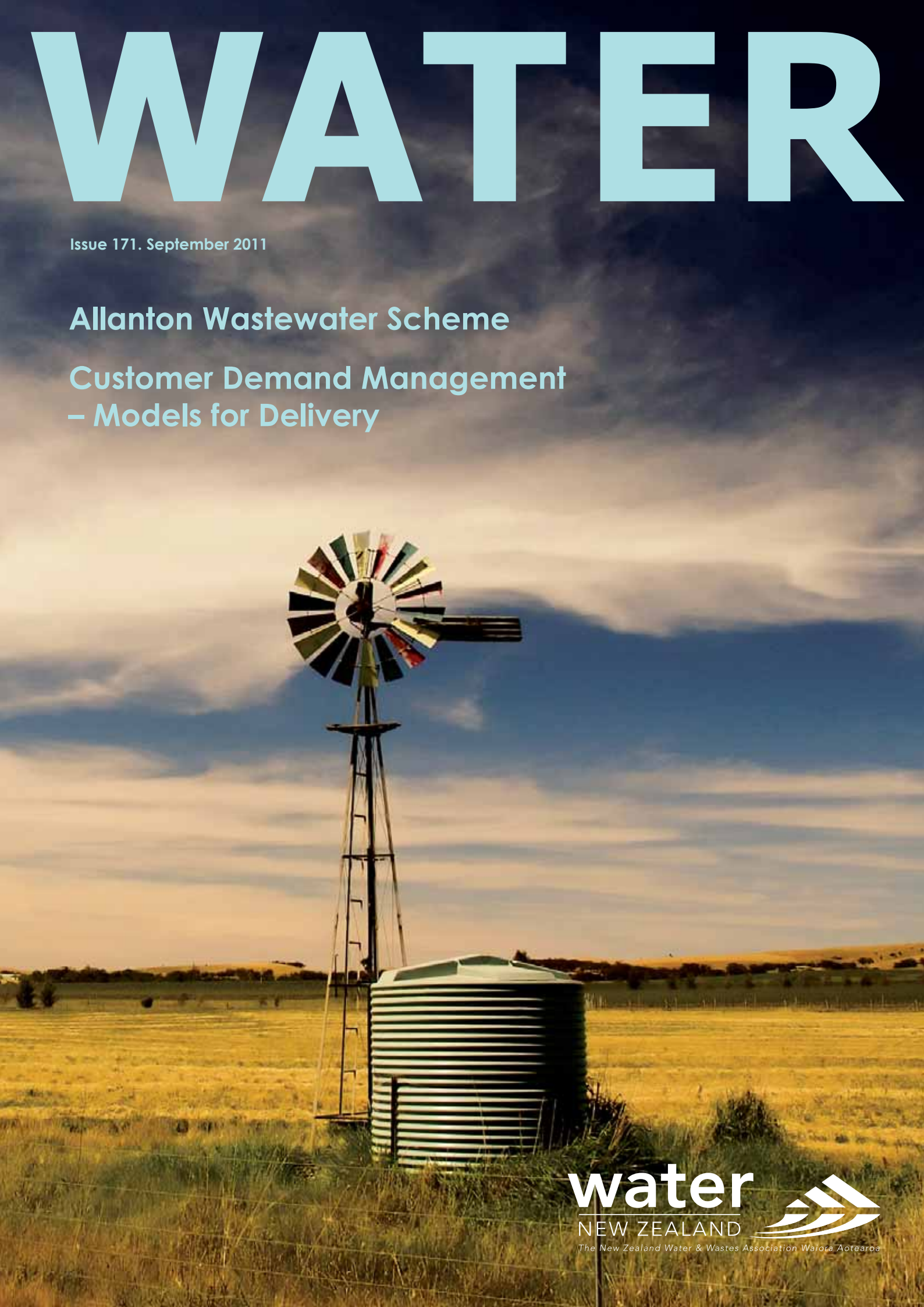
WATER

Issue 171. September 2011

Allanton Wastewater Scheme

Customer Demand Management – Models for Delivery



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The New Zealand Water & Wastes Association Waiora Aotearoa

WATER

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ISSN 1177–1313

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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

More Work for the Land and Water Forum

The Land and Water Forum has been reconvened to provide further advice to Ministers on how to improve water management in New Zealand. *Water New Zealand* has played an active part in the Forum's work to date and this will continue as it is vital that our collective knowledge influences the future shape of water policy. I thought it worth using my column this month to update you on developments so far and the likely next steps.

The Forum was established on the premise that stakeholders in water management needed to engage directly with each other if a sustainable way forward was to be found for better water management in New Zealand. It had become increasingly difficult to establish a consensus about what constitutes sustainable land use and its implications for freshwater. This difficulty is hampering our economic development and damaging our environment. Previous attempts to deal with these matters, principally under the sustainable water programme of action, had been unsuccessful.

The Forum draws together interest groups to take an overall view of New Zealand's water issues and experience and build consensus for a way forward. Its genesis lay in a 2009 Cabinet decision for a new strategic direction for freshwater. It effectively merged two non-government led initiatives already underway. These were the *Water New Zealand* led Turnbull Group, and the Sustainable Land Use Forum, an Environmental Defence Society initiative. Both were set up to look at better land and water management.

The Forum was asked to develop shared outcomes, goals and long-term strategies for freshwater. It reported to the Minister for the Environment and Minister of Agriculture and Forestry in early September 2010. The Ministers then asked the Forum to engage regionally on the report's recommendations. Public engagement followed and the Forum reported back to Ministers in early April 2011. There was general support for the report's recommendations and a view that the Government should implement them with a sense of urgency.

In May of this year the Cabinet agreed to a three-tranche process for water reform. The process was:

- Firstly, the National Policy Statement for Freshwater Management, and revised funding for the development of irrigation infrastructure
- Secondly, a programme of work on setting limits on water quality and quantity, including governance arrangements, for delivery in February next year
- Thirdly, work on managing to limits, including more efficient allocation mechanisms and additional tools to manage the effects of land use, to report back by October 2012

The Forum's task now is broadly to flesh out the second and third steps described above. These cover a range of issues including methods for the allocation and transfer of water rights once limits are set, along with instruments that incentivise efficient use of water in rural and urban areas.

The Forum has also been asked to provide advice to Ministers on a possible National Land and Water Strategy, including why a strategy is important, and key elements within it.

It will engage with officials and Ministers on the Forum's recommendations on rural infrastructure, and water services management, and how advice might be integrated with other elements of the local government reform.

These activities fit squarely within our constitutional purpose 'to be the pre-eminent organisation for promoting and enabling the sustainable management and development of the water environment.'

We will make our collective voice heard. It is important work and a challenging time to be in the industry. ■

Clive Rundle
President, Water New Zealand

> "The Forum was established on the premise that stakeholders in water management needed to engage directly with each other if a sustainable way forward was to be found for better water management in New Zealand. It had become increasingly difficult to establish a consensus about what constitutes sustainable land use and its implications for freshwater. This difficulty is hampering our economic development and damaging our environment."

new members

Water New Zealand welcomes the following new members:

NAVIN CHANDRA
CHANDAR SEN
DENNIS MCAULAY
DARREN MICHALSKI
MARK LAUTRE
REBECCA DEMCHICK
BRUCE HENLEY
AMELIA CUNNINGHAM
VERONIQUE RAMEN
EDWARD REID
WAYNE CROOKS
MICHAEL GREEN
PAUL NUTTER
RICHARD MORROW
JACK BRENNAN
CHRISTINE MILLER
RICHARD REID
ANDREW BIRKILL
DAVID WEATHERLEY
CHRIS HAMMETT
ANDREW LINEHAN
KIRSTEN MANDENO
MARCIA BEUTH
KIERAN SCOTT

Murray Gibb

Malthus Revisited

"Over the last few decades the debate has resurfaced. Environmental and conservation groups suggest that there are resource limits and that compounding human and economic growth is simply not possible because of supply constraints. Some suggest that these constraints have already been reached."

Current evidence suggests homo sapiens emerged roughly 200,000 years ago, taking until the beginning of the 1st millennium for populations to build to 200 million. When I took on this job in 2008 the world's population was 6.7 billion. In the intervening three years it has increased by three percent to 6.9 billion.

In three short years the world's population has increased by the same number achieved from the time our species evolved to the time of Christ. Increasing at a linear rate, the one billion mark was passed in 1804. Since then it has grown exponentially.

Those 200 million extra mouths need food, shelter and water and are more likely to want BMWs than buggies.

Ironically, just a few years prior to the first billion being reached, Thomas Malthus wrote *An Essay on the Principle of Population* arguing that, amongst other things, resource constraints limiting food production would preclude future population growth. Others at that time argued to the contrary, suggesting instead a future of untrammelled growth and increasing prosperity.

Over the last few decades the debate has resurfaced. Environmental and conservation groups suggest that there are resource limits and that compounding human and economic growth is simply not possible because of supply constraints. Some suggest that these constraints have already been reached.

Malthus based his hypothesis on past observations of the effects of both famine and plentiful food supplies on human and animal populations. What he was unable to foresee was the effect of the fossil fuel powered industrial revolution and the extraordinary flowering of science in the 19th Century, both of which enabled rapidly expanding living standards, vastly increased wealth and exponential population growth.

Writing in his quarterly newsletters[1], Jeremy Grantham argues that the mismatch between the supply of finite resources and demand from exponential growth has already been reached.

Firstly, he argues that wealth creation within nations has accelerated over time. As the first industrialised nation, Britain's wealth doubled in 100 years. Germany took 80, Japan 20, South Korea 15 and China a mere 10 years to do the same.

He then looks at the resource required to meet compounding demand. He examines supply and demand for 33 commodities including minerals, fossil fuels and food. For a century prices for these commodities declined in real terms because production exceeded supply. In the last decade the explosive economic growth in India and China has lifted compounding demand to new heights and, in Grantham's view, tipped the balance so that the long-term trend towards lower prices has been reversed.

He cites oil as his first example. Traditional onshore oil production peaked 30 years ago. Harder to obtain sources, such as tar sands, oil shale, deep water oil and the like, are more expensive to produce and so oil prices have risen in real terms. Peak oil is close.

He then looks at metals. Declining ore quality and rising extraction costs are repeated across most important metals. Iron is a good example. Since a 2002 low point, iron ore prices reversed a 100 year decline, taking only eight years to reach record highs. China now uses 47 percent of global iron ore consumption.

Lastly, he looks at agriculture. Supply constraints include productivity, available land, soil, water, fertilisers and variances in weather.

By the end of the 1960s average gains in agricultural productivity stood at 3.5 percent per annum, but these rates have since declined to just over one percent. Investment in agricultural science has been reduced because we thought the green revolution was won.

Available arable land per capita has halved from 0.4 hectares in 1961 to 0.2 per person today. This trend will continue due to future population growth, coupled with soil loss. One third of the world's cropland has been lost to desertification in the last 40 years.

Deforestation is causing erosion at rates far in excess of new soils being created, reducing fertility and water retention capacity. The world's great breadbaskets, including parts of the US plains, the northwest of the Indian subcontinent and the northeast China plain, rely on fossil aquifers, which are being depleted.

While nitrogen is plentiful, reserves of potash and phosphate are finite and prices will also increase at some point in the future. Anthropogenic climate change is here with associated uncertainty. Drier areas will get drier. Wetter areas will get wetter.

Grantham argues that we are now living beyond a sustainable level and that the world's population will probably have to decline substantially to balance resource supply with demand. The question is – do we have the time to balance off reducing demand (read reducing populations as is occurring in Western European counties) before severe supply constraints throw the whole equation out of balance? He argues we do.

He argues Malthus was right and that his pitch was just a few centuries early. From a selfish perspective this bodes well for resource-rich New Zealand. We must also get our water policy right and remove the term 'waste' water from our lexicon. Discarding a valuable resource would seem increasingly irresponsible going forward. ■

Murray Gibb
Chief Executive, Water New Zealand

Footnotes

[1]www.gmo.com/America/

Constitutional Matters

Notice of Annual General Meeting

The 2011 Annual General Meeting of *Water New Zealand* will be held on Friday 11 November 2011 at 9.00am in the Energy Events Centre, Rotorua.

Board Election

Nominations for election to the Board of *Water New Zealand* close on Friday 23 September at 5.00pm. There are six elected Board members, who are elected for three year terms. With the change from two to three year terms this year, two sitting Board members, Onno Mulder and Steve Couper retire by rotation. A copy of the official nomination form can be downloaded from the *Water New Zealand* website at www.waternz.org.nz

Members interested in standing for the Board are advised to discuss the governance duties of directors with past or present Board members.

