities as government trading enterprises, subject to the same regulation as private companies; removed cross-subsidies; implemented full-cost recovery pricing (including a requirement that a market-rate return on investment be achieved) and fostered independent decision-making by boards overseeing the newly corporatised entities.

An important component of the governance of the sector was the introduction of 'yardstick' competition (or competition by comparison) and the creation of independent economic regulators with responsibility for setting prices. In large measure these regulators were established to ensure that utilities do not pursue monopoly pricing practices.

"The rationale for the Productivity Commission's recent review appears to come from the perception that the costs to consumers arising from the responses taken to prolonged drought by governments and water utilities are high and that some of the responses have been inefficient."

No reform process is ever perfect and governments have adopted different approaches in different jurisdictions and have proceeded at different paces, but the efficiency of the sector has improved markedly against almost every measure and in all states and territories. Critically, the sector is generally financially sound, water consumption per capita has declined (see Figure 1 below) the sector's expenditure is better targeted and reflects a better use of capital and its administration has been enhanced significantly.

Figure 1 – Water Consumption Relative to Population (Sydney)



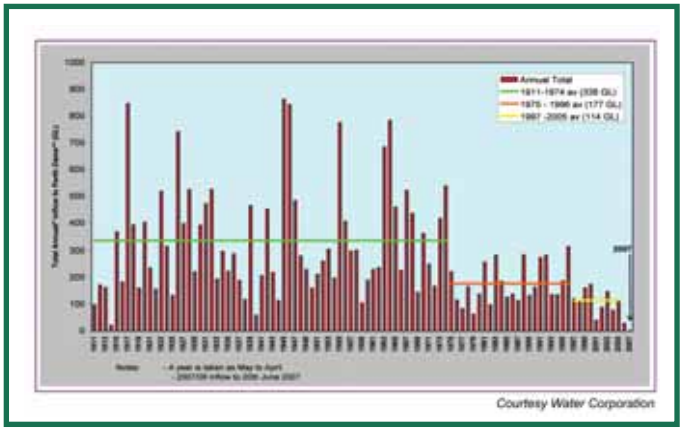
In 2004 a further agreement was negotiated by COAG – the National Water Initiative. This had a primarily rural focus, although it did reconfirm commitment to urban water utilities being operated along commercial lines and with independent regulation. In addition, a separate institution, the National Water Commission, was established to oversee implementation of the NWI and, among other things, report biennially to Parliament on progress against the Initiative.

The rationale for the Productivity Commission's recent review appears to come from the perception that the costs to consumers arising from the responses taken to prolonged drought by governments and water utilities are high and that some of the responses have been inefficient.

For almost a decade, most of the Australian continent has experienced record low rainfall. At various times more than 90% of the population has been subject to water restrictions, in many cases for extended periods and they have often been quite stringent restrictions.

The patterns of rainfall in a number of centres suggest that there may have been a step change in precipitation, often ascribed to the early impacts of climate change. Figure 2, below, shows the change in flow to dams in Perth in recent decades.

Figure 2 – Inflows to Perth Surface Water Storages 1911–2007



The form of water restrictions has generally been limits on what water can be used for and when it can be used. Restrictions have been primarily directed at reducing what is perceived as 'discretionary' water use, usually taken to mean water used outside the home. Limits have been placed on the times during which householders can irrigate gardens and as conditions have worsened, the days on which they may irrigate, the watering of public open spaces and the washing of cars other than at facilities specifically designed for this purpose and which recycle water, to provide some examples. Some industrial uses have also been curtailed.

The Productivity Commission notes, and many in the water sector would agree, that restrictions are a blunt instrument. While they are strongly supported by the community generally, they deny consumer choice and can be expensive and inefficient. It is difficult, for example, to argue that the recreational opportunities that might be lost because a playing field becomes unusable are not more highly valued by the community than the water savings that might be achieved. There is also a general loss of amenity if gardens die and opportunities to garden are curtailed and if householders resort to the purchase of expensive rainwater tanks to overcome water restrictions. The Productivity Commission reported, for example, that the Centre for International Economics estimated the total cost of Stage 1 restrictions (the lightest) for the Australian Capital Territory was A$5.2 million per annum and A$209 million for Stage 4 (the heaviest). The Commission had similar if not more significant concerns about the cost-benefit of subsidies that had been made available for water saving appliances.

In the face of drought, utilities have to diversify supplies. Whereas traditionally most major cities and many regional centres have relied solely on surface waters, utilities have now developed a suite of supply options, including desalination, recycled water, groundwater, new surface water options, more active maintenance of infrastructure, better catchment management to improve yield, purchases of water from irrigators and demand management. Many of these have been cost effective, but unsurprisingly some options, notably desalination, are expensive.

The Productivity Commission has been particularly critical of decisions to develop desalination plants earlier than necessary. The Commission notes, for example that a 2006 review of plans for a desalination plant in Sydney showed that potential savings of A$1.1 billion were available from adopting a 30% dam storage trigger relative to a decision to proceed with augmentation when dam levels were at 48%. Subsequently, the government committed to proceeding when dam levels were at 34% and signed the contract to proceed at a time when storages were at 57%. Throughout the drought, dam storage levels never did fall to the 30% trigger level. The cost of the completed desalination plant was A$1.9 billion.

Accordingly, the Productivity Commission described the urban water sector as being 'under stress'. It has put forward a number of options for reform, albeit subject to further consultation and are provided to the government as advice only. Nevertheless, the suggestions currently in some areas are significant.

The Commission firstly believes that the sector needs to be given a clearer set of objectives. Its proposal is that relevant policy documents should define the sector's objective as being "to provide water, wastewater and stormwater services in an economically efficient manner so as to maximise net benefits to the community". This objective is obvious. Indeed, the Australian Water Association put forward in its submission that neither the objective nor the need for it should not be considered novel.

AWA argued that the objective, in fact, reflected the spirit of the 1994 Water Reforms and that it was not so much a failure of the industry as intervention by politicians (for example in decisions to

The breaking drought over much of eastern Australia may lead to changes to water form priorities

accelerate the construction of desalination plants) that had led to an obscuring of the sector's goals.

Concomitant with this recommendation are others concerned with improving governance arrangements for utilities. Essentially, the Commission is seeking a clear separation between the roles of governments and the roles of utilities.

Thus, for example, it is acknowledged that the role of governments is to set overall water security and reliability objectives and requirements for wastewater, stormwater and flood mitigation, but it is the role of utilities to determine how best to achieve these objectives. In this regard, the Commission also recommends greater separation between Ministerial and Board governance, including the implementation of procedures to guarantee the independence of boards and ensuring that responsibility for determination of dividend payments rests with Boards, not shareholding Ministers. Recommendations are also made that utilities be subject to Corporations Act (Commonwealth) 2007, which would require board members' first responsibility be to ensure prudent financial management of their organisations.

The Commission further argues that were boards strengthened in this manner, a more light-handed approach to economic regulation could be introduced that would streamline processes and reduce the cost of compliance. The 1994 Agreement led to many (now almost all) jurisdictions creating an economic regulator, independent from government, to control prices charged by utilities. Economic regulators are a surrogate for the market, intended to control monopolistic behaviour by utilities. They have responsibility for administering the formal process of price setting and determination of other economic regulatory performance requirements. Instead, the Commission's suggestion is that utilities themselves, under the oversight of robust boards, should set their own prices and that the role of the economic regulator should be reduced to periodically reviewing pricing practices to ensure that abuse is not occurring.

It would be an odd industry that would argue for tighter regulation, but a number of water sector leaders in Australia interviewed for the AWA/Deloitte State of the Water Sector Survey have commented that economic regulation introduced a discipline and rigour that had been lacking and that is has improved the management of utilities.

Utilities that have been subject to economic regulation for some time may well have no further need of this discipline, but those with less experience or which are only now being formed (there is a push for amalgamation of some smaller, local government-owned water service providers) could benefit from closer scrutiny, at least in the short term.

Clarifying the roles and objectives of utilities also lies behind the Commission's recommendations for structural reform of the sector. Its report includes a number of models, but it prefers an option that would see separate retailers-distributors created with security of supply responsibility vested in these entities. The Commission's argument is that it is the retailer that is best placed to determine customer preferences and that such entities can "facilitate contestability and competition for new water supplies and services from potential service providers". That is, without any vested interested in any one supply option, a retailer can choose in a contestable market – which might comprise dam operators, groundwater mangers, providers of processed water (recycled and desalinated) – the option that best meets its needs.