Proposed Changes to the Constitution

The Board intends to propose two changes to the constitution at the Annual General Meeting in November this year.

1. Remove Honorary Membership Category

Rule 4.1(f) allows non-members to be elected as honorary members. Prior to 2007 constitutional changes, this rule allowed for members and non-members to be elected as honorary members.

The relative standing of honorary and life members, along with the suite of Association awards generally, has been subject to considerable discussion over a prolonged period. The Board

"Nominations for election to the Board of *Water New Zealand* close on Friday 23 September."

wishes to ensure that there is clarity and clear direction on these matters going forward. The Awards Committee has recommended and the Board has agreed to recommend to members that *Water New Zealand* should focus on recognising eminent members, rather than non-members.

Accordingly it is proposed that Rule 4.1(f), which admits non-members who are eminent in their field to membership, be deleted.

The proposed change will have no effect on the standing of those who have been elected to be honorary members in the past. They continue to be eminent members. In accordance with rules applicable at the time of their election, they will continue to enjoy the benefits of membership without charge. They are entitled to describe themselves as honorary members. The standing of all honorary members, alive and deceased, is recognised in Association records and publications. Rolls of Honour of all life and honorary members sit prominently within the Association offices.

2. Life Membership be Restyled as Honorary Life Membership

Rule 4.1(g) allows members to be elected to be life members. The Awards Committee has recommended and the Board has agreed that the life member category of membership be revised to honorary life member in recognition of its high standing. The change is intended to convey that it is the Association's highest award. The style is consistent with this category of membership offered by many other membership organisations. ■

WEFTEC – So Big it Can Be Seen from Outer Space!

Garry MacDonald, Water New Zealand's WEF Director

While the truthfulness of this claim has not been verified, WEF guarantees that WEFTEC is bigger than any other annual water event. WEFTEC 2011, 15–19 October in Los Angeles, will feature up to 21 concurrent technical sessions per day for a total of more than 800 presentations, nearly 1000 exhibitors in more than 292,000 sqft (almost 3 hectares) of exhibit space and nearly 18,000 professionals from more than 70 countries. Amongst all of these people and exhibition stands will be at least four Kiwis, all *Water New Zealand* members, who will be forsaking the Rugby World Cup semi-final weekend in order to make technical presentations at WEFTEC.

"If you have never been to a WEFTEC, then I would strongly encourage you to do so."

It's not easy getting a paper selected for podium presentation at WEFTEC – this year only 50% of the abstracts submitted got through the exacting evaluation process undertaken in February, and these included:

- **The Canterbury Earthquakes – Water Infrastructure Response, Recovery and Lessons Learned** (Feature Session – three Invited Speakers on Disaster Response, Recovery and Resilience) – Mark Christison, Christchurch City Council
- **Sustaining Water Infrastructure, After the Goldrush** (Symposium – Varied Perspectives on Sustainability: Topics in Utility Management) – by John Mackie, Dunedin City Council
- **Sustainable Water and Energy Resources at College of Marshall Islands: Implementation and Challenges** (Symposium – Hot Topics: Small Island and Developing Nations) – by Rob Fullerton, Beca (Auckland)
- **"Co-Management" – Agreeing Objectives for Protection and Restoration of Rivers to Meet the Needs of Indigenous Communities** (Symposium – Hot Topics: Small Island and Developing Nations) – by Garry Macdonald, Beca (Auckland)

These are the only New Zealand speakers that I know about, so my apologies to anyone else who has also had their abstract selected and will be speaking at WEFTEC.

The diversity of subjects addressed by these four speakers demonstrates the wide range of topics that is covered in the WEFTEC programme every year. It just goes to show that there is really 'something for everyone' in the technical programme and certainly more than enough for one person to discover and explore on the exhibition floor!

If you are already registered to go to WEFTEC in Los Angeles and are also missing the RWC semifinals – then please let me know (see contact details below) as the rest of the Kiwi contingent, as well as a few passionate rugby-loving mates from Australia, South Africa, Canada, UK and Argentina, will be gathering at a downtown LA sports-bar to watch the two RWC semi-final matches on the weekend of 15/16 October!

If you have never been to a WEFTEC, then I would strongly encourage you to do so – if not in 2011 in LA – then perhaps in New Orleans (aka Mardi Gras City) in 2012. If you have been to WEFTEC before, then you might consider submitting an abstract for a technical paper for WEFTEC 2012 – and if you need any help or guidance contact me at garry.macdonald@beca.com or phone 09 300 9281. ■

advancing water reform 2011

WATER NEW ZEALAND'S ANNUAL CONFERENCE & EXPO
ENERGY EVENTS CENTRE ROTORUA 09–11 NOVEMBER

REGISTER NOW!

The Annual Conference will be held 9–11 November – save this date in your diary now!

Register now to attend the only New Zealand conference that covers every aspect of the water environment and its management.

Earlybird Registration Fees, Accommodation Rates and Discounted Corporate Packages are available until 21 September.

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 Conference 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 and a forum discussing 'The Future Face of Water Services' will be held. The Conference will close at 1.00pm on Friday.

Programme

A challenging, interesting and future focussed programme has been put together and is now available on the website. This year's conference will offer presentations covering every aspect of the water environment and its management.

Conference Expo

Exhibition sites have sold out and we have a record 169 sites this year. The Conference Expo continues to be the largest trade exhibition for the sector.

Key Dates for Your Diary

21 September	**Earlybird registrations close**
9–11 November	**Annual Conference & Expo**

Key Diary Dates for Presenters

29 September	**Final papers due**
19 October	**Powerpoint presentations due**

Expo Visiting Times

Visitors are only permitted into the Expo during the following times:

Wednesday 9 November
9.00am – 10.15am
11.00am – 12.15pm
2.00pm – 3.15pm
4.00pm – 5.15pm

Thursday 10 November
9.00am – 9.45am
10.30am – 11.45am
1.30pm – 2.45pm
3.30pm – 5.00pm

Friday 11 November
9.00am – 9.45am
10.30am – 11.45am

Networking Opportunities

Social functions throughout the Conference continue to provide prime networking opportunities with attendees from all aspects of the water environment and management sector. Visit www.waternz.org.nz for further information and to book tickets for the following Conference social events:

- **AECOM NZ Welcome Reception**
  Wednesday 9 November
- **Applied Instrument Group Operations Dinner**
  Wednesday 9 November
- **INNOVYZE Modelling Dinner**
  Wednesday 9 November
- **Conference Dinner and Awards Presentation sponsored by Hynds**
  Thursday 10 November

Water New Zealand Awards 2011

The following awards will be presented at the 2011 Conference:

- CH2M Beca Young Water Professional of the Year 2011
- Opus Trainee of the Year 2011
- Orica Chemnet Operations Prize
- Hynds Paper of the Year 2011
- AWT Best Poster Award

Advance Notice of the 2011 *Water New Zealand* AGM

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.

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Keynote Speakers

Hon Dr Nick Smith

Nick Smith was born and educated in North Canterbury in a bridge construction business family. He subsequently completed a first-class honours degree in civil engineering and a PhD in landslides at Canterbury University.

Nick was politically active from a young age and influenced by a year as an AFS scholar to Delaware, USA. He became a district councillor while studying and has held many offices in Young Nationals and in the senior National Party prior to being selected as the National candidate for Tasman in 1989.

He won the Tasman seat in 1990 and 1993 and, following the introduction of MMP, Nelson in 1996, 1999, 2002, 2005, and 2008, despite both having a long previous history as Labour areas. Nick has held nine Ministerial portfolios in the Bolger, Shipley and Key Cabinets, covering Conservation, Education, Immigration, Corrections, Social Welfare, and Treaty Negotiations. He is currently Minister for the Environment, Climate Change, and ACC.

His greatest passion has been improving New Zealand's management of the environment and natural resources. In 1998 he founded the Bluegreens as a group within National that wish to advance policies that support economic prosperity and a clean, green New Zealand.

Professor David Bibby

Professor David Bibby, Pro Vice-Chancellor of the Faculties of Science, Engineering and Architecture & Design at Victoria University of Wellington, joined Victoria in April 2003 following long-term research and teaching collaborations with staff and students.

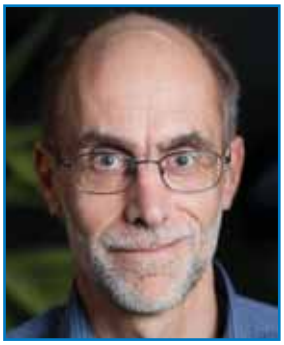
A graduate of the University of Loughborough, UK, he subsequently received a PhD in 1970 and moved to the Nuclear Physics Research Unit, University of the Witwatersrand, Johannesburg, South Africa. There he researched the geochemistry of diamonds using neutron activation analysis. He joined the DSIR Chemistry Division in Wellington, New Zealand, in 1975 as a member of the Inorganic Materials Team. His research was primarily on the synthesis and characterisation of zeolite catalysts for which he was awarded a DSc in 1995.

He became Group Manager Science in DSIR Chemistry Division in 1988, and then became a General Manager in the Crown Research Institute, Industrial Research Ltd, in 1992. He has served on a number of government advisory panels and is also a member of the management and advisory boards of various research centres and institutes, including the MacDiarmid Institute for Advanced Materials and Nanotechnology, the Antarctic Research Centre, the Joint Antarctic Research Institute (with NIWA and GNS), the Malaghan Institute of Medical Research and Victoria Link Ltd.

Invited Speakers

Alastair Bisley

Alastair Bisley is the Chair of the Land and Water Forum, which was established to reach consensus on the sustainable management of land and water in New Zealand. For most of his career, he worked in the Ministry of Foreign Affairs and Trade (he became New Zealand's Ambassador in Geneva at the end of the Uruguay Round of trade negotiations, and subsequently the Ministry's Principal Trade Negotiator) and was Secretary of Transport from 1998 – 2004. He is a Senior Associate of the Institute of Policy Studies and a member of the New Zealand Meat Board.



Dave Brunsdon

Dave Brunsdon is the National Engineering Lifelines Co-ordinator, a role which works at the interface between infrastructure providers and emergency management agencies. He is also a director of Kestrel Group, a consulting practice specialising in strategic emergency management planning for local and central government agencies and infrastructure providers.

Dave co-ordinated the building safety evaluation process immediately following the September 2010 Canterbury earthquake, and led the Urban Search and Rescue Engineering team during the response to the February 2011 earthquake. He currently leads the Engineering Advisory Group, which has developed assessment, repair and reconstruction solutions for residential and commercial buildings following the earthquakes.

Mark Christison

Mark Christison is professional engineer with a degree in mechanical engineering.

Over the past 23 years Mark has held senior management and operational positions in both private and public infrastructure companies in the energy, water and solid waste disciplines.

During the Christchurch earthquakes Mark performed the role as Chief Engineer and led the recovery team during the immediate response phases of all three major earthquakes. This has involved restoration of service to over 50,000 homes since the February earthquake, the setting and lifting of three city wide boil water notices as well as prioritising the repair to essential infrastructure to help get the city back on its feet after each event.

Brent Clothier

Brent Clothier is Group Leader of Systems Modelling within Plant & Food Research. Brent is an Adjunct Professor in the Life Cycle Management Centre of Massey University. Brent has a BSc (Hons) from Canterbury University, and a PhD and DSc from Massey University. Brent is a Fellow of the Royal Society of New Zealand, the Soil Science Society of America and the American Geophysical Union. Brent has published over 200 papers on water in production systems, as well as on product footprints, environmental policy and natural capital valuation. Brent is Joint Editor-in-Chief of the international journal Agricultural Water Management.

Brian Hallinan

Brian Hallinan is Team Leader within the New Zealand Treasury's National Infrastructure Unit, responsible for the development and implementation of the 2011 National Infrastructure Plan. Brian has worked on a variety of topics in the Treasury over the last ten years, including Budget strategy and design, housing policy (home ownership and social housing), justice sector policy, Treasury's internal organisational strategy, and spent two years as Economic Advisor to the Minister of Transport.

Kate Miles

Kate Miles is a Principal Engineer in AECOM's Water group in Sydney, with nine years experience in water, construction and environment in both the public and private sector. She leads AECOM's Water Policy and Planning Team in NSW and is part of AECOM's Infrastructure Advisory Services Team.

Kate is an active member of the Australian Water Association (AWA), and is Co-convenor of the Water Management Law & Policy Specialist Network.