Also suggested is the further disaggregation of utilities such that wastewater treatment services are also horizontally disaggregated, allowing the retailer-distributor to choose its service provider and to encourage development of a contestable market. With regard to both bulkwater supply and wastewater treatment, it is argued that better signals will be sent to the market if the retailer-distributor is responsible for efficient procurement of services. One must ask, however, whether such a market would ever be viable given that the capital investment required would militate against rival wastewater treatment facilities being established within a single catchment and that pumping and transportation cost would limit the opportunity for wastewater to be delivered to a facility outside the catchment to which it would naturally flow.

Competition is also encouraged between retailer-distributors through recommendations that several comparable utilities be created within discrete geographic areas and that their relative performance be compared and reported on periodically. 'Yardstick' competition is intended to introduce an element of moral suasion where contestable markets are otherwise unlikely to emerge due to the natural monopoly characteristics of water retail-distribution. This situation exists already in Melbourne and the Commission would like to see it extended.

There is considerable strength to the Productivity Commission's report and, generally speaking, it has been well received. One cannot be as sanguine, however, about the Guide to the Murray-Darling Basin Plan released by the Murray Darling Basin Authority (MDBA) late last year. This document is a precursor to a plan intended to specify the allocations of water that might be made to the environment, irrigators and other users in the each of the sub-catchments of which this extensive river system is comprised, and has been heavily criticised.

It is the subject of a number of federal Parliamentary inquiries. The grounds for criticism are the way in which the science underpinning the recommendations has been interpreted and the way in which community consultation was carried out. In turn, the recommendations themselves – some of which would lead to a reduction in water available for irrigators in some sub-catchments of more than 40% – have been criticised as has the way in which the Water Act (2007) has been interpreted.

It is disappointing that this should have been so. This is not to defend the MDBA, but is said because it has led to what amounts to a deferral of important decisions about the future of the river basin. Because of the controversy, calls have been made for a rethink. This is legitimate. However, the breaking of the drought across most of the basin area has also allowed some to argue that there are other priorities beyond determining water allocations.

There is no doubt that drought will return. It is characteristic of Australia and may in fact be worse in future if climate change predictions are accurate. While the government insists that decision-making will proceed, there is considerable pressure to defer. If this were to occur, allocation decisions may once again be being made in the face of water shortage.

It would speak poorly of rural water reform if Australians were only willing to tackle their problems in a time of crisis.

We should have no desire to prove Machiavelli right. ■

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Water Industry Training is organised and administered by Agriculture ITO, who are the TEC registered Industry Training Organisation with NZQA accredited scope and standard setting responsibility for the water, wastewater, reticulation and irrigation industries. Water Industry Training PO Box 10-383, The Terrace, Wellington 6143.

Readily Accessible Training Gives South African Expat the Edge

Water Industry Training

Andries Erasmus of City Care in Masterton

When Andries Erasmus moved to New Zealand from South Africa six years ago he had eight years' experience in the water industry but no formal qualifications.

"When I came here I had no formal qualifications apart from eight years in the industry. I couldn't believe training was so readily accessible here through Water Industry Training," he says.

Andries has since made the most of his opportunities to train having completed a number of qualifications through Water Industry Training since beginning work with Fulton Hogan in Pukekohe and then moving to Te Anau in the South Island 3 years ago.

"I started off in South Africa working for a local town council and then moved to New Zealand and started dairy farming before joining Fulton Hogan on a water and wastewater contract as a reticulation operator," he says.

"I started doing my Level 3 Water Reticulation qualification while with them. I then moved to do a contract with them in Te Anau and did my Level 3 Wastewater Reticulation and Level 4 Wastewater Treatment certificates."

Andries' training adviser Martyn Simpson says, "Andries is very motivated. He wants to get places as quick as he can and he saw that apart from gaining even more experience, getting qualifications is the quickest way to do this. He's had the enthusiasm to complete qualifications through distance learning, which is great."

"Andries has completed qualifications across the board in reticulation and wastewater treatment, including the Water and Wastewater strands of the National Certificate in Water Reticulation Level 3, the National Certificate in Water Reticulation Level 4 and the National Certificate in Wastewater Treatment Level 4," Martyn says. "He has been in Te Anau and taken advantage of the fact that in smaller areas staff tend to do a bit of everything."

Andries is a fan of attending block courses due to the networking opportunities with other trainees, but at the time he took advantage of his option to complete the qualifications through correspondence due to the isolated location of his work.

"I enjoyed studying by correspondence," he says. "I had to look for my answers in the industry and talk to the people doing these jobs. I got to know people who've been doing it for a long time."

Andries spent three and a half years in Te Anau and moved his way up through the ranks from operator to foreman to supervisor before relocating to the North Island.

"I got a job offer from City Care to supervise their water and wastewater contract in Masterton," he says. "I've been here for nearly a year."

His personal experience as a trainee has driven him to stay involved in training and he has just recently become an assessor for Water Industry Training's qualifications.

"I'm an assessor for water and wastewater reticulation," he says. "One of the guys I work with in Masterton is going through Level 3 at the moment and I am also helping with City Care's guys in Wellington, assessing them on the job.

"I enjoy it so much," he says. "You learn so much and meet so many different people in the industry. I would recommend training to anybody if they get the opportunity, especially in our industry with WOP starting – you can't say you're a professional if you're not qualified."

Water Operations Professionals (WOP) is a new scheme that promotes the continued professional development of operators in the industry. Andries has applied to become a member and says he believes qualifications are now becoming expected in the industry.

"Councils are now saying that you have to be trained up or in a modern apprenticeship or studying – it's the way of the future."

> "It's not just the trainee who receives benefits from training, but also the organisation they work for."

He believes he has also received a confidence boost from up skilling and says it has also helped with his career progression.

"I'm more confident in what I'm doing especially on the practical side of things – if I have to work within council bylaws or consents, my training gives me confidence," he says. "The day I sent my CV in to City Care, I was told that when they saw my experience and qualifications they said I was head and shoulders above the rest."

He adds that it's not just the trainee who receives benefits from training, but also the organisation they work for.

"It stops people who come into the industry from getting bored," he says. "It's a good way of stimulating them and making them feel important by giving them knowledge. Luckily I'm in a position with good managers who are really keen on getting the guys to train."

The support from Water Industry Training's training advisers is also a value-add for trainees.

"It's good to have guys like Martyn who've been in the industry for a while, it's as easy as picking up the phone and giving him a call," he says. "I appreciate the support but also appreciate that he doesn't give all the answers, you still have to find those out for yourself. I've had a lot of support from Water Industry Training."

Making the most of opportunities to gain knowledge has brought new opportunities Andries' way. This year he was asked to present a paper at the WIOG conference in Queenstown in May.

"It was called 'There are people in the drinking water' and it was about the people aspects of the water industry. I spoke about the way we look after our workers and operators in the industry and the way they are treated.

"Training adviser, Rebecca Fox, asked if I would be interested and I came up with the topic and presentation myself," he says. "It was about my own experiences and personal observations. I've met a lot of different people and managers over my time in the industry and observed how they operate. I got really positive feedback from operators."

The sky is the limit for Andries who is keen to continue learning new skills and knowledge.

"I am starting my National Diploma in Asset Management within the next month and I reckon I'll also do the National Diploma in Wastewater Treatment Level 5, at a later stage.

"The current stage I'm at is as a supervisor/operations manager – the council comes to me for solutions – but I want to get into preventative maintenance and fix things before they become problems," he says.

To enrol or for more information about Water Industry Training's qualifications, call your local training adviser today on 0800 WATER IT (0800 928 374) or visit www.waterit.ac.nz.

Reticulation Qualification Review

Water Industry Training

The water industry has endorsed the changes proposed by the reticulation qualification review undertaken by Water Industry Training and Infratrain. The revised qualifications are currently with NZQA for registration – a process due to be completed by the end of June.

The consultation has resulted in the identification of a new unit on asset condition assessment which will be added to the elective section of both the water and wastewater strands of the National Certificate in Water Reticulation (Planned and Reactive Maintenance).

Five qualifications are expected to be available for the reticulation sector. These will be:

- National Certificate in Infrastructure Works (Level 2)
- National Certificate in Infrastructure Works (Excavation and Reinstatement) (Level 3)
- National Certificate in Infrastructure Works (Infrastructure Pipelaying Technician) (Level 3)
- National Certificate in Water Reticulation (Planned and Reactive Maintenance Technician) (Level 3)
- National Certificate in Infrastructure Works Supervision (Level 4)

The new pathway will be promoted widely to the industry before implementation later this year.