Kate was the lead author of Infrastructure Australia's Review of Regional Water Quality and Security, which advised the Australian Government on policy to address risks to water quality and security in country towns.

Tom Mollenkopf

Tom Mollenkopf is the Chief Executive of the Australian Water Association, a role he commenced in May 2007. Tom's experience covers many years in the water sector as well as in general industry and private professional practice.

Between 2005 and 2007 he was based in London where he has served as Deputy Executive Director of the International Water Association. From 1995 to 2005 Tom was an executive at South East Water in Melbourne, Australia.

Tom has a Masters of Business Administration from the University of Melbourne, Bachelor of Jurisprudence [with studies in Economics and Politics] and Bachelor of Laws from Monash University. He has served on many industry bodies including the NHMRC Water Quality Advisory Committee, as Chairman of the Water Industry Superannuation Fund and on the Board of Corporate Social Responsibility Australia.

Greg Pollock

Greg Pollock is a Director at Beca in the Planning business. He has 16 years experience in resource management, town planning and policy development. He has recently been seconded to the NIU in Treasury, where he was involved in developing the second version of the National Infrastructure Plan, which was launched in July 2011. Greg has particular experience in working with local authorities on land use planning, infrastructure projects and community engagement.

Alex Sundakov

Alex Sundakov is a leading economist in the Asia-Pacific region. He joined Castalia as Executive Director after a career spanning the New Zealand Treasury, the International Monetary Fund, and serving as a Director for the New Zealand Institute of Economic Research. Alex co-manages Castalia and leads many of Castalia's consulting assignments on competition and regulatory policy and transactions both in New Zealand and overseas.

He has worked extensively in the water and electricity sectors. He has led numerous projects in the water sector internationally. He provided regulatory and institutional advice to support private participation in Indonesia, the Philippines, and in the greater Baku area in Azerbaijan. For the New Zealand Government, he led a study on the current state of water infrastructure in New Zealand, and advised on sectoral investment planning, and improving governance to assist in sector development. Alex currently serves as a member of the New Zealand National Infrastructure Advisory Board, and is a member of the Infrastructure Partnerships Australia water and road sector taskforces.

Hon Fran Wilde QSO

Fran Wilde has held a number of leadership positions in business and politics. She is currently Chair of the Greater Wellington Regional Council and also chair of the Local Government New Zealand Regional Sector Group, which comprises of Chairs and CEOs of all regional councils in New Zealand. Fran is a company director and has her own consultancy business, Fran Wilde & Associates Ltd.

In politics Fran has been MP for Wellington Central, a Minister in the Labour Government of the 1980s and Mayor of Wellington. Business positions have included CEO of the New Zealand Trade Development Board and a number of chair and director roles in the private and public sectors.

Fran is active in the philanthropic and community sectors. She has an honorary doctorate from Victoria University of Wellington and is a Fellow of the NZIM.

Julian Williams, Tainui

Julian Williams is a Senior Advisor for his tribe with experience in resource management and a passion for strategic integration between Iwi, the Crown and the community. Julian majored in Resource and Environment Planning at the University of Waikato. Julian was involved in the development of the Waikato River Settlement and continues to advise the co-management arrangements of the Settlement through the implementation of Local Authority Joint Management Agreements and Accord agreements with Crown agencies and departments. ■

NEXT ISSUE OF *WATER*

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

The topics for the November issue will be **Water Quality, Diffuse Pollution, World Water Monitoring Day and Auckland Supercity – 12 months on.**

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 12 October 2011.

Become a Member of *Water New Zealand* Today

For a membership application form please contact: **Jan Lang**
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Team Aurecon Army doing the word challenge in Bay of Plenty

Oxfam Water Challenge 2012

Oxfam New Zealand

The Oxfam Water Challenge is up for a fourth year in 2012, continuing the successful collaboration with Beca and local councils. We are thrilled that the official launch of the 2012 Oxfam Water Challenge will be held at Oxfam's stand at the *Water New Zealand Annual Conference & Expo* in Rotorua, held over 9–11 November.

The Oxfam Water Challenge is a Top Town-style relay, where participants carry two 10-litre buckets of water on a fun and challenging beach relay course. The concept of the challenge serves to highlight the fact that in many developing countries, people have to carry 20 litres of water for hours for their families' basic needs.

The challenge is the organisation's key annual fundraiser specifically for water and sanitation projects in developing countries. Four team members compete in a beach relay, requiring strength, speed and skill to swim, run and strategise how best to bring home their 20 litres of water.

Challenge other teams in your organisation to enter and fundraise and each year the course changes, so even veterans can expect some surprises. It's a fantastic chance to build team spirit and do something that you know makes a big difference in the lives of people who don't have access to clean water. The Oxfam Water Challenge is also a great opportunity to network with other people from the water industry at the post-event function.

Events are timed to coincide with World Water Day every year. The 2012 Oxfam Water Challenges are planned for:

- Auckland, Saturday 17 March 2012
- Bay of Plenty, Sunday 18 March 2012
- Wellington, Saturday 24 March 2012
- Taranaki, Sunday 25 March 2012

Sign up your team at Oxfam's stand at the *Water New Zealand Annual Conference & Expo* and receive a special offer. You can also call 0800 400 666 or visit www.oxfam.org.nz/water to learn more. ■

"The concept of the challenge serves to highlight the fact that in many developing countries, people have to carry 20 litres of water for hours for their families' basic needs."

Government Proposes New Environmental Reporting Act

Environment Minister Nick Smith has released a discussion document, Measuring Up, seeking public feedback on a proposal for a new Environmental Reporting Act.

"We need to strengthen the integrity of New Zealand's clean, green brand by requiring independent and nationally consistent reporting on the state of our environment," Dr Smith said at an event in Wellington to mark the 25th Anniversary of the Parliamentary Commissioner for the Environment last month.

"We are the only OECD country not required by law to produce independent state of the environment reports, yet we more than any depend on our natural environment for so much of our wealth and economic success."

"We need to strengthen the integrity of New Zealand's clean, green brand by requiring independent and nationally consistent reporting on the state of our environment."

"We are proposing to make the Parliamentary Commissioner for the Environment responsible for independently reporting on the state of the environment every five years. It will report on important issues like water quality, air quality, coast and oceans management, waste and our native plants and animals. The proposals include amendments to the RMA to improve the consistency of environmental monitoring across regions for national reporting. This would enable the PCE to rank our lakes and rivers from the cleanest to the dirtiest and identify which are improving and which are deteriorating."

"This reform was recommended by the Land and Water Forum as part of improving New Zealand's fresh water management. Some regional councils monitor problem areas; others do on the basis of recreational usage or on a representative basis. This inconsistency enables some to minimise the problem and others to exaggerate them. Clear environmental reports will avoid wasting energy in a debate over data and help focus everyone on addressing the problem."

"This reform is part of the Government's bluegreen agenda to improve New Zealand's environmental institutions. Our first step was restructuring the Environment Ministry to bolster its policy capability. The second step was creating the Environmental Protection Authority. This third step is to strengthen the audit functions of the Parliamentary Commissioner for the Environment."

"This discussion document on the proposed Environmental Reporting Act is the public's chance to have a say on what a national-level environmental monitoring and reporting system for New Zealand should look like."

Measuring Up: Environmental Reporting – A Discussion Document is available at: http://www.mfe.govt.nz/publications/ser/measuring-up-environmental-reporting/index.html ■

$4 Million for High-Tech Mapping Programme

High-tech mapping of New Zealand's forests, pastures, rivers and cities will result from a research programme announced last month by Environment Minister Nick Smith and Science and Innovation Minister Wayne Mapp.

The Government will give $1 million a year over the next four years for the research which uses satellite technology, geospatial mapping techniques and advanced computing power.

"The four-year Land Cover Research Programme will provide vital information about our rural and urban environment for the natural resources sector, regional councils and research organisations to use," Dr Smith said.

"Using the best in modern technology, we can thoroughly map New Zealand's changing land use so we can quantify the pressures on water quality and biodiversity."

Dr Mapp said land cover research is moving forward and needs to apply the best in science and innovation for the sake of New Zealand's environmental and economic health.

"Up-to-date information about vegetation, water sources and the built environment is critical for the success of natural resource industries such as agriculture and forestry," Dr Mapp said.

The Land Cover Research Programme will build on the Ministry for the Environment's Land Use and Carbon Analysis System (LUCAS) developed to report New Zealand's carbon emissions to the United Nations.

The Land Cover Research Programme will be led by Crown Research Institute Landcare Research, with the involvement of the Ministry for the Environment, the Department of Conservation, the Ministry of Agriculture & Forestry and regional councils. ■

Recycled Plastic Helps Clean Rotorua Lakes

Using recycled plastic bottles to make floating wetlands is helping nature restore water quality in Rotorua's lakes, Minister for the Environment Nick Smith says.

Dr Smith was at Lake Rotoehu recently to launch a new 2800 square metre floating wetland made from 364,000 recycled plastic soft-drink bottles. The wetland is one initiative of the Rotorua Lakes Protection and Restoration Programme in which the Government has invested $72.1 million.

"Native plants are planted on floating islands of plastic bottles, which then form a new habitat for both the plants and wildlife. The roots of the plants reach into the water, removing nitrogen as the plants grow. Because the plants are naturally working to remove the nitrogen from the water, we are giving nature a hand to solve a man-made problem," Dr Smith said.

"The Bay of Plenty Regional Council and the Te Arawa Lakes Trust have successfully used floating wetlands on local lakes and are looking to extend their use. Nitrogen from intensifying land-use is one of the causes of the algal blooms that choke the waterways in and around the Rotorua lakes."

"As well as improving the quality of water in the lakes, the floating wetlands are also providing a habitat for wildlife such as native crayfish species like koura, and bird life."

"Using recycled plastic drinking bottles that may have otherwise ended up in landfill is in itself great for the environment, but to use them to help improve water quality and provide a habitat for local wildlife is a huge bonus." ■

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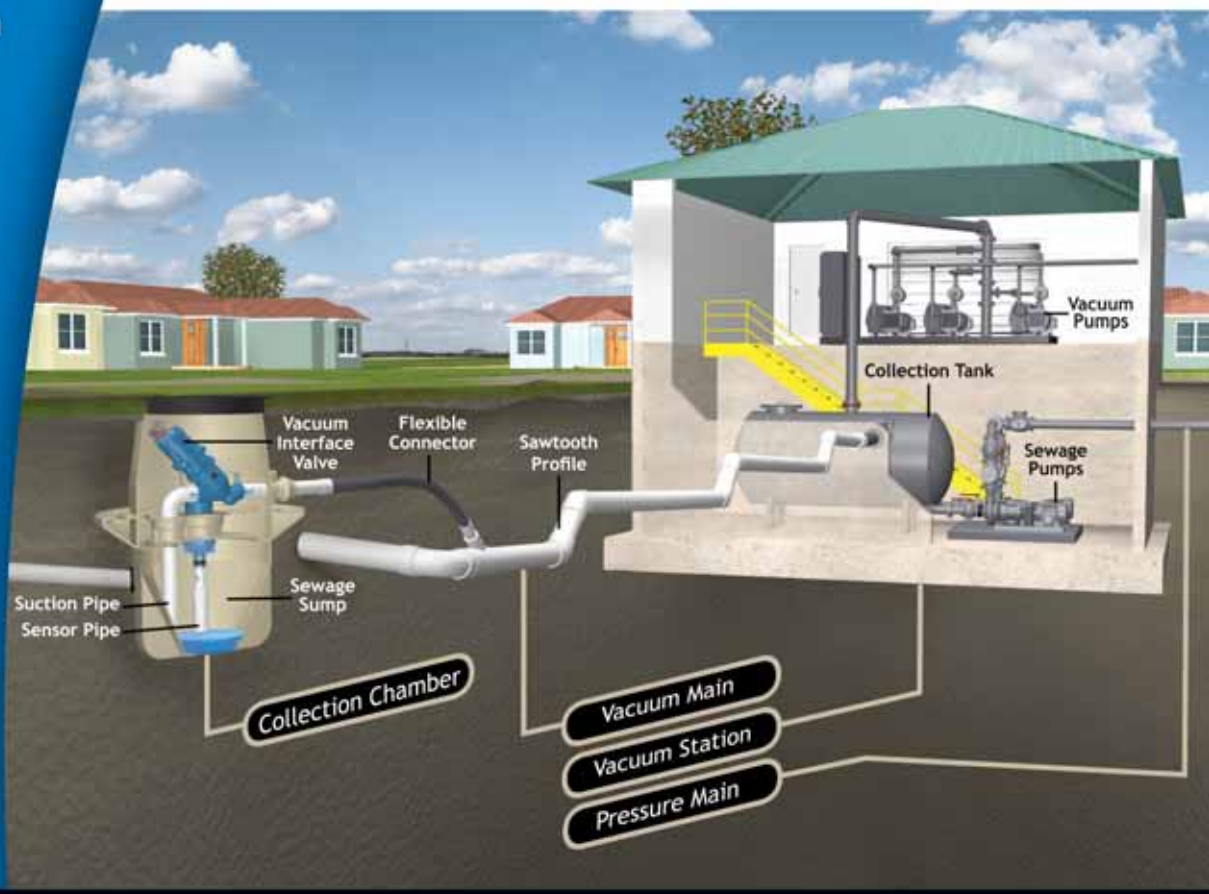

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The Future Framework for Water Infrastructure

Hon Rodney Hide – Minister of Local Government

Rodney Hide

The New Zealand economy relies on ready access to quality water for farming, manufacturing, tourism and a number of other uses. And quality drinking water is essential.