For more information on these new developments, contact the Water Industry Training team on 0800 WATER IT (0800 928 374).

"It will provide a career pathway for both the school leaver and new science graduates and produce an employee that has interdisciplinary skills. It will also produce an industry recognised level of certification."

Environmental Monitoring Project

Water Industry Training is working with industry to develop an Environment Monitoring qualification. The project aims to address the current recruitment and retention problem for environmental monitoring staff in New Zealand by creating an industry based qualification that allows organisations to 'own' their own talent and access qualifications irrespective of their geographical location.

A lack of up and coming technicians has placed a strain on experienced staff and also contributed to the skills shortage in this field. The development of an industry based qualification will allow organisations to meet their own needs on an ongoing basis, instead of relying on a tertiary organisation to 'churn' them out.

It will provide a career pathway for both the school leaver and new science graduates and produce an employee that has interdisciplinary skills. It will also produce an industry recognised level of certification.

Project leader, Grant Barnes of Auckland Council, says, "We are looking to address a long standing gap in provision of skilled environmental monitoring technicians. We will have a qualification at certificate level in hydrology available by early next year and hope to follow this with further modules in areas like air and water quality that will make up a comprehensive environmental monitoring qualification at diploma level."

Proposed reticulation qualification pathway

Professional Development

Water Industry Training offers a wide range of short programmes ideal for your continued professional development or to meet a specific training need. These programmes are in addition or supplementary to the national qualifications we offer.

Undertaking these programmes may help you with the continuing education requirements for Water Operations Professionals (WOP) re-registration.

For further information about the types of programmes available please contact your Water Industry Training Adviser on 0800 WATER IT (0800 928 374).

The Rise of the Young Professional

Chris Maguire – Asia Pacific Coordinator for the MWH Young Professionals Group, MWH New Zealand

MWH's Chris Maguire looks at how young professionals are interacting with each other, their organisations and their communities to define their own professional development.

For the current generation of graduates, engineering is no longer simply about gaining a career. Engineering can be a life choice, a method of making a difference in the world. As one of the first generations to have been taught from an early age about limited natural resources and the need for sustainable development, they have developed a desire to go beyond the boundaries of normal engineering specialities to make a difference in the world and in the environment.

Professional development is changing from being purely management led – to graduates being empowered to create opportunities for themselves and find new methods to gain knowledge.

What is driving these young professionals to seek their own professional development? Why are they actively seeking out environmental and social change projects and why are we not using this desire and momentum to progress professional development and social responsibility in our own organisations?

Graduate Led Professional Development – The Drivers

Young professionals look beyond internal training to achieve professional and personal development. The modern young professional often utilises a growing network of opportunities to achieve their requirements for development. These opportunities and networks often interact with three core drivers of professional, societal and environmental and individual motivation. The interaction between these drivers can be seen in Figure 1 below.

Figure 1 – Young Professional Drivers

Professional motivation is the desire to succeed, to further their career through chosen path-ways to gain skills which they deem are required to achieve their goals.

Societal and environmental motivation is the desire for the young professional to give something back, the feeling that there has to be a purpose behind their work that will enable a greater goal to be achieved.

Individual motivation is the human emotion behind development interactions – young professionals use their networks and professional development as methods of socialising and gaining new connections.

"These drivers and connections are nothing new but for a generation brought up on a diet of the internet, instant technology and constant change it is easier than ever to create instant connections through professional social networking."

These drivers and connections are nothing new but for a generation brought up on a diet of the internet, instant technology and constant change it is easier than ever to create instant connections through professional social networking.

Increasing competition between graduates and greater demand for chartered professional engineers, coupled with decreasing training budgets for graduates and young professionals, have created a need for young professionals to create their own development paths.

Young Professional Engagement

Young professional engagement happens the world over but the tools that are used to create interactions and develop networks differ depending on the initiative or purpose. In reality any of the network interactions can be utilised and more interactions lead to more engagement.

Societal & Environmental

Professional Institution Based – Institution of Professional Engineers New Zealand (IPENZ) Futureintech

Futureintech is an initiative of IPENZ which looks to provide information to encourage more people into engineering. It has been identified that there is a general shortage of qualified engineers in New Zealand across specialisations. Futureintech has eight full time regional facilitators who co-ordinate a network of ambassadors across the country. The network of Futureintech ambassadors is made up of a majority of young professionals and graduates with less than 10 years' experience. Ambassadors work with the facilitators to 'enable primary and high school students to interact with successful role models in engineering, science and technology' (IPENZ Futureintech).

In 2010 the New Zealand Council for Educational Research (NZCER) evaluated the Futureintech programme. It surveyed 116 teachers, 219 ambassadors and 90 ambassadors' managers/employers to investigate the perceived benefits of the programme from all parties. Overall it showed a consensus that the programme benefited the ambassador, the schools, students and the ambassadors' employers.

The NZCER survey asked respondents to reply to set statements. 97% of managers/employers agreed or strongly agreed that the programme 'provides the ambassadors with professional development that benefits our organisation (e.g. public speaking skills)'. 98% of ambassadors agreed or strongly agreed to the statement 'I feel good about helping students learn more about technology/engineering/science'.

Network Interactions:

- Teleconferences
- School visits
- Email exchange
- Ambassador meetings

Company Based – MWH Climate Change Commitment Education Outreach (MWH CCCEO)

In 2007, MWH developed the CCCEO programme as part of its third commitment of addressing climate change that it "…will leave a lasting legacy in the communities in which we work by educating students about climate change and the water cycle". Since 2007 it has given presentations to over 12,000 students in ten countries around the world. Figure 2 below shows one of the earth promises from MWH CCEO by a primary school student in the Waikato.

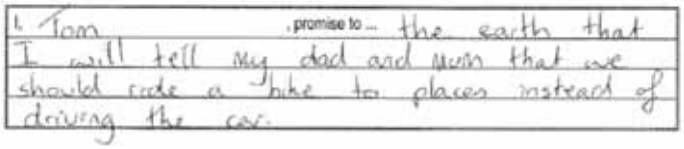

Figure 2 – Promise to the Earth, Waikato, New Zealand

Presentations are given by a variety of engineers from across specialisations/disciplines with the majority of volunteers being young professionals. The volunteers have the opportunity to give something back to the communities in which they live while at the same time developing their communication, facilitation and often negotiation skills.

Network Interactions:

- Teleconferences
- Virtual presentations
- Use of fora to share presentations and develop best practice.
- Virtual social networking to share ideas and innovation

Other examples of this type of engagement can be seen in many other schemes including the Transpower Neighbourhood Engineers Awards in New Zealand and the Institution of Civil Engineers, Civil Engineering in Primary Schools (CEPS) scheme.

The Transpower Neighbourhood Engineers Awards has the aim of "engineers and students working together on practical projects in the school and community". The programme uses a network of volunteers, which has a majority of young professionals, to facilitate the development of an idea into a practical project.

CEPS was an initiative of the ICE developed in Northern Ireland in 2007 to address the need for good quality civil engineers. It partnered schools with Civil Engineering ambassadors, a group of volunteer young professionals who undertake projects on real engineering solutions. Ambassadors used the CEPS as a direct link to the ICE Chartership requirement to "demonstrate a personal commitment to professional standards, recognising obligations to society, the profession and the environment". This link between engineering and society outlines the fundamental purpose of an engineer, to manage natural resources for the benefit of society.

Professional Development and Networking

Professional Institution Based – ICE Northern Ireland Graduate and Student (ICENI G&S) Committee

The ICENI Graduate and Student Committee developed from a need to provide networking for graduates in Civil Engineering. The aim of the ICENI G&S was to provide opportunities for graduates to develop towards Chartered Engineer status. The committee organises a range of events from professional development lectures, conferences, networking events to education outreach. In recent years the construction and infrastructure industry in Northern Ireland has been in decline, with the result that training budgets for graduates diminished across the industry.

"When the recession hit Northern Ireland graduates, like me, were really struggling to get the professional development we needed. The ICENI G&S Committee provided excellent technical lectures and networking to help me advance my career." Dr Patrice Cairns, (Lecturer in Civil Engineering, Edinburgh University).

The ICENI G&S Committee answered this by providing free evening lectures given by Professional Engineers aligned to specific Chartership requirements. Prior to the recession, attendance at the events was poor, yet when training budgets began to decline graduates sourced their own professional development and this led to constant oversubscribing of ICENI G&S Professional Development events.

Network Interactions:

- Professional development lectures
- Professional development conferences
- Networking events
- Study groups

Professional Institution Based – Engenerate IPENZ Young Professionals

Engenerate is an initiative of IPENZ for young professionals under the age of 30 or who have had less than eight years work experience. Its purpose is to encourage and facilitate young professionals who wish to aim for Chartered Professional Engineer (CPEng) status. The Engenerate brand is an example of capitalising on the desire for young professionals to help themselves. In ways similar to the ICENI G&S, the graduates are the driver for their own development; they create professional development opportunities for themselves and other young professionals and encourage networking and engagement.

Network Interactions:

- Professional development lectures
- Professional development conferences
- Networking events
- Study groups

Social Networking and Individual Engagement

Company Based – MWH Young Professionals Group

In global organisations it is quite easy for a young professional to feel isolated. In small offices in diverse locations it can be hard to create meaningful interactions. Graduates at MWH Global felt a need to connect with fellow graduates in other corners of the company and with that vision created the MWH Young Professionals Group (YPG), with the mission;

"To be the recognised leader in developing and advocating young professionals at MWH by providing career enhancement through quality education programs, global networking, and leadership opportunities."

YPG | Leading the Way

Figure 3 – MWH YPG Logo (MWH, 2011)

This mission statement was aligned with a vision for the YPG to work alongside leaders of MWH, for the young professionals to leverage their knowledge and skills and for the leaders to utilise the energy and enthusiasm of young professionals, together driving the success of the company.

"The stated purpose of MWH is 'Building a Better World'. The YPG of MWH provides fertile ground for the passion, curiosity, and resolve required to achieve that purpose. In many ways the YPG actually

leads the way for the company with ideas and innovation." Marshall Davert, MWH Asia Pacific Managing Director.

MWH YPGs exist in over 70 offices in 10 countries around the world. The active local YPG chapters organise virtual presentations, conferences and networking opportunities with other chapters in different countries. New company initiatives and innovations are trialled with YPGs before being rolled out to the global company.

MWH YPG has cultivated an atmosphere of progressive achievement through creating leadership opportunities and allowing motivated and enthusiastic YPs to showcase their talents.

Network Interactions:

- Teleconferences
- Virtual professional development presentations
- Virtual conferences
- Use of forums to share presentations and develop best practice
- Virtual social networking to share ideas and innovation.

Purpose Based – Intersect – Purposeful Young Professionals

Intersect is a social networking site with purpose, it connects young professionals who have a common interest in sustainability and societal change. The networking site is supported by Intersect Trust, a charitable trust that financially supports and manages the site. Intersect enables over 1,800 young professionals, who have a desire to create a better society and feel that collectively they can achieve these goals. See Figure 4 for reasons why people joined Intersect.

Set apart from the likes of Facebook and Myspace, which are based around popular interactions and keeping in contact with existing real networks, Intersect facilitates young professionals who are interested in creating new networks with like-minded individuals who have the desire to build a better world and create meaningful, purposeful interactions. It is based on the idea that innovation feeds inspiration and that networking and idea sharing can create real results with benefits for society.

Figure 4 – Word Cloud – Explaining why people joined Intersect (Intersect, 2009)

The social and professional connectivity of these young professionals is not only a benefit; it represents a specific and critical skill set. This type of networking and cloud intelligence is not adapted from traditional knowledge frameworks; it is intuitive for young professionals.

In 2009 Intersect undertook a study of its membership in which it found that 75% of its members are aged 25–35 years old and that 88% of its membership identified themselves as young professionals. The ideas created and discussed on Intersect also create real life interactions and projects including Frocks on Bikes, which

encourages woman to get into cycling and to actively petition for better and safer cycle routes and active sustainability programmes. 52% of respondents said they 'most appreciate the people, energy and positivity associated with Intersect'. A quote from an unnamed young professional on the social networking site commented: "Intersect makes me feel hopeful for the future!"

Network Interactions:

- Social networking site
- Blogs
- Online interest groups
- Intersect meet ups
- Active sustainability programmes

Benefits of Young Professional Engagement

Young professionals are the driving force behind all the examples given. They are the motivated, enthusiastic and active resources that help deliver the programmes. In a number of these cases the young professionals are self-organised, operated and managed. Although the original purpose behind the engagements may differ they are all dependant on the enthusiasm of the young professionals who want to make a difference. Encouraging young professionals to be proactive in these activities and initiatives has benefits for all involved.

These benefits are aligned along the drivers of the young professional and are interconnected as shown in:

Benefits to Professional Organisations

- Educates the public about engineering
- Promotes professionalism
- Promotes Corporate Social Responsibility
- Actively engages with the public
- Creates innovation
- Reinvigorates organisations
- Easily adapts to changing situations
- Creates new ideas
- Grows future leaders
- Increases profile
- Improves retention

Benefits to Society and Environment

- Promotes sustainability initiatives
- Promotes importance of citizenship
- Encourages public participation
- Public engagement enables them to gain understanding of infrastructure issues
- Enables public to provide solutions

Benefits to Individuals

- Builds confidence
- Develops communication skills
- Increases the feeling of making a difference
- Gives back to society
- Facilitates social interactions
- Helps personal and professional development

Can we Learn from Today's Young Professionals?

Young professionals are using alternative methods to achieve professional development. These individuals are actively engaging in community outreach to raise the profile of their industries and to gain professional and personal development.

The drive and determination of these individuals is commonly being used by organisations through educational streams to promote community engagement. Through community presentations young professionals are effectively enhancing their communication and engagement skills, connecting to ever greater networks.

The modern graduates' network of influence is no longer confined by distance. Social networking has linked liked minded individuals from across New Zealand and across the world. Use of appropriate social networking can not only improve a young professional's sense of belonging. It can actively increase their knowledge sharing and professional development.

Far from isolating young professionals, today's professional networks are enhancing job satisfaction and engaging teams in a new and dynamic way. The world view of young professionals is equally global and local.

Through fostering and actively encouraging young professionals to engage with each other and the public, organisations can drive more effective solutions to meet their customers' needs.

Modern young professionals have been brought up in a faster ever changing world. They do not accept that things have to be stagnant, as a result of our evolving society the young professionals are not only ready for change; they actively seek and promote it. Industry must learn how to utilise the enthusiasm and motivation of young professionals to drive their organisations forward.

Take a step back in your organisation and see how young professionals can help you create momentum, innovation and positive change. The chances are it's already happening. ■

Chris is the Asia Pacific Coordinator for the MWH Young Professionals Group. MWH is an employee owned global engineering and environmental consultancy.

Managing Groundwater Storage – Aquifer Recharge in New Zealand's Water Future

Bob Bower – Principal Hydrologist/Member of Golder's Global MAR Team, Golder Associates (NZ) Ltd, Christchurch and Howard Williams – Senior Hydrogeologist, Golder Associates (NZ) Ltd, Nelson

Introduction

Countries throughout the world are coming to terms with the over-allocation of groundwater resources. Growing irrigation and municipal water needs coupled with the increasing need to protect our threatened ecological systems, challenge us to find ways to better manage our water resources. The over-allocation of groundwater supplies can lead to a wide variety of environmental, economic, and cultural issues with solutions often becoming more expensive and politically divisive if the problem is allowed to fester.

New Zealand, with its emerging groundwater needs, is uniquely positioned to utilise lessons learned from the historical over-development of groundwater in other parts of the world, to better manage this public resource sustainably and in keeping with our 'cleaner, greener' image.

As an example, in the United States, over-allocation of groundwater began over a century ago with the development of modern irrigated agriculture and a growing population base, particularly in the arid western states. As surface water use dramatically increased, groundwater became the alternative source to meet growing demand. As groundwater use dramatically increased, declining water tables forced communities to begin developing counter-measures to stop the mining of this resource while still providing for the growing demand. Continued calls for large-scale surface storage and the development of improved irrigation efficiencies became the perceived technological solution to this emerging crisis.

For decades, through both governmental and privately funded feasibility studies and public planning processes, large scale storage proposals were assessed. However after considerable effort and cost, few reservoirs have materialised mainly due to the imbalance between benefits and costs. This imbalance can be directly related to skyrocketing construction costs as well as the environmental and social backlash of impeding free-flowing waterways. These issues have many predicting the end of the 'damming era'.

Advances in water conservation through improved irrigation efficiencies such as the piping and lining of races and through on-farm water delivery conversions (i.e. border-dyke to sprinkler or drip) help to maximise usage and increase cropping yields at the farm-level. However, these measures to increase efficiency act to decrease the additional incidental recharge that these practices have historically provided at the catchment-level, further stressing groundwater supplies.