So we need enough water, we need the necessary infrastructure to get it to where it is needed and we need the water we receive to be of good quality.

Water management has been hampered in the past by a lack of nationally consistent financial and asset information. However, the 2010 amendments to the Local Government Act 2002 have addressed this through changes to the transparency and accountability of local government decision making and to the availability of financial management information.

Local authorities are now required to report on the actual and planned costs of urban water services and use a consistent set of performance measures so that service levels can be compared between communities.

In the productive water sector we need sufficient incentives for long-term investors in large water infrastructure projects – particularly in the rural irrigation and hydro-generation sectors.

Water quality is another area of concern.

Many streams, lakes and other aquifers are degrading because of diffuse discharges in urban and rural areas – for example the pollution from urban stormwater, animal effluent and fertiliser run-off.

Since the Resource Management Act 1991 came into force, we have made some progress in cleaning up point source pollution, but the Act has failed to deal with the issue of non-point source discharge.

The National Policy Statement requires regional councils to set limits on contaminants entering freshwater bodies, but to meet those limits we will need more sophisticated ways, than we currently have, to deal with diffuse discharges from both urban and rural land.

This is a challenge for the future and as meeting it will have national as well as regional and local benefits, we need to work together on it.

There are great opportunities. There is no doubt we can raise economic performance and lift New Zealand's gross domestic profit through better investment in water infrastructure.

For this to happen, central government needs a clear strategy for water management, including developing a clear policy position on the provision and role of infrastructure necessary to maximise its social, economic, environmental and cultural values.

We can promote sustainable water management through investigating options for better demand management practices in allocation, ownership and charging as well as longer term planning.

Councils have been reluctant to fully charge for the full costs of providing potable water services and this reluctance has led to an inefficient use of water and poor asset management.

The Local Government Act 2002 provides a great deal of flexibility in how local authorities recover the costs of providing water services. This flexibility enables communities and councils to decide what degree of cross-subsidisation, if any, is appropriate for the delivery of water services.

At present, a lack of information on asset condition, performance and levels of service does not allow a firm conclusion to be reached about whether a greater level of national direction is needed on how the real costs of water should be charged.

However, I am hopeful that the changes to the Local Government Act 2002 will address this issue.

Certainly metering provides for a fair distribution of the costs and benefits of sustainable water management.

Metering is already being used in varying ways by several different local authorities for urban supply. It can be a useful method for balancing good access to water with necessary allocation limits. Metering can encourage water conservation, better, more thoughtful use of water and overall better management of the resource.

An independent review of Tauranga City's decision to implement water metering showed net benefits to the City and its ratepayers of $53.3 million, mainly arising from deferring investment in new supply infrastructure of $40 million by ten years.

I would very much like to see central government and the local government sector working together to explore the possibilities of metering as a water management tool, at least for urban supply.

There have been other changes in the local government portfolio which should improve our management of water.

For example the Auckland governance reforms brought in a single dedicated council controlled organisation to deliver water services across Auckland.

> "Certainly metering provides for a fair distribution of the costs and benefits of sustainable water management."

Watercare Services has already achieved significant improvements in both the environmental and financial sector. For example they recently announced that from 1 July 2011, the price for 1,000 litres of water will be $1.30.

This represents a significant drop in price for all consumers, which has resulted from efficiencies generated since Watercare took over responsibility for service delivery from six previous councils and council subsidiaries. I believe this model has potential for other communities throughout New Zealand.

Another model that may achieve efficiency in water service delivery is the shared services model, which has been used by the Nelson City Council and Tasman District Council.

The Smarter Government, Stronger Communities review that is currently underway, will take a first principles look at the whole system and structure of local government in New Zealand. I envisage the review will include consideration of how the structure of local government can best be set up to ensure councils are able to maintain their infrastructure and deliver vital services such as water.

There is also a need to look for improvements to how we use and manage water resources currently allocated for irrigation use, including capital upgrades of existing irrigation scheme infrastructure, water harvesting, storage and distribution.

Again I am hopeful that the changes to the Local Government Act 2002 which provide for more consistent data gathering and reporting by local bodies will enable improvements in how we manage water in the productive sector.

Another change I made to the Act was to provide more flexibility around the public-private partnership model. The aim of these changes was to make it easier and simpler for local authorities to work with private companies to ensure they are providing quality services at the best possible price for their ratepayers.

One area where I see this has good possibilities is in water and its management.

I believe the Local Government Act reforms have widened the possibilities for local authorities in working with private companies and that it should increase the potential to improve management practices and get better value for public money.

In particular, I see this working in infrastructure – and the infrastructure for water services, including for water supply and wastewater.

The amendments also extend the period for which local authorities can enter into water contracts from 15 to 35 years to enable realistic timeframes for entering into long-term capital projects. This amendment was specifically intended to reopen the option of public-private partnerships in water services to local authorities.

The Wellington City Council already has a successful public-private partnership scheme for the treatment of sewage at Moa Point. Similar partnerships operate in many Australian communities as well. The amendments provide the opportunity for other councils to explore this model of service delivery.

Earlier this year the Government established a New Zealand Productivity Commission. It is loosely based on the Australian version and focuses on the 'framework' level – that is, helping the government to improve the laws, regulations, institutions and policy choices that guide and incentivise how individuals, businesses and other organisations make their decisions.

Currently the Commission is working on inquiries into housing affordability and international freight, but I noted with interest that the Australian Commission has recently released a report on urban water.

I would be interested to see if our Commission can provide some guidance on some of the key questions – including how we can effectively use the possibilities of public-private partnerships in water infrastructure to improve productivity.

I am not proposing that the Commission covers ground already covered by the Land and Water Forum, or that which will be covered in the next phases of the Fresh Start for Fresh Water reforms. However, I do think the Commission has a useful role to play as New Zealanders grapple with these important issues.

I think some of the actions which have been taken over recent years – such as the National Policy Statement on Freshwater Management, the analysis undertaken in the National Infrastructure Plan and the changes made to the Local Government Act are all an excellent start to managing our water resource in the future.

I am looking forward to seeing both the results from these initiatives and the ongoing work to manage our water resource, to ensure its ongoing availability and quality to support our population and our economic growth. ■

Industry Training Feeds Downer's 'Talent Pipeline'

Leeann Clark, Crew Essentials Manager for Downer NZ, says up-skilling employees through training has many benefits for the organisation and for its employees.

"Training means we have a skilled and qualified workforce and that our employees know what they're doing on the job and that they're doing it properly," she says.

Downer NZ is one of New Zealand's largest transportation, water, telecommunications and renewable energy infrastructure service providers. It has around 30 trainees with Water Industry Training at National Certificate and Diploma level in the wastewater, water treatment and reticulation sectors.

"Our training philosophy follows the '70–20–10 model'," Leeann says. "70 percent of training is on job, 20 percent is through mentoring with other more experienced employees and 10 percent is through formal training such as Water Industry Training's qualifications. However ITO qualifications feed into that 70 percent that occurs on the job.

Leeann says Downer NZ benefits from having trained employees in a number of ways.

"Obviously one benefit is that employees are trained to do their job effectively, not only meeting what we expect of them but also what our customers expect. Having qualified people helps us to secure new contracts as well."

"We're very stringent about health and safety in the workplace and what our employees learn through qualifications is part of that," Leeann says. "A supportive environment in the workplace encourages staff retention and creates opportunities for advancement. We have a talent pipeline we use – not only to hire the best people but to help those in the business up-skill and become the best they can be within Downer."

"A supportive environment in the workplace encourages staff retention and creates opportunities for advancement. We have a talent pipeline we use – not only to hire the best people but to help those in the business up-skill and become the best they can be within Downer."

"Succession planning is important," she says. "We make sure that as the workforce gets older we have younger people coming along, getting qualified and gaining experience."

Water Industry Training Manager Ashley Chisholm says that Water Industry Training and Downer have developed a good working relationship.

"Downer creates a positive learning environment and encourages productive discussion and informed decision making amongst their employees," he says. "At the end of their Water IT qualifications Downer's employees are well trained and more confident, knowledgeable and enthusiastic. They are ready to take responsibility and make a positive contribution to the business.

Leeann Clark

"Our training helps ensure businesses meet changing local authority and Ministry of Health requirements," Ashley adds. "This minimises risk because well trained employees are more accurate in the workplace, which reduces hazards and results in better quality work."

Leeann has found working with Water Industry Training to be a positive experience. "I talk to Marzanne (Krogmann, Customer Relationship Adviser) at Water Industry Training directly. Whenever I need anything she's onto it quickly – it's great to have a 'go to' person at the ITO to help you access the information you need."

"Water Industry Training has upped the game with regards to individual trainee support and that's nice to see. They've definitely come to the party." ■

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

Water Reforms

Helen Atkins – Partner & 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 overview of a new draft discussion paper released by the Human Rights Commission in relation to human rights and water. An overview of the reaction to the recently released National Policy Statement on Freshwater is then provided with a brief note on a recent change to the Water Metering Regulations. This is then followed by an outline of what the National Infrastructure Plan has in store for water. This article concludes with some comments regarding the Waitangi Tribunal's recommendations for reform of the Resource Management Act as part of the Wai 262 Claim Report.

Human Rights and Water

In July 2011, the Human Rights Commission released a draft paper for consultation entitled Human Rights and Water. The purpose of the paper is to "promote the human rights implications of water" to assist the government and the New Zealand community in balancing conflicting rights and interests in relation to the use of, access to and ownership of water.

The paper notes that the rationale for taking a human rights approach is two-fold – because it is the "right thing to do" and because it "leads to better and more sustainable human development outcomes."

While by international standards New Zealand ranks fairly highly in terms of abundance of renewable freshwater resources (fourth of out 30 OECD countries) and cleanliness of those resources (in the top 10 of the 30 OECD countries), there is growing concern about the sustainability of the current water allocation and management frameworks.

These concerns have been instrumental in driving the recent freshwater reforms. However, the Human Rights paper also identifies a further six key principles as being of relevance to taking a human rights approach to water in New Zealand. These are:

- Availability – sufficient quantities, reliability and continuity of supply
- Quality and safety – water not a threat to human health
- Affordability – accessibility to water at affordable price
- Acceptability – water and sanitation services to be culturally and socially acceptable
- Participation of citizens in water-related matters – participation in all aspects (planning, design, monitoring, maintenance), transparency and access to information
- Accountability – of the State to respect, protect and fulfil its responsibilities including access to effective judicial or other remedies

All of the above principles relate to both domestic and non-domestic (ie commercial) uses of water. However, in terms of the way that domestic and non-domestic uses are managed there are some differences.

For example, in terms of availability, the paper notes that there is now a requirement (contained in the Resource Management Measurement and Reporting of Water Takes 2010) to meter non-domestic takes over five litres per second. There is however currently no requirement for the metering of domestic water takes, even though there

"The difference in the way domestic and non-domestic water takes are managed is undoubtedly partly a reflection of the increased level of concern attaching to non-domestic takes."

is evidence to suggest that where such metering occurs takes are lower[1].

The difference in the way domestic and non-domestic water takes are managed is undoubtedly partly a reflection of the increased level of concern attaching to non-domestic takes. In particular, the paper notes that there are increasing community and cultural concerns with non-domestic takes[2]:

"As more commercial water users secure property rights to water which the wider community regards as "free", that community has little prospect of any direct returns from the freshwater resources that are being used to generate commercial gain. While the Resource Management Act allows water to be taken and used for up to 35 years, nothing is paid for the commercial use of the water resource. This has Treaty of Waitangi/Te Tiriti o Waitangi implications and impacts on economic, cultural and social rights, among others."