Furthermore, urbanisation has limited groundwater replenishment opportunities through the increase of impervious areas, loss of wetlands and the channelisation of rivers and streams for flood protection and stormwater management. These issues have led water management in the United States, as in other parts of the world, to re-focus water management to catchment-level water balance processes and search for tools that can better utilise the natural storage features of each system.

Managed Versus Unmanaged Aquifer Recharge?

The management of groundwater storage in an aquifer can be simply summarised as an ongoing balance between what is goes into an aquifer (recharge) and what comes out (discharge). Internationally, groundwater management has typically focussed on the human-use (discharge) side of this balance by setting limits for groundwater pumping and limiting any further development once a system is considered fully allocated.

These limits are generally invoked after the resource has shown considerable indication of overuse, such as, declining water levels in bores; degrading groundwater quality; salt water intrusion into coastal groundwater; drying of natural springs and reductions in the quality and quantity of baseflows to ecologically sensitive rivers and streams (Bower 2010).

Over-allocation often leaves groundwater managers with the option of clawing back enough consented use for a balanced system, which is socially and economically often unachievable. The recharge side of the aquifer storage balance has generally been left to a catchment's natural ability to replenish itself from both river and stream seepage and the climate-dependent cycles of rainfall and varying snow packs. While many systems can naturally provide sufficient amounts of natural recharge there does exist a threshold whereby groundwater use can exceed an aquifer's ability to be replenished. Decadal drought patterns, growing water demand and the degrading water quality and quantity conditions in groundwater-dependent rivers and streams mean that while groundwater limits may be in place they may not represent the only tool we have to better manage this natural underground resource.

One tool for managing the recharge side of this groundwater storage balance is Managed Aquifer Recharge (MAR). Managed aquifer recharge can be defined as the purposeful recharge of water into an aquifer for the purpose of recovery for human needs and to help protect and enhance water-dependent natural systems. There is a wide variety of water management applications for MAR as well as a large number of physical methods by which to achieve it (Figure 1). MAR applications for managing municipal, industrial, agricultural and environmental groundwater issues have

"Furthermore, urbanisation has limited groundwater replenishment opportunities through the increase of impervious areas, loss of wetlands and the channelisation of rivers and streams for flood protection and stormwater management. These issues have led water management in the United States, as in other parts of the world, to re-focus water management to catchment-level water balance processes and search for tools that can better utilise the natural storage features of each system."

been widely demonstrated internationally in varying hydrogeologic, economic and socio-cultural circumstances. The physical methods of aquifer recharge vary from those applied at the surface including constructed wetlands, spreading basins (Figure 2), dual-purpose irrigation systems and targeted bore injection to deeper confined aquifers. MAR has proven affective for both short and long term storage and has the advantage of essentially zero evaporative loss as well as providing easier conveyance of the stored water from one location in the catchment to another. MAR is often most cost effective when compared with other storage options but is best utilised when incorporated into a whole-catchment strategy that includes both surface and groundwater storage coupled with aggressive conservation measures.

Figure 1 – Applications Methods of Managed Aquifer Recharge (Dillion, et al. 2007)

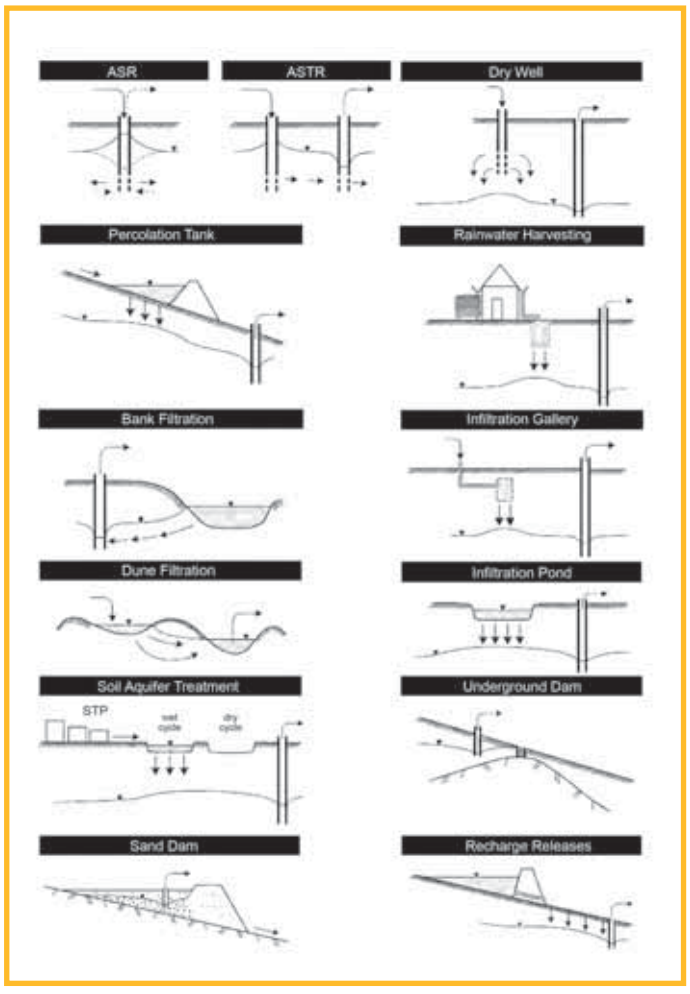

Figure 2 – Aqua Fria Recharge Project using spreading basins to recharge the groundwater resource, Central Arizona (CAP 2011)

One main disadvantage of MAR usually lies with the national and regional policies and regulations that relate to the management of groundwater. Surface water and groundwater resources are often acknowledged to be connected but are not typically conjunctively managed, making the overuse of one difficult to manage with regards to the sustainability of the other. Where MAR has overcome this hurdle, some regulatory approaches have enabled groundwater credits to be awarded for water recharged. These credits can be bought and traded which provides a revenue source to actively build and monitor the groundwater storage programmes. These credit systems coupled with water banking programmes provide management agencies, water-users and environmental interests an incentive-based tool by which to collaboratively work to replenish and protect groundwater systems.

Another issue relating to the implementation of MAR projects is the general lack of understanding that the public and even many water professionals have of how groundwater storage works. People are often unclear on how storage of groundwater can effectively be tracked and then recovered to justify the storage costs. The standard use of groundwater through pumping and the recharge, that occurs naturally year in and year out, is generally unquestioned. The purposeful storage of water into that same system by increasing recharge artificially is often perceived as perplexing and branded as something 'unproven' or 'unlikely to be useful in our catchment'. To overcome this knowledge hurdle, successful MAR programmes have generally followed what is considered the golden rule in artificial recharge – start small, learn or teach as you go and expand as needed (Bouwer 2002). This approach, developing demonstration projects, not only helps overcome natural apprehension and regulatory hurdles but also helps to improve the engineering designs, topographic placement and allows site adaptation for some of the actual physical constraints that can be encountered.

Examples of Successful Managed Aquifer Recharge Programmes

Some of the most prominent and cited recharge programmes occur in the Central Arizona and Orange County, in southern California, United States. Central Arizona uses managed aquifer recharge as a "critical" component of its current and future water management planning needs. The Central Arizona Project (CAP) project utilises the unused portion of Arizona's allocation of Colorado River water to actively recharge more than 400million m^3 of water annually via seven regional recharge sites. The CAP programme refers to MAR as playing:

"… a critical role in the Central Arizona Water Conservation District (CAWCD) mission … Recharge is a long-established and effective water management tool that allows renewable surface water supplies, such as Colorado River water, to be stored underground now for recovery later during periods of reduced water supply."

Over a 15 year period (1996–2011) CAP has built seven MAR sites on both leased and purchased properties where geological conditions and water conveyance logistics proved favourable. The sites varied in size from 4.5 hectares (Arva Valley Recharge Project – AVRP) to nearly 90 hectares (Tonopah Desert Recharge Project – TDRP) and range in construction costs from NZ$1.1 million to more than NZ$23 million (Figure 3).

CAP sites vary in both their annual capital costs and in their recharge capacity based on a number of factors including real estate costs and the site specific hydrogeologic conditions. The TDRP site recharges up to 184million m^3 of water annually at an actual unit cost of NZ$170 per 1,000$m^3$ (Figure 4). These actual unit costs include expenditures incurred from the original designing and permitting through to the ongoing operations costs. Ongoing operational costs

include an extensive groundwater quality monitoring and modelling programme as well as recharge basin operations and maintenance costs.