While internationally New Zealand compares well in terms of water quality (second highest in the 2010 Environmental Performance Index of 163 countries), nationally there are increasing concerns about the deterioration of the freshwater resources[3]:

"There is rising industry, agency and public concern about the deterioration of the worst-affected waterways and increased nitrate pollution levels per litre of water. Worsening pollution is evident in the latest report on the Dairying and Clean Streams Accord. It shows that full compliance rates with effluent disposal requirements is at 65 per cent and the level of "significant non compliance" nationally is up to 16 per cent."

The Government as the representative of the State has recently announced a series of freshwater reforms the first step of which was the introduction of the National Policy Statement for Freshwater (Freshwater NPS). Comments on this statement are discussed in the next section.

The submission period for this paper closed on 15 August 2011 and the Commission hopes to publish the paper in final form by the end of August 2011.

Freshwater NPS

As we noted in our last article, the Freshwater NPS was notified in early May and came into force on 1 July 2011. Reactions to the Freshwater NPS have been mixed. While most commentators have welcomed the enactment of the Freshwater NPS as a first step in providing national guidance for freshwater management, there are concerns that the resulting Freshwater NPS lacks teeth and does not go far enough. Some key criticisms include that:

- The Freshwater NPS has been "gutted by the Cabinet – which added 19 changes, most of them allowing continued agribusiness expansion at the environment's expense"[4]
- The compliance period (of up to 2030) is too long and will allow the quality of lakes and rivers will continue to decline during that period[5]
- The requirement to protect the overall quality of freshwater within a region is too broad and will allow an offsetting approach ie further degradation of some water bodies will be allowed provided others are improved[6]
- The NPS does not provide national guidance on the way in which water

quality standards should be set and leaves the methodology largely to the discretion of Regional Councils[7]

The Cawthron Report[8], which was commissioned by Fish & Game on the implications of the Freshwater NPS, put it thus:

"The lack of national standards that apply to all water bodies and the likely long period for implementation, combined with new subsidies for irrigation schemes that are likely to result in further intensification of land use, suggest that despite the NPS the condition of New Zealand's lakes, rivers and wetlands is likely to continue to decline for several more years and possibly longer."

In response to questions in Parliament about these criticisms Hon Dr Wayne Mapp on behalf of the Minister for the Environment recently stated[9]:

"The [Cawthron] report makes the incorrect assumption that regional councils will be too slow in acting on the new national policy statement to improve water quality. The experience last month since the national policy statement took effect is that regional councils are taking the requirement to step up their management of freshwater very seriously..."

"Cabinet took a balanced approach to this [NPS]. It balanced, obviously the need to improve water quality with the need to improve growth."

Given this response, it would seem that the Freshwater NPS in its current form is here to stay (at least for now) and the focus must now be on how the NPS is given effect to by regional councils.

Water Measurement Regulations

We noted earlier in this article that the Resource Management Measurement and Reporting of Water Takes 2010 requires the measurement of non-domestic takes of water over five litres per second. These regulations have recently been amended to expand the transitional provisions (set out in regulation 13) to also apply to renewal and replacement consents[10]. Previously, such consents were treated similar to 'new' consents and immediate compliance was required. This change came into effect as of 24 June 2011.

> "The Plan also notes some strategic opportunities for improving both urban and productive water infrastructure for example in relation to water harvesting, storage and distribution. Clearly, there is a busy time ahead for the water sector!"

National Infrastructure Plan 2011

The National Infrastructure Plan 2011 covers a 20 year timeframe and sets out a vision, principles and a directional programme of work for that period. The work is to be led by the National Infrastructure Unit but will involve a range of agencies.

In terms of water, the vision is that water infrastructure will "contribute to healthy and safe communities, promote the social, economic, environmental and cultural well-being of those communities, and will provide a competitive advantage for New Zealand's primary producers and industry."

There are a number of goals for water infrastructure, including efficient development and operation, better alignment of central

and local government interests with funding and accountability, win-win outcomes for the community and industry in terms of projects, a consistent set of performance measures, a range of measures are used to maximise water benefits, and better integration of land and water management including views of iwi and other stakeholders.

In terms of the work to be done, the Plan states:

"Of all the sectors analysed in this Plan, the management regulatory settings and governance relating to water infrastructure will require the most attention in the next three years. This work will allow the next version of the Plan to set out a sustainable approach to water infrastructure management into the future."

The work programme notes the Freshwater NPS and Water Measurement Regulations already in force as well as indicating the following work which is yet to be undertaken/completed:

- Regulations under the Local Government Act 2002 in relation to financial reporting
- Funding for drinking water subsidies to assist local authorities achieve minimum water quality standards
- A review of the 2007 amendments to the Health Act 1956
- Funding for the Irrigation Acceleration Fund to support the development of irrigation infrastructure

The Plan also notes some strategic opportunities for improving both urban and productive water infrastructure for example in relation to water harvesting, storage and distribution. Clearly, there is a busy time ahead for the water sector!

WAI 262 – Recommendations for Reform of RMA

On 2 July 2011, the Waitangi Tribunal released its report on the Wai 262 claim relating to New Zealand's law and policy affecting Maori culture and identity[11].

Ko Aotearoa Tenei ('This is Aotearoa' or 'This is New Zealand') is the Tribunal's first whole-of-government report, addressing the work of around 20 government departments and agencies and Crown entities.

It is also the first Tribunal report to consider what the Treaty relationship might become after historical grievances are settled, and how that relationship might be shaped by changes in New Zealand's demographic makeup over the coming decades.

The report concerns one of the most complex and far-reaching claims ever to come before the Waitangi Tribunal. The Wai 262 claim is commonly known as the indigenous flora and fauna and cultural and intellectual property claim. As the report's preface puts it:

"The Wai 262 claim is really a claim about matauranga Maori – that is, the unique Maori way of viewing the world, encompassing both traditional knowledge and culture. The claimants, in other words, are seeking to preserve their culture and identity, and the relationships that culture and identity derive from."

The key comments recommendations in the resource management area made by the Tribunal are:

- They acknowledge that Maori interests and kaitiaki relationships are important, but this does not mean that iwi and hapu should have a generally applicable veto as there are a number of other interests should also be considered.
- They found that the RMA provides a mechanism for balancing competing interests in the environment. But the Act, and the way it has been implemented, only very rarely support kaitiaki control or partnership in relation to taonga.
- The RMA delegates most decision-making to local authorities. They rarely delegate decision-making powers to iwi.
- The RMA allows iwi to set out their resource management priorities in so-called 'iwi management plans', but in practice these have little influence over local authority decision-making.
- They found that, for the RMA regime to more effectively support kaitiaki relationships, engagement between tangata whenua and local authorities needed to become compulsory, formal and proactive.

The Tribunal also recommended:

- Changes to existing RMA provisions to remove unnecessary obstacles to the delegation of decision-making powers to, and establishment of partnerships with, iwi.
- Greater use of national policy statements to guide local authorities over the involvement of Maori in decision-making.

The Government is considering its response and this is expected to take some time. ■

Footnotes

1 Human Rights Commission, Human Rights and Water – Draft Paper for Consultation, July 2011, at page 16.

2 Ibid at page 12.

3 Refer note 1, at page 13.

4 New Zealand Labour Party Press Release, Brendan Burns, Associate Spokesperson for the Environment, 1 July 2011.

5 Sinner J 2011. Implications of the National Policy Statement on Freshwater Management. Prepared for Fish & Game New Zealand. Cawthron Report No. 1965. 10 p plus appendix, at page 1.

6 Refer note 5, at page 7.

7 Refer note 1, at page 23.

8 Refer note 5, at page 9.

9 Questions and Answers in Parliament, 2 August 2011 available from http://parliamenttoday.co.nz/2011/08/questions-and-answers-august-2/.

10 Refer Gazette Notice 4136 dated 23 June 2011.

11 For a link to the full report see http://www.waitangi-tribunal.govt.nz/scripts/reports/reports/262/F0461D82-FC25-42BA-BEB4-0DC9857FA909.pdf

By Understanding the Microorganisms in Wastewater Treatment Processes We Can Design Better Systems

Clark Ehlers and Susan Turner – Centre for Microbial Innovation, School of Biological Science, The University of Auckland

All modern wastewater treatment processes include a biological treatment step that capitalises on the degradation and breakdown processes of naturally-occurring microorganisms. Though this is a simple concept, the reality is that microbes can behave as mysterious wild beasts that are easily perturbed and often prone to feral acts of unpredictability.

The art of engineering design is in the creation of an environment that provides a level of control over the microbial community and enables optimal use of its functional properties. This requires, in the first instance, some fundamental understanding of useful microbial properties and growth characteristics. Existing design and engineering approaches already incorporate knowledge of how wastewater bacteria function, for example, to convert nitrogen species into N_2 gas or attach to solid surfaces to form layers as a biofilm.

Increasingly, there is recognition amongst the engineering fraternity that in order to improve wastewater treatment operation and develop new technologies, a deeper level of understanding of microbial processes is needed. Where wastewater process designs have primarily focused on the retention of biomass in reactors in order to develop stable treatment efficiency, the opportunity now exists to incorporate what research is telling us about the occurrence and behaviour of microbes from studies of both simulated laboratory and natural environments.

Though practical applications may seem a distant promise for research that is focused on deciphering the genetic make-up of a single bacterium, it is expected that with greater degrees of insight into microbial processes, enhanced process control can be exerted over a treatment system. Moreover, further advances in design will be made as new microbial-mediated processes are discovered and elucidated in the laboratory. Here we offer some insights into current research that may serve to underpin wastewater treatment designs of the future.

A laboratory reactor system used grow activated sludge micro-organisms in to simulate wastewater treatment processes in order to better understand treatment performance factors. This can aid in the development of new and improved wastewater treatment designs.

Wastewater treatment reactors are tailored to perform particular functions depending on the nature and constituents of the influent and the desired end products of the process. Therefore, if a wastewater reactor has to treat a wastewater with a high BOD load, process performance will depend on the retention of the microbial biomass, for example, as biofilms or flocs, as this is regarded as the primary design consideration. However, biomass retention is but one factor that will influence the reliability and efficiency of processes that can treat high-strength wastewaters.

Although numerous studies have considered the impact of complex waste streams on microbial populations, new studies are looking into the mechanistic responses of microbes that drive key performance factors such as floc formation. These chemical and physical processes are steered by microbial metabolic functions and by investigating process performance factors on a microscale, bottlenecks in process optimisation can be identified and remedied. There is still a gap in scientific literature on the relationships between floc settling characteristics, floc size distribution (ie, treatment performance) and operational parameters such as influent wastewater strength (BOD, COD & varying nutrient conditions).

Applied studies in our laboratory in the Centre for Microbial Innovation at the University of Auckland are investigating these performance factors in the context of activated sludge using different lab-scale reactor configurations.

These reactor studies have shown that there is a strong relationship between nutritional conditions and activated sludge bacterial aggregation properties in different reactors which include continuous stirred tank (CSTR) and sequencing batch (SBR) configurations. Bacterial aggregation is a factor that supports the settling of biomass which is co-driven by extracellular polymer or EPS production and bacterial surface properties during flocculation processes. An inverse correlation between food to microorganism (F/M) ratio and EPS levels was obtained in a number of reactor studies. This coincided with enhanced aggregation when nutrient levels became depleted and the bacteria responded to famine conditions by producing more EPS.

The complexity and strength of influent wastewaters impacted the quantities of EPS that were produced in these reactors in addition to the settleability of the biomass. It also contributed to shifts in the size of the flocs that developed during the operation of the reactors and was also shown to be dependent on reactor configuration. Sequencing batch reactors for example showed larger flocs compared to CSTR irrespective of the return of settled sludge to the reactor as RAS or not. This coincided with excellent nutrient removal efficiency in the SBRs.

These studies have signaled the possibility of developing strategies for improved solid-liquid separation in the event of influent nutrient varying conditions. This could be a consequence of seasonal fluctuations or, in the case of an onsite system that treats industrial or agricultural effluents such as dairy processing wastewaters, due

"We have also begun to see that what we do or do not do about our freshwater in New Zealand impacts both on our standard of living and our quality of life, on the economy and the environment. One way of thinking about this point is in terms of our brand, which is based on a promise about the environment but is important not only for tourism but also increasingly for the perception – and reception – of our primary exports abroad."

to cleaning-in-place (CIP) processes. Improved separation could be attained by configuring a reactor that incorporates early detection of polymer accumulation. The response could be the automated augmentation of the reactor with an auxiliary carbon source to reduce EPS production and avoid poor settling.

The future of reactor design and configuration will also greatly benefit from studies on model microorganisms that are found in, for example, activated sludge communities. These model microbes can help us to understand important metabolic and mechanistic functionalities of communities in wastewater treatment processes. One such model microorganism (Acidovorax), which is typically found in activated sludge reactors, has shown great promise in elucidating the biological process that underpins bacterial aggregation.

Extensive investigation into the aggregation capacities and growth traits of this bacterium indicate that aggregation is a transient phenomenon mediated by varying nutrient conditions and bacterial cell concentrations. This understanding may aid in remedying poorly settled sludge by designing a system that detects changing nutrient conditions that are biologically relevant. As discussed above, process improvements may be achieved by incorporating a strategy whereby nutrient conditions can be artificially altered and that could cue microbial communities to aggregate.

The biological basis for treatment performance factors such as settleability and floc formation ultimately depends on the genetic material and the switching on or off of particular genes of wastewater microbes. Development of improved systems will ultimately depend on the application of new and emerging tools that can detect metabolic processes on molecular and microscales. Tools that allow us to study bacterial behavior on a molecular level will provide greater insight into how divergent groups of microorganisms interact and shape floc or biofilm formation in reactors. Coupled with a better understanding of microbial community dynamics this knowledge may be advantageous in defining treatment system design parameters that select for a particular microbial community.

The suite of new molecular and modelling tools can also augment our assessment of treatment performance which is currently measured using analyses such as BOD or COD removal, pH,

dissolved oxygen and nutrient levels. Increasingly, the molecular tools or microsensors that are applied in biomedical biofilm research are proving useful in wastewater research. These tools include molecular strategies such as fluorescent in-situ hybridisation (FISH) and quantitative real-time PCR that enable the tracking of specific bacterial groups that could be beneficial in trouble-shooting process performance. These diagnostic tools may also play pivotal roles in the development of strategies for improved performance control by developing linkages between metabolic functions and microbial community dynamics.

The insight into how process performances can be enhanced by evaluating bacterial community structures and metabolic functions has played out in the development of hybrid systems that combine suspended and fixed film reactors. By providing support media either as attached surfaces or in suspension, as in integrated fixed-film activated sludge reactors or hybrid moving bed biofilm reactors (MBBR), the system capitalises on the metabolic capabilities of different groups of microorganisms (those that grow in suspension and as biofilms).

A current study in our laboratory investigates the community composition and dynamics in two full-scale MBBR systems in central New Zealand. Results to-date indicate that there are differences between the microbial communities in these biofilm-based reactors when compared to conventional activated sludge floc-based systems. This raises the question of whether symbiotic associations in biofilm communities can be further exploited for enhanced process performance. This study may also provide for a greater degree of understanding in how process design can be tailored to support the development of those microbial communities and their beneficial metabolic pathways.

One particularly relevant example that shows the potential wealth that lies within uncovering novel and potentially beneficial metabolic pathways is the discovery of anaerobic ammonium oxidation or the anammox pathway (ANAMMOX®). This has led to the design of a wastewater process that benefitted from the use of molecular tools and capitalised on a naturally-occurring valuable nitrogen removal pathway. The application of quantitative real-time PCR and FISH analyses revealed the co-existence of ammonia oxidising bacteria and anammox bacteria and led to the development of community structures and spatial organisational models. These results had a downstream impact in that a reactor could be designed that facilitated optimum nitrogen removal in a single-stage autotrophic process.

Today there are pilot scale reactor systems that exploit the close metabolic relationship that exists between the two groups of bacteria by providing particular niches for them to establish themselves and create microenvironments that integrate their metabolic pathways. This has evolved into an innovative biological treatment process that holds excellent prospects for domestic but also industrial wastewater treatment.

In summary, new molecular tools and research strategies can provide insight into metabolic process within complex and dynamic microbial communities. Whether the research occurs on a molecular scale, or is more applications driven through simulations of wastewater processes in the laboratory, the ultimate outcome is a better understanding of microbial processes. With this knowledge comes the ability to harness the microbial beasts of wastewater treatment through novel reactor design and process control. ■

Allanton Wastewater Scheme

Peter Evans – Senior Civil Engineer, Harrison Grierson Consultants and Janan Theiva – Civil Project Manager, Dunedin City Council

Introduction

The Dunedin City Council successfully commissioned the Allanton Pressure Sewer Wastewater Scheme in July 2011, on time, under budget and to the delight of the local community which, for many years, has had to contend with the consequences of poorly performing onsite disposal systems.

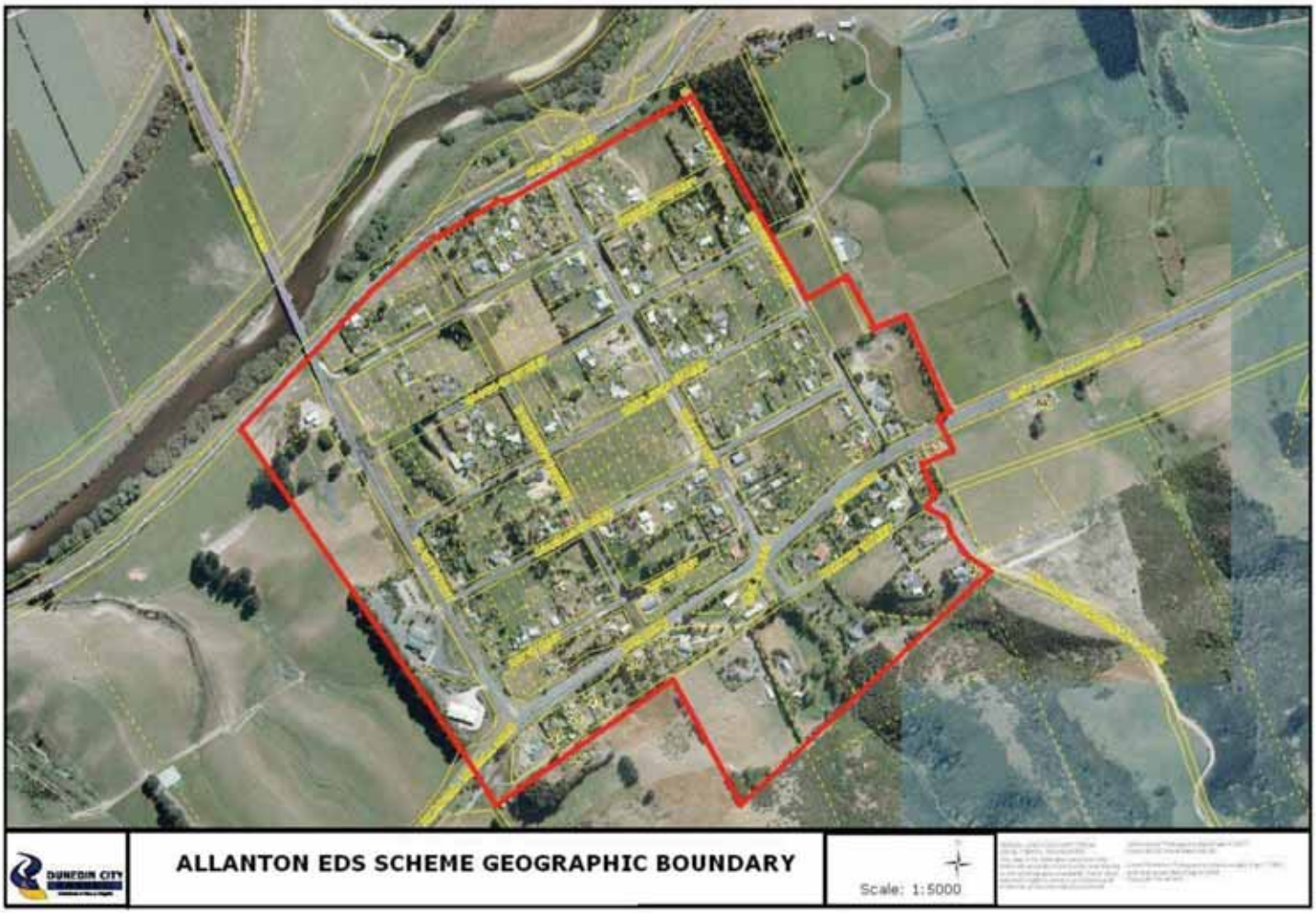
Dunedin is the largest city in New Zealand, by geographical area, and has several communities still using very basic onsite disposal systems or septic tanks. The decision to adopt a pressure sewer system for the Allanton community was a first for the Council that was initially met with some scepticism in some quarters, but has now set the benchmark for future schemes in the wider city.

Allanton is situated 20km southwest of Dunedin, towards Dunedin International Airport and, consists of a total of 257 properties, of which 115 are currently developed including a primary school, community hall and engineering workshops.

"The town of Allanton has a number of features that required specific consideration during design. While the town generally has fall from South to North the local topography also undulates. This would have made servicing the town with a conventional gravity system problematic. A pressure sewer system is well suited to this type of topography, however careful consideration of air relief and scour locations is required to ensure the system operates with maximum reliability."

Allanton EDS Scheme Geographic Boundary

Prior to the scheme the community did not have a reticulated sewage system, instead relying on individual septic tanks with disposal fields located within the property boundaries. Septic tanks with their associated effluent seepage disposal field are a well-established method for onsite management of household sewage, providing the circumstances are suitable. Onsite management of sewage in Allanton is not technically feasible as a sustainable treatment and disposal option because the ground conditions do not allow adequate drainage of the septic tank effluent on the average sized



plot. The soils are relatively thin with a clay layer underneath and do not allow for adequate treatment or soakage of the effluent discharged from the septic tanks. These short comings cannot be overcome by improvements in the septic tank arrangement or the effluent disposal fields, due to the nature of the underlying land.

The Dunedin City Council prepared its Water and Sanitary Services Assessment (WSSA) in June 2006. Key issues and actions in the WSSA that triggered the need for improvements in Allanton included:

- Some of the existing septic tank systems in Allanton were failing and contaminating watercourses and roadside ditches. The situation was exacerbated by sections being undersized for adequate sewerage disposal and lack of soakage capacity in the ground
- Elevated levels of faecal coliform were detected in the Taieri River downstream of Allanton, with levels (at very low river flows) sometimes above contact recreation standards. The elevated levels were related to septic tank system discharges
- Requiring individual property owners to improve or replace their septic tank systems would not have mitigated all of the problems and in most cases, would have been uneconomic

As a step towards addressing these concerns identified in the WSSA and to ensure that sewage in Allanton was managed in a way that protected human health, minimised adverse environmental effects and complied with regulatory requirements, the Council allocated funding over a two year period from 2009/10 to 2010/11 with a total budget of $4,367,000.

Professional Service

The Council considered several options during the feasibility stage, including constructing a small bore Effluent Disposal System (EDS) to collect wastewater from properties from Allanton. Engineering consultants were invited to submit a proposal to design and supervise construction of an EDS system or to propose an alternative design. The proposals were to include an estimate for whole of life costs for the proposed design.

In accordance with the Request for Proposal (RFP) for Engineering Consultancy Services for the Allanton Wastewater Scheme, the shortlisted tenderers were evaluated based on the information provided in response to the RFP, tender clarification and presentation at an interview against the following attributes with weightings as shown below in Table 1.

Table 1

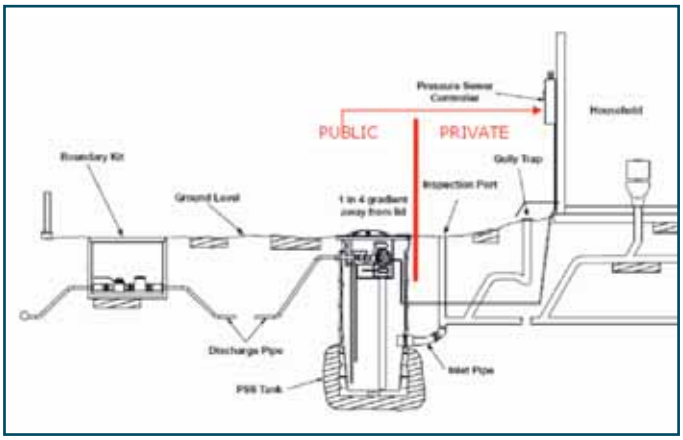
Attributes	Weighting (%)
Cultural	10
Social	10
Environmental	10
Economic	10
Track Record / Experience / Innovation	6
Project Specific Staff Experience	6
Project Team / Management	6
Methodology / Expertise in Contractor Procurement	6
Programme	6
Professional Services Fee / Total Project Cost	30
Total Score	**100**

The proposed Pressure Sewer System (PSS) submitted by Harrison Grierson Consultants Ltd was further evaluated including carrying out a project risk analysis between EDS and PSS based on design, construction, infiltration, inflow and overflow. The Council decided on a PSS following consultation with the Allanton community. Further, the Council decided on a traditional ownership structure where the Council owns and operates the entire collection system including the pump units installed within private property.