In 2011 the Superstition Mountains Recharge Project (SMRP) is the last planned CAP site being built and will utilise the remaining unallocated portion of CAP's Colorado River water to be stored as groundwater.

Figure 3 – Tonopah Desert recharge project (TDRP) comprising of nearly 90 ha of spreading basins (CAP 2011)

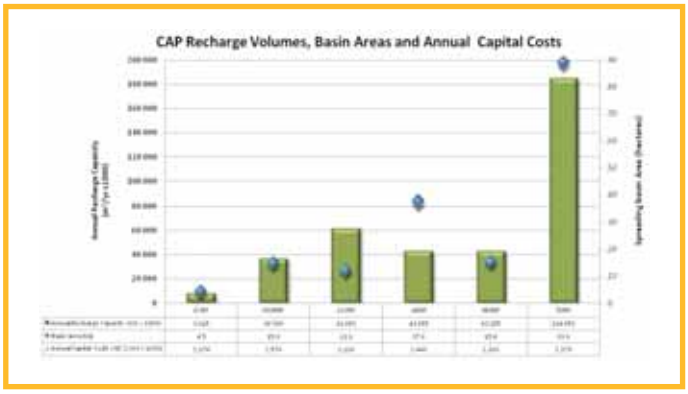

Figure 4 – Arizona's Managed Aquifer Recharge Program (CAP) volumetric recharge and unit costs (CAP 2011). (Recharge Projects – Avra Valley (AVRP), Pima Mine Road (PMRRP), Lower Santa Cruz (LSCRP), Aqua Fria (AFRP), Hieroglyphic Mountains (HMRP) and Toponah Desert (TDRP).

On California's southern Pacific coast, the Orange County Water District (OCWD) was formed in 1933 by a special act of the California Legislature for the purpose of managing and protecting the Orange County groundwater basin. A rapidly growing population coupled with rising real estate costs and issues of salt water intrusion, all situated in an arid desert climate, meant that OCWD had to work hard to solve its water management issues. Since its formation OCWD has developed a Groundwater Replenishment System (GWR System) that has "doubled the yield of this groundwater basin".

Currently OWCD has over 400 hectares of recharge sites and several flood control basins that can provide up to 3.7 million m^3 of groundwater recharge annually which supplies nearly 2 million people with ¾ of their water needs. To meet this demand, OWCD has become a global leader in water reuse and recycling.

In 2008–09 recycled treated wastewater comprised approximately 23% or 67 million m^3 of its total recharged to storage (Figure 5). The GWR system also used water from the Santa Ana River and stormwater sources, water purchased from other basin groundwater producers/agencies, and imports from the Colorado River and State Water Project. In 2008–09 imported water recharge was 63% below the 10-year average of 93 million m^3 per year making both use of recycled water and groundwater storage a vital component of their current and future water management needs.

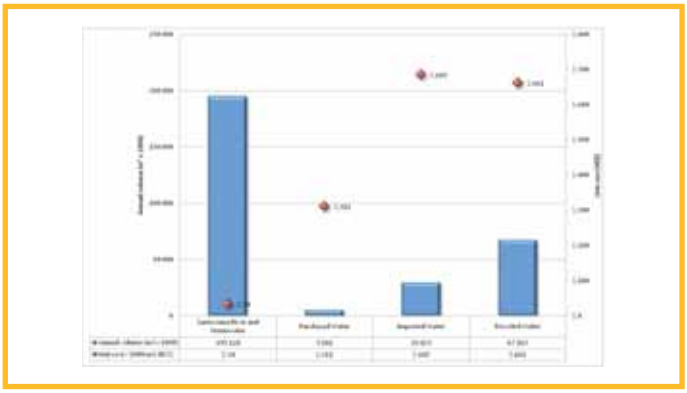

Figure 5 – OWRD's Groundwater Replenishment System's water sources (OWCD, 2010)

Strategies to Explore Managed Aquifer Recharge

Successful MAR programmes can be found in many other countries around the world including Australia, South Africa, India, Israel, Palestine, Sweden, Switzerland and the United Kingdom (DWF 2007). National and regional governments have worked to build the regulatory frameworks needed to more widely utilise this innovative tool.

In 2007 the South African government published its national recharge strategy for what it considers an under-utilised tool that can contribute significantly towards maximising the use and sustainability of the water resources. Its strategic vision for MAR is:

To use natural sub-surface storage as part of Integrated Water Resource Management wherever technologically, economically, environmentally and socially feasible.

In 2009 the Australian government published its guidelines for implementing a systematic approach to the development of MAR programmes in Australia (NRMMC et al. 2009). This report provides a stepwise process by which projects can be assessed at various development stages to ensure that they meet the basic go/no-go criteria needed to move a project from design to implementation. India has also developed a master plan for aquifer recharge which looks to develop thousands of MAR sites in conjunction with rainwater harvesting from over 3.7 million rooftops to help replenish groundwater supplies (DWF 2007). The plan provides a basic outline of the concepts and the need for artificial recharge in India covering from conceptual design through to the monitoring mechanisms needed to implement a national scenario.

MAR in New Zealand

The first MAR trial in New Zealand occurred 25 years ago – the earliest documented MAR trial was conducted on a small scale in the Levels Plain of South Canterbury in 1986 (Bird 1986), involving discharge of surplus irrigation scheme water into an open gravel pit where it infiltrated to the underlying unconfined aquifer, as described in Williams and Aitchison-Earl (2011).

In 1988, in Hawke's Bay (Brooks 1999, White and Brown 1997) a MAR trial beside the Ngaruroro River showed the potential for

increasing storage associated with river gravels. Subsequently, in the West Melton area, MAR trials were carried out on behalf of Canterbury Regional Council (Moore 1994). These small-scale trials indicated that infiltration ponds within gravel pits worked as a means of recharging the aquifer. The results of these trials recognised that water turbidity is an issue which limits infiltration rates, an issue that needs resolution for its application in New Zealand. The latest MAR trial involved infiltration of Waimakariri Irrigation Scheme water into the dry Eyre River bed in Canterbury (CRC 2007), successfully recharging the river bed gravels.

Dam storage and release of surface water into flowing rivers have successfully maintained riparian groundwater storage in Tasman (Wai-iti scheme) and in South Canterbury at Opuha. A further scheme in Tasman has been proposed involving storage and release on the Lee River. Maintaining stream base flow management is one of the most significant environmental issues in many of our large waterways especially in the South Island. MAR may be able to help reverse over allocated supplies and in some cases used to mitigate some of the potential adverse effects posed by additional water take applications.

These New Zealand MAR trials indicate that it is not just a single process. Recharge can be achieved in different ways, each one designed to take advantage of local conditions and resource availability.

Modelling of a potential MAR proposal for the Central Plains area of Canterbury has been carried out by Williams (2011) in which he showed how relatively modest discharges to ground in winter could significantly reduce the impact of summer groundwater abstractions on groundwater-dependent streams feeding into Te Waihora/ Lake Ellesmere.

We now have a unique opportunity to build on these trials and to develop the physical infrastructure, modelling-monitoring tools and regulatory frameworks to actively manage groundwater storage where it is required. Managed aquifer recharge has been shown internationally to have the potential to improve groundwater quality and municipal supply, better manage seasonal variability in environmental baseflows to rivers and springs and prepare us as a society for the fluctuations in precipitation expected from a changing climate.

Regulatory frameworks that help manage both water use and replenishment can be developed to help move towards healthy and well managed groundwater systems. The use of natural groundwater storage is in keeping with the national image of providing 'cleaner and greener' solutions that can be cutting edge examples of the best way forward.

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Te Puru Flood Protection

Megan Wood, Environmental Engineer – Waikato Regional Council

Introduction

On Thursday, 20 June 2002, a storm event known as the 'Weather Bomb 2002' made landfall bringing high winds and torrential rain across most parts of the upper North Island. The resulting floods and damage led to many communities on the Thames Coast of the Coromandel Peninsula being evacuated from their homes and in one case, there was loss of life. There was also disruption to sewage, water supply and power services. The event produced rainfall intensities in the order of 100mm in one hour registering up to a 1% Annual Exceedance Probability (AEP) event and creating river levels ranging from 20% to 1% AEP. Trickling hillside streams became raging torrents in just a few minutes, carrying fallen trees, boulders and many thousand tonnes of mud through homes, properties and roads.