Pressure Sewer System Overview

In a typical pressure sewer system grinder pumps are installed at each property. The grinder pumps are installed in pump chambers that provide for both operating and emergency storage. The pump chambers are typically located close to both the house and the existing septic tanks. This reduces the required length of power and control cables and household drainage works. The cost of the power consumed by the pump and control panel at each property is typically less than $20/annum. In the event of a power outage or planned maintenance the chambers provide storage for a set period (usually approximately 24hrs) above the pump start level. A control panel at each property controls the operation of each pump, provides an alarm in the case of pump fault or failure and aides diagnosing of faults. Isolation and non-return valves are installed at each property to allow for planned maintenance.

Because grinder pumps are used, the size of the piped reticulation on each street is minimised. Pressure mains within Allanton vary from 40OD to 110OD. The depth of the sewer mains in a pressure sewer system is much reduced when compared to the depth of a conventional gravity system as there is no need to provide constant fall. As with a conventional rising main, air valves are required to



Typical household pressure sewer installation

provide relief at localised high points and scour valves are required to allow draining of the lines at low points for maintenance operations. Similar to a water supply network isolation, valves are installed at any location where a branch connects into a main. In addition, flushing points are installed at the terminal end of each local branch and at intervals on the sewer mains. These points are necessary because the mains will be sized contingent on development. As a result, in the initial stages of a project cleansing velocities may not be met and periodic flushing may be required to maintain the pipe capacity.

Pipe Sizing

Within a pressure sewer system the reticulation is zoned, with each zone connecting into a downstream zone. Loops in the reticulation are avoided as this would create uncertainty about flow direction and distribution. For the Allanton project a total of 44 zones were considered. There are a number of pumps within each zone and pumps in zones upstream of each zone that pump through. The reticulation is sized based on the number of pumps connected to each zone and the maximum number of pumps assumed to be operating within the zone simultaneously (determined by previous project data). In the case of Allanton the reticulation was sized based on various scenarios including the connection of the initial 115 already developed properties and the ultimate development within the township. Over time the pipes within the network can be subject to slime build-up. So the reticulation size was checked with a number of pipe roughness coefficients (Hazen-Williams C) assumed. The final reticulation size within the town represents a compromise between retention times, cleansing velocities and pump head requirements.

Site Specific Features

The town of Allanton has a number of features that required specific consideration during design. While the town generally has fall from South to North the local topography also undulates. This would have made servicing the town with a conventional gravity system problematic. A pressure sewer system is well suited to this type of topography, however careful consideration of air relief and scour locations is required to ensure the system operates with maximum reliability. A number of low lying areas within the town are also prone to periodic flooding.

A local school within Allanton is serviced by the system and a dual pump unit was specified to cope with the expected flows.

Wastewater treatment for the pressure sewer system is provided by the Mosgiel Wastewater Treatment Plant. The rising main from

Allanton to the treatment plant is approximately 8.5km long. As a result careful consideration had to be given to retention times to avoid septicity and odour control issues. Reduced rising main size affects retention time but at the same time increases velocities and pump head requirements. Self cleansing velocities also required consideration. Balancing these issues led to the selection of a 125OD rising main. The rising main route crosses the South Island Main Trunk railway line and two road bridges. The length of trenching or directional drilling for the rising main was significantly reduced by slip lining a 3km stretch of existing disused 600NB outfall pipeline that ran from the treatment plant to the Taieri River.

Pressure Sewer System Construction

Within a developed catchment one of the first considerations of any utilities construction project is disruption to residents and the need for reinstatement. One of the benefits of a pressure sewer system is reduced reticulation diameters and depths when compared to a traditional gravity sewer system. Because of this reduced reticulation footprint, tenderers were given the option of constructing the system by either directional drilling/trenchless techniques or a more conventional trenching methodology. Construction of the Allanton wastewater mains generally used trenchless techniques with the exception of a handful of locations where trenching was more practical.

Within each property to be connected to the scheme the proposed 40OD household main was installed by either trenching or directional drilling. A hole was excavated for the pump chamber and the chamber was installed. Mass concrete was installed around the base of each chamber to prevent flotation due to the high water table. Much of the construction footprint within each property resulted from the need to decommission existing septic tanks. If not correctly decommissioned by appropriate removal, demolition or filling, the septic tanks represent a potential public health and safety hazard.

A control panel for the pump at each property was installed either on a post or attached to an existing structure and connected to the household switchboard. For smooth operation of the system both an adequate household power supply and a suitable network supply are required. Prior to the commencement of works a household power supply investigation was carried out to determine if any upgrades were required.

Once the pump chambers were installed and tested household drainage connections could be made. The existing household drainage was intercepted and connected into the pump chambers. One of the benefits of a pressure sewer system is a substantial reduction in infiltration due to sealed mains and chambers. This in

"One of the benefits of a pressure sewer system is reduced reticulation diameters and depths when compared to a traditional gravity sewer system."

turn provides a significant reduction in the volume of wastewater requiring treatment. However care must be taken when connections are made to avoid connecting sources of stormwater such as downpipes and rainwater tank overflows. Connection of grey-water systems within the properties must also be considered when making connections and may require specific investigation.

Once construction was completed within a private property or public reserve, reinstatement commenced. As with most reticulation projects the bulk of reinstatement was ground levelling, filling, grassing or other surface reinstatement.

Costs

The total project cost was $3,015,000 including consultancy and capital works, well below the budget of $4,367,000 allocated by the Council. The per property installation cost for connection to the scheme, including the pump unit, storage tank, control panel and discharge pipes up to the boundary kit was $10,565 per property (excl GST). This included decommissioning of existing drainage and septic tanks, drainage consent and complete reinstatement.

The network cost is shared by the total of 257 properties that will ultimately be served by the scheme and this amounts to $7,000 (excl GST) per property. In accordance with the Council's New Reticulated Services Policy, the existing 115 developed properties contributed 20% of the total cost per property or $3,513 (excl GST). Connection to the scheme will be compulsory for future development within Allanton and will be on the basis of a 100% developer contribution.

Conclusion

For the town of Allanton a pressure sewer system provided a very cost effective alternative to the more conventional gravity sewer reticulation system. In addition to the lower project cost the pressure sewer system has had a number of other benefits including:

- Reduced exfiltration. A pressure sewer system will typically have a much lower rate of exfiltration than a conventional gravity system. Leak detection is also made easier. Coupled with the decommissioning of the existing septic tanks this is likely to have public health and environmental benefits within the town.
- Reduced infiltration and volumes of sewage for treatment. Over time this can have significant cost benefits to Council as plant upgrades can be deferred or avoided.
- Low upfront costs. Unlike a gravity system where all of the costs are incurred up front the grinder pump costs are incurred only as properties are connected.
- Reduced construction footprint and disruption to residents. As a result of the reduction of main sizes and depths and a reduced need for manholes/chambers. As the pressure sewer mains are not required to be installed at grade the feasibility of trenchless techniques is also increased.

For the reasons discussed above, pressure sewer systems should be considered when assessing sewer reticulation options for towns geographically separated from the existing reticulated wastewater network and treatment infrastructure. In the case of Allanton a positive outcome has been achieved for all project stakeholders. ■

Miraka Limited wastewater treatment plant

New Dissolved Air Flotation Design Benefits Miraka Dairy

Dr Matt Savage – Managing Director, Apex Environmental Ltd

Recent advances in the design of Dissolved Air Flotation (DAF) systems have led to significant improvements in their performance, robustness and capacity. Apex Environmental recently completed the design and build of such a system for the Miraka dairy factory near Taupo. This project was managed by Auckland firm SKL8 Limited who, from previous work with Apex, recognised both the benefit of the design and build approach and the value for money offered by this solution.

Miraka Limited is a collaborative effort between a group of Maori trusts and incorporations that place a high value on Kaitiakitanga – guardianship of the environment that supports us. The flotation process has been around since the late 1800s when oil and other low density compounds were used to separate minerals by floating them off from an aqueous phase in a froth. More recently, the process has been developed to use high pressure to dissolve excess air into water, which when released to atmospheric pressure, nucleates on suspended solid, oil and grease particles causing them to float to the top of the collection chamber.

In this, the principle of operation is not dissimilar to the effect of shaking a bottle of beer (to dissolve and disperse carbon dioxide throughout the contents under high pressure) and then opening the lid to release the contents to atmospheric pressure. This causes the dissolved gas to nucleate and rapidly rise to the surface (and typically out the spout of the bottle). In the DAF process, the tendency of the bubbles to form attached to any suspended solids or fat globules is used to carry these to the surface along with the bubbles.

"By using a solids-handling whitewater pump, it becomes possible to pressurise the full flow of untreated water into the DAF and super-saturate it with air. While this produces a very high level of treatment once the pressure is released, it also uses more power than the traditional recycle method where only a portion of the flow is pumped to high pressure."

Sludge removal and treated water discharge from the DAF

A key advantage of the DAF process over gravity clarifiers and decanter centrifuges, is that it can process a high hydraulic loading in a compact space, whilst providing a high level of solids and grease removal.

In the dairy industry, acid is added to the wastewater prior to flotation in order to promote precipitation and coagulation

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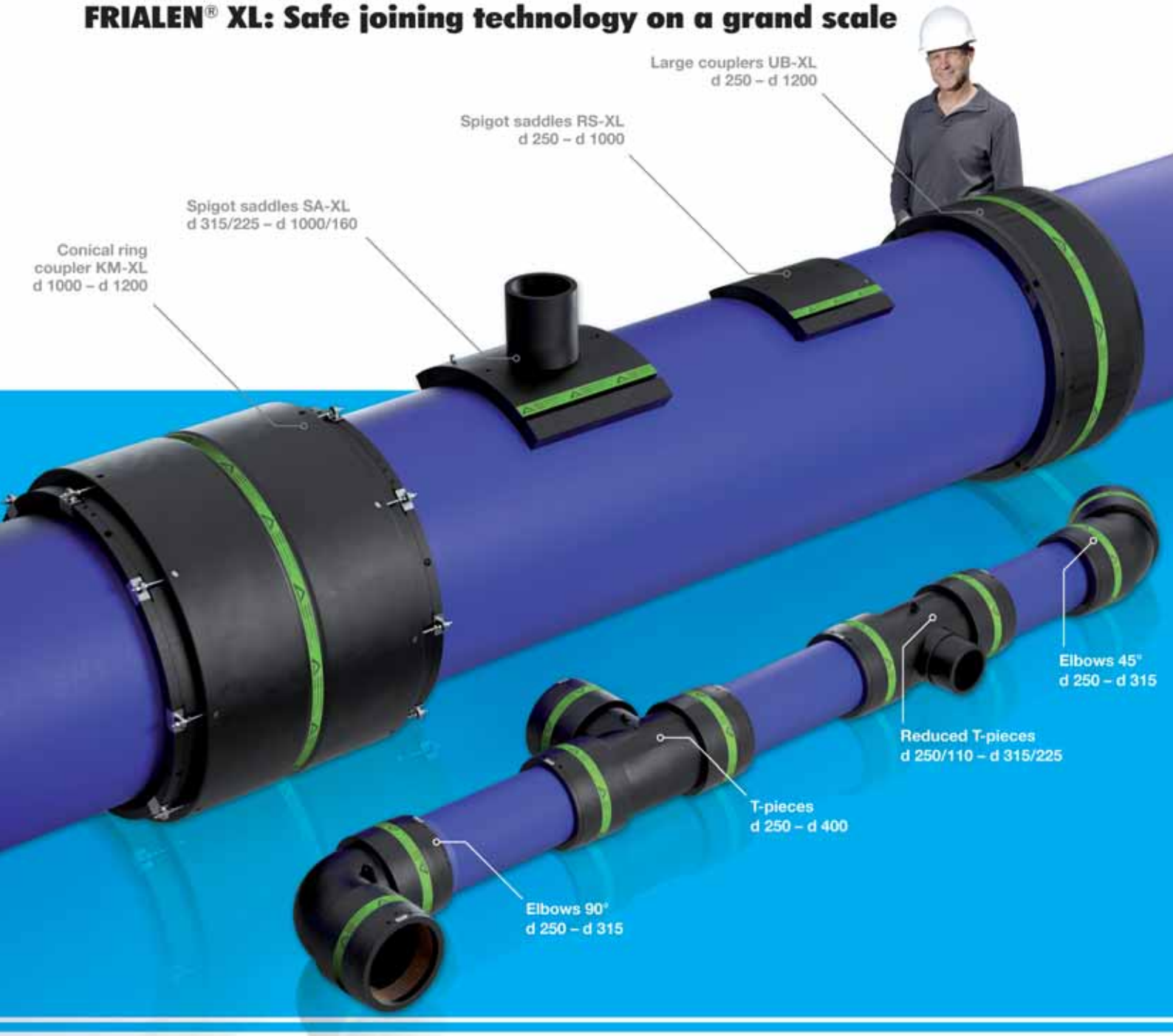

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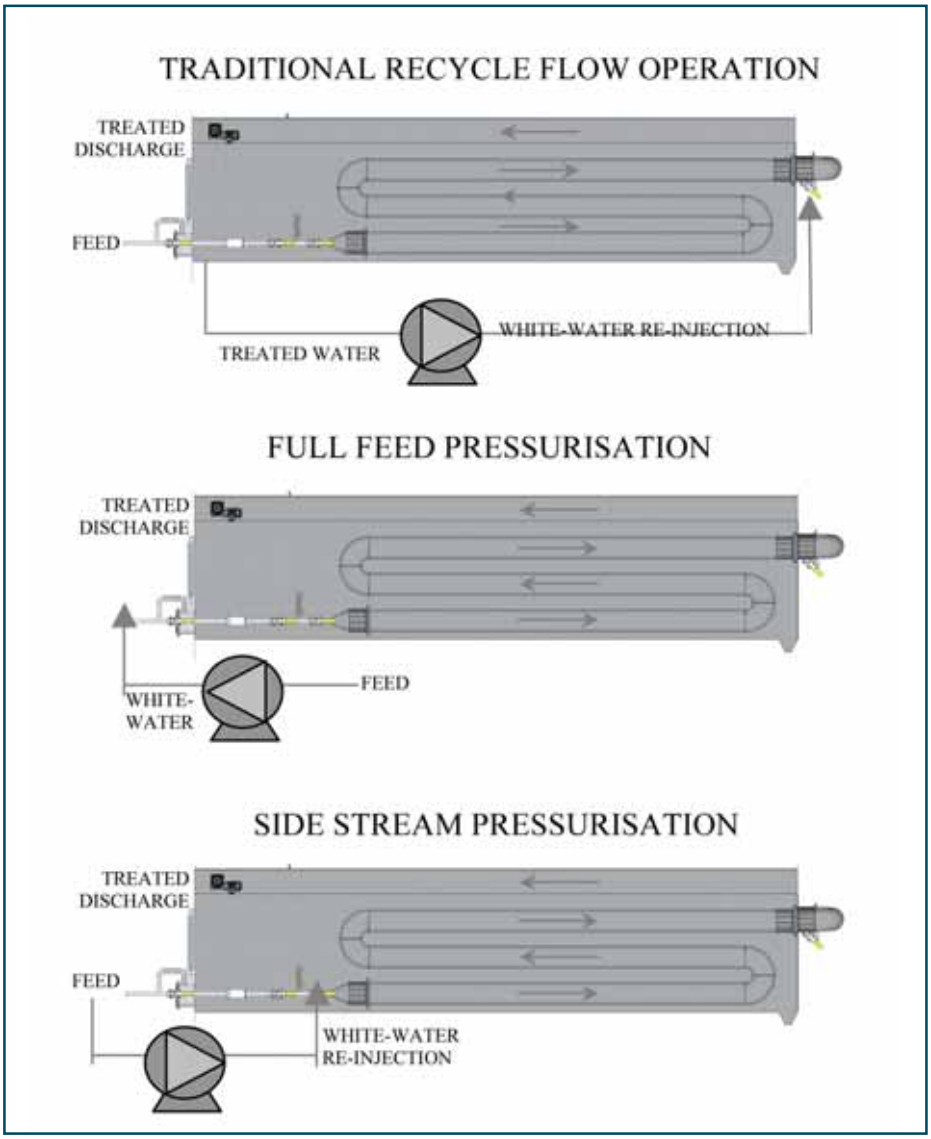
of the proteins and fats into larger, easier to collect particles. By injecting water super-saturated with dissolved air during the coagulation process, tiny air bubbles can be made to nucleate within the flocs formed, resulting in rapid flotation of the particles to the surface of the collection chamber.

Historically, one of the weakest components in the DAF process is the high pressure pump used to pressurise a portion of the flow so that the water can be super-saturated with the air required to provide flotation. Due to the relatively high pressures required, this is usually achieved by using a multi-stage centrifugal pump with a number of closed impellers operating at tight tolerances. These small internal tolerances mean that pumps are easily blocked and performance rapidly degrades as the impeller tolerances increase due to wear.

After identifying the need for improvements to the robustness of this inherently weak point of traditional DAF designs, Apex has developed a DAF design that uses a whitewater pump (so called due to the milky appearance of all the microscopic bubbles as they come out of super-saturated solution) that is able to pass 10–20mm solids through the pump. The impellor of this pump is also designed to be able to pump an air-water mixture. This enables air to be injected directly into the pump body giving extremely high intensity, high shear mixing and optimising mass transfer of air into the high pressure water stream.

An additional benefit of this pump design is the ability to operate the DAF in a number of ways not typically possible with traditional multi-stage whitewater pumps.

Most DAFs operate in a mode where they recycle treated wastewater from the discharge end of the DAF through the whitewater loop where it is pressurised, saturated with air and re-injected into the feed of the DAF separation vessel. Whilst the use of treated water protects the tight



Alternative modes of DAF operation

"The impellor of this pump is also designed to be able to pump an air-water mixture."

tolerances in a traditional whitewater pump from blockage, this mode of operation typically requires 20–25% of the flow being treated to pass through the DAF twice, therefore either necessitating larger equipment be installed to handle this additional hydraulic load, or compromising treatment effectiveness.

By using a solids-handling whitewater pump, it becomes possible to pressurise the full flow of untreated water into the DAF and super-saturate it with air. While this produces a very high level of treatment once the pressure is released, it also uses more power than the traditional recycle method where only a portion of the flow is pumped to high pressure.

The best of both worlds can be achieved by taking a side stream of approximately 20–25% of the untreated feed flow into the DAF, pressurising it in order to provide super-saturation of air and then re-injecting this back into the feed to the DAF. While using the same amount of power as the traditional recycle method, this side stream pressurisation significantly reduces the hydraulic load on the DAF therefore enabling smaller equipment to be used, or improving the level of treatment achieved by the process.

Because the treated wastewater from this plant is reused to irrigate to both pasture and a horticultural crop, the low pH water treated by the DAF is neutralised by controlled lime metering rather than the simple and more common method of liquid caustic soda dosing. This not only eliminates any damage to soil caused by dosing additional sodium to the wastewater in the treatment plant, but the calcium in the lime reduces the sodium adsorption ratio of the soil, therefore significantly reducing the negative impact on soil structure that may otherwise occur due to the caustic soda used for cleaning in the factory.

Miraka DAF white-water pump and side-stream pressurisation system

The Miraka dairy factory commenced operations in August 2011 and, while commissioning and running in of plant is still ongoing, initial results from the operation of the wastewater plant are very positive with excellent treated water quality being achieved and all consent water quality and design parameters being complied with.

This new type of DAF can be fitted with lamella plates to give an even more compact design and is well suited to many other industries such as meat processing, textile factories and vegetable processing as well as dairy. ■

For further information, use a smart phone or PDA to scan the QR code below.

Dr Matt Savage is a chartered chemical engineer with a PhD in industrial wastewater treatment plant design and a decade's experience in designing and installing a wide range of wastewater treatment plants around the world. He is the Managing Director and co-founder of Apex Environmental which designs and builds water and wastewater treatment systems for a wide range of commercial and industrial applications.

Upgrading an Existing Wastewater Pump Station

Ron Haverland – CH2M Beca

Pump station upgrading can deliver valuable improvements in operating costs, performance and capacity. However, these projects can be technically challenging and often involve compromises due to space and layout restrictions. This article focuses on one such pump station upgrade to illustrate some of the opportunities, considerations and lessons that can be learnt.

Porirua City Council's Tangare Drive wastewater pump station is the larger of the two main pump stations supplying the Porirua Wastewater Treatment Plant. The pump station, with an original design capacity of 1100L/s, was commissioned in 1989 in conjunction with Porirua's new activated sludge wastewater treatment plant.

The pump station has a wet well/dry well configuration with one 287kW and three 250kW dry mounted pumps supplied by suction pipes and bell-mouths from the wet well. The pump motors and switchboards are housed in the upper level of the dry well.

Porirua City Council (PCC) commissioned CH2M Beca to review options for the replacement of the pumps and motors, which after 22 years of service had a significantly reduced pumping capacity of 800L/s. One of the pumps had been replaced more recently with a dry mounted submersible due to a failure with an original pump.

Preliminary Design and Optimising Power Use

The preliminary design work reviewed the system hydraulics, pump selection, efficiency of energy use, and options for the pump installation in either the wet well or the dry well.

The pumps, which were on variable speed drives, were operating at flows as low as 100L/s which for these pumps represented an operation at 23% of the Best Efficiency Point (BEP). At this point the efficiency is just 43% compared to 80% at the pumps' BEP. It is important, particularly for pumps of this size that they operate within the Preferred Operation Range (POR) of 70% to 120% of the BEP. The problem with running the pump with a poor efficiency was easily resolved by changing the set points in the pump controller to limit the pumps' minimum speed to 50% of the BEP.

"Two options were considered for the pump replacements with 180kW and 287kW motors. The 187kW motor was power limited at 385L/s so could not deliver the full flow capacity of the pump. The 287kW motor had slighter better efficiencies and so both options had the same power consumed at a flow of 220L/s. The 287kW motor was therefore the best selection as a replacement pump and also matched the rating of the existing replacement pump."

Therefore, when inflows to the pump station are less than the minimum pump speed, the controller reverts to a stop/start mode and the number of pump starts needs to be maintained within the motor's rating. Energy consumption for the Tangare Drive pump station was substantial, with $24,000 in power consumed per month, so the savings with these changes were considerable.

Two options were considered for the pump replacements with 180kW and 287kW motors. The 187kW motor was power limited at 385L/s so could not deliver the full flow capacity of the pump. The 287kW motor had slighter better efficiencies and so both options had the same power consumed at a flow of 220L/s. The 287kW motor was therefore the best selection as a replacement pump and also matched the rating of the existing replacement pump.

In addition, various options were considered for the installation of the new pumps including the following:

- Installation of submersible pumps in the existing wet well. The advantage of this option was that it avoided the need for a costly upgrade of the suction pipe-work, which was required for this upgrade. The wet well installation was however found to be

impractical due to the difficulty in reconfiguring the new access hatches for the pumps, the need for a lifting arrangement for the pumps in a different location, and the modifications to the discharge pipe-work.

- Converting the dry well to a wet well with the installation of submersibles. This option was discounted as it would have required the construction of a new floor and hatches in the dry well and would have required significant relocation of electrical services and modification of the pump discharge pipe-work.
- Installing the pumps in their current position in the dry well. This requires upgrading the suction pipe-work, however had the advantage that no major modifications to the wet well or dry well are required.

For the above options, installing the pumps in the existing dry well and upgrading the suction pipes was considered to be the most favourable option. This minimised the modifications required to the wet well, dry well and discharge pipe-work and was determined to be most economical and straight forward option.

Design of the Upgrade

The design of the pump suction pipes and wet well was reviewed in accordance with the American National Standard for Pump Intake Design, Hydraulic Institute (ANSI/HI 9.8), an internationally accepted standard. The existing 400mm diameter suction pipes had a maximum velocity of 3.8m/s. Suction pipe velocity is a critical aspect for pump performance and this velocity exceeds the ANSI/HI recommended velocity range of 0.9 to 2.4m/s for this range of pump flows. High suction velocities can result in subsurface