The Te Puru community is located on the west coast of the Coromandel Peninsula, 8km north of Thames on State Highway 25. It was the smaller streams north of Thames (associated with short, steep catchments), like Te Puru, that bore most of the storm's sting. The Te Puru Stream burst its banks sending tonnes of mud and debris through homes and properties. Severe infilling occurred as a result of the heavy bed load movement and slipping. Lateral erosion was evident and the flood struck with enough force to move caravans, garages, boats and cars.

Figure 1 – Damage to Te Puru Creek Road after the "Weather Bomb 2002"

An Integrated Approach

In response to the severe floods generated by the 'Weather Bomb 2002', Waikato Regional Council established the Peninsula Project to address flooding on the Thames Coast and river and catchment issues across the Peninsula. The Peninsula Project, a collaborative project between Waikato Regional Council, Thames Coromandel District Council, Department of Conservation and Hauraki Maori Trust Board aims to improve the environment and address flood risks. In terms of flood risk the initial focus has been on five priority at-risk communities on the Thames Coast, one of which is Te Puru.

The Peninsula Project integrates five key areas of work including planning controls, animal pest control, soil conservation, river management and flood protection measures. The project encapsulates an approach where the issues and mitigation options have been considered from the mountains to the sea. By taking a whole of catchment approach to flooding and gaining ownership from the various parties, a more sustainable means of reducing the effects of flooding was established.

Since the introduction of the Peninsula Project, Waikato Regional Council and Thames Coromandel District Council, have been working with the Te Puru community on addressing the Te Puru Stream flood hazard. A Flood Mitigation Working Party representing the Te Puru community was established to facilitate consultation. With input from the working party a risk assessment was undertaken, technical investigations were carried out and risk mitigation options were developed. A successful business case to central government was also made for funding support for the flood mitigation on the Thames Coast. Based on this work a flood protection scheme was developed for Te Puru, consulted on and consented.

This article provides details about the flood protection works that are currently under construction at Te Puru.

Flood Protection Scheme

The Te Puru Stream has a 24 km^2 catchment that originates in the western Coromandel Ranges. This catchment is relatively steep and covered in regenerating native vegetation and scrub. It is also susceptible to short duration but high intensity rainfall events that cause flash flooding and debris flows in the Te Puru Stream with little or no warning. Parts of the Te Puru community are located on the floodplain and sediment/debris fan created by the Te Puru Stream.

Figure 2 – Location plan

There is a State Highway 25 (SH25) Bridge crossing through the middle of the community. At the time of the 'Weather Bomb 2002' the SH25 Bridge was under capacity hence contributing to the flood effects experienced in the community. Waikato Regional Council and Thames Coromandel District Council submitted to New Zealand Transport Agency's project planning process and in 2010 the New Zealand Transport Agency completed the upgrade of the bridge to provide capacity for the 1% AEP flows with freeboard.

The Te Puru flood protection works have been designed to provide protection to the Te Puru community for the 1% AEP event. Waikato Regional Council's flood protection scheme comprises a flood wall that has been constructed predominantly on the true left bank, with some portions of flood wall along the true right bank. Where there is sufficient room, the floodwall has been designed with clay bulking

on the landward side to provide additional robustness and in case of overtopping to prevent the flood wall from being undermined.

Figure 3 – Flood protection scheme

The upper section of the scheme is located on the true left bank between Te Puru Creek Road and the northern boundary of residential properties (located in road reserve and on private property). The access to these properties was originally from Te Puru Creek Road, which would be cut off by the flood wall. A new arrangement was developed providing access to these properties from the adjacent residential road to the south, with a shared accessway being designed to enable access to six dwellings.

The middle section of the scheme located on the true left bank is located within a campground. To provide adequate space for the stream berm and improvements to the channel protection the flood wall alignment was cutting through several existing river frontage lots with cabins located on them. Waikato Regional Council consulted with all affected land owners and came to an altered arrangement for the lots which all parties agreed to. A raised platform was also incorporated in the design on the landward side of the flood wall for the cabins to be located on so that the occupiers would retain their water views.

Figure 4 – Flood wall construction

The secondary overland flowpath for the bridge and flood protection scheme operates on the true bright bank upstream of the bridge. Prior to the works there was an existing overland flowpath in this location, however the capacity of the flowpath was significantly altered by the upgraded northern approach to the upgraded SH25 Bridge. The flood protection scheme includes a spillway located immediately upstream of the bridge. A spillway has been designed at this location with the sill level set to improve the level of protection to properties located to the north of the stream and when operating to match the capacity available in the overland flowpath. Close consultation with New Zealand Transport Agency was required on this matter.

Channel protection works have been upgraded on the left bank upstream and downstream of the bridge and also on the right bank downstream of the bridge, at locations on the outside of the bend. The channel protection works will help to protect the flood wall from erosion and undermining and also reduce the risk of Te Puru Creek Road being damaged.

'Residual flood risk' is a term used to describe a river flood risk that exists due to the potential for 'greater than design' flood events to occur. The design of the scheme does not reflect hazards influenced by extreme uncertainties. Such uncertainties may include larger than design events, blockages, bed load movement/debris – leading to channel infilling, erosion, flood protection failure and ponding. For Te Puru the greatest residual risks may be considered to be bed load movement, debris, erosion and larger than design events.

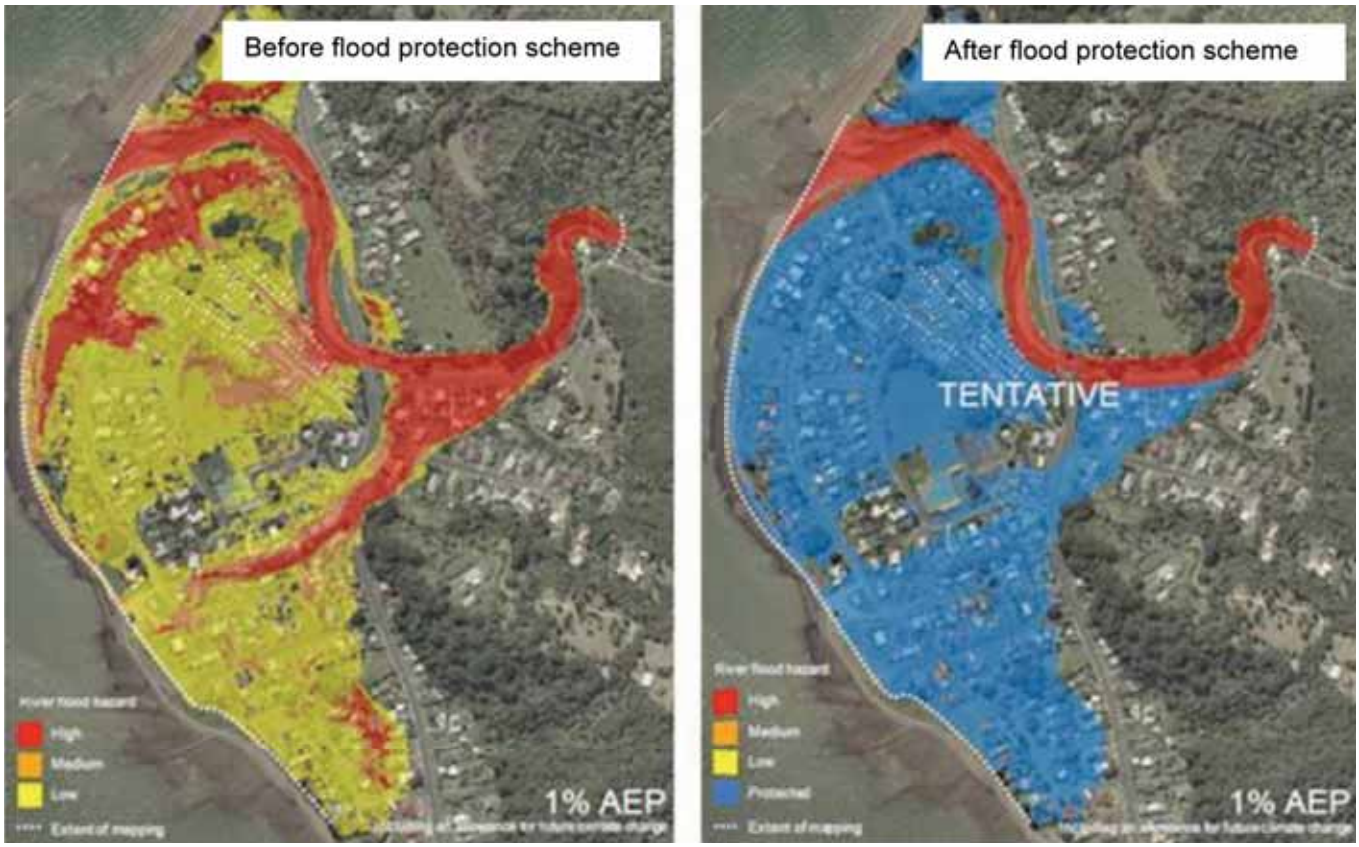
Channel Maintenance

The main channel of the Te Puru Stream is monitored and periodically maintained by Waikato Regional Council to remove accumulated sediment and debris. This work maintains the capacity of the Te Puru Stream, reduces the risk to adjacent land that would otherwise be inundated more frequently and will also help to maintain the performance of the flood protection scheme.

Planning Controls

Waikato Regional Council has been working closely with the Thames Coromandel District Council on the development of a District Plan Change 3 – Naturals Hazards: Flooding. This proposed variation/plan change outlines how river flood risks will be managed in the Thames Coromandel District using four levels of hazard (low, medium, high and residual) and specifies land use planning controls depending on the level of hazard. The following figure demonstrates the flood hazard map for Te Puru before and after the flood protection scheme.

Figure 5 – Te Puru flood hazard map



Animal Pest Control

Animal pests in the upper areas of the catchment lead to the destruction of forest and vegetation, increasing catchment erosion and instability and increasing runoff. Animal pest control, aimed at possums and goats, will allow the forest to recover, improving the stability of the catchment and downstream river system.

The Department of Conservation and Waikato Regional Council joined forces to target possums and goats on the Thames Coast, a partnership that has been extremely successful at both on the ground and strategic levels. The programme targets 70,000 hectares of Crown and private land. The improved condition of the forest is already apparent with monitoring showing an increase in bird numbers and vegetation cover.

Conclusion

A key aspect to the success of the project has been the collaboration between multi agencies at a local and central government level to address flooding issues. This partnership has proven extremely valuable and effective. As has the partnership with New Zealand Transport Agency in regard to State Highway bridge issues being resolved at Tararu and Te Puru on the Thames Coast.

The development of a community working party to discuss and consult on the flood mitigation proposals helped to expedite the consent process. By the time the consent application was lodged the community were already well up to speed on what the council was proposing.

The approach of identifying issues and mitigation options by considering the catchments from the mountain to the sea has been successful. The approach takes into account the use of planning controls, animal pest control, soil conservation, river management and flood protection measures. By combining these five areas of practise a more robust and sustainable means of reducing flood effects has been established. ■

"The channel protection works will help to protect the flood wall from erosion and undermining and also reduce the risk of Te Puru Creek Road being damaged."

Note

Figures 2 and 4 – Imagery sourced from Terralink International Limited (TIL) 2007 and is the property of TIL and the Waikato Regional Aerial Photography Syndicate (WRAPS) 2007. Copyright Reserved

The Hidden Dangers Lurking in Underground Concrete Wastewater Tanks

Greentank Environmental Engineering

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Most importantly, the pre-fabricated fiberglass tanks provide superior resistance against leakage and cracking compared with traditional pre-cast concrete wastewater tanks.

"Most importantly, the pre-fabricated fiberglass tanks provide superior resistance against leakage and cracking compared with traditional pre-cast concrete wastewater tanks."

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Coronet Peak

Coronet Peak Ski-Field – Protecting the Mountain

Hynds Environmental

The world renowned Coronet Peak ski area is located just 20 minutes drive (18km) from central Queenstown and is one of the largest and best developed ski fields in the Southern Hemisphere. Covering 280 hectares of skiable area, Coronet Peak attracts hundreds of thousands of visitors every year and the facilities include restaurants, cafes, full bars, retail outlets and a crèche.

Coronet Peak has been operating for over 60 years and is owned and operated by NZSki Ltd who also own and operate the Mt Hutt and The Remarkables ski areas. The company is committed to the ongoing development of the ski areas, their industry partners and home resort communities. Extensive capital investment over the past three years has considerably upgraded the infrastructure at all three mountains.

As part of this ongoing commitment to the development and protection of Coronet Peak, NZSki recently applied to the Otago Regional Council to renew their discharge permit. The ORC issued a new 35 year discharge consent for the wastewater from the ski area. To meet the current high treatment levels required for onsite disposal and to cope with the increased facilities, NZSki was required to upgrade the existing wastewater secondary treatment system onsite.

The wastewater generated from this development has been measured in excess of 100m³ per day during peak periods. The wastewater treatment plant has been designed to treat a peak of 65m³ per day with the excess flow being stored in the existing pond. The stored effluent from the winter is slowly fed to the plant during the off season to maintain the microbiological activity.

Using their in-house engineering team, NZSki managed the design and tendering process for this project and in November 2010, Hynds Environmental was awarded the contract to design and build the wastewater treatment plant and on-site disposal system.

Greengates chairlift at Coronet Peak

The first stage of this project was to design and build the wastewater treatment plant. The design of this plant had its unique challenges with freezing ambient temperatures during the peak flow periods and permafrosts through the land application field. The SAF design, a fixed filmed technology, was the ideal solution.

With the microbiological activity occurring within the fluid, which retains heat significantly better than air, and this fluid being heated by warm air from the aeration process, the SAF technology is best suited for this environment.

The entire plant has been fully buried to utilise the concrete tanks and surrounding earth as natural insulation. The modular design allows for future upgrades if required. The plant has been constructed using a combination of precast concrete tanks manufactured in the Hynds factory in Christchurch and modular concrete tanks constructed on site using Hynds "Hypond" systems. The plant includes primary treatment followed by a two stage fixed film biological treatment process. The third stage is clarification using a laminar plate separator which also returns activated sludge back to the primary tank. The entire plant is controlled using a Hynds PLC unit which is connected via fibre optic to the main building at Coronet Peak. This allows the plant to be monitored remotely by the Coronet Peak operations team and also by Hynds Environmental via the internet.

The second stage was the installation of 24 kilometres of buried drip-line irrigation covering 2.4 hectares of the mountain. This disposal system had to be buried at least 600mm deep in the rock fields of the mountain. To achieve this, the pressure compensating dripline was placed in 63mm nova-coil pipe which was installed by a D9 Bulldozer, with a mole plough, across the mountain.

The extreme weather experienced on Coronet Peak resulted in some unique design and construction challenges for Hynds Environmental. The lids of the concrete tanks are designed to withstand several metres of snow loading and the cold weather is also a major factor in the ability of any wastewater plant to achieve the required treatment levels.

The construction of the wastewater plant and disposal field began in January 2011 and the system was commissioned in mid-April. It is showing excellent treatment results to date and will be closely monitored over the winter as the temperatures drop and the wastewater load increases. Hynds Environmental has also been engaged by Coronet Peak to operate and maintain the wastewater treatment plant over the next 5 years.

Hamish McCrostie, Ski Area Manager for Coronet Peak and Project Manager for this project has been impressed by Hynds Environmentals performance on this project. "This plant has really future proofed Coronet Peaks wastewater requirements and Hynds Environmental have been very good to work with through the whole process. We are committed to ensure the very best environmental standards are maintained and excited to see the plant operating." say Hamish.

For further information on Hynds Environmental Wastewater Treatment Systems, ph 0800 425 433 or visit www.hyndsenv.co.nz

Water New Zealand Conferences & Events

2011 *Water New Zealand* Annual Conference & Expo – *'Advancing Water Reform'*
9 – 11 November 2011
Energy Events Centre, Rotorua, New Zealand
For more information visit www.waternz.org.nz/events

Other Conferences

The New Zealand Trade & Industrial Waste Forum
10 – 12 August 2011
Napier War Memorial Conference Centre, Napier, New Zealand
For more information visit www.confer.co.nz/tiwf

IWA Diffuse Pollution Specialist Group – 15th International Conference
18 – 23 September 2011
Energy Events Centre, Rotorua, New Zealand
For more information visit www.dipcon2011.org

16th International Symposium on Health Related Water Microbiology – WaterMicro2011
18 – 23 September 2011
Energy Events Centre, Rotorua, New Zealand
For more information visit www.on-cue.co.nz/hrwm2011/index.html

Pacific Water & Wastes Association Water Conference & Expo 2011
28 – 30 September 2011
Novotel Hotel, Lami Bay, Suva, Fiji
For more information visit www.pacificwaterassociation.org

84th Annual Water Environment Federation Technical Exhibition and Conference
15 – 19 October 2011
Los Angeles Convention Centre, Los Angeles, California, USA
For more information visit www.weftec.org

6th International Specialised Conference on Sustainable Viticulture
6 – 10 November 2011
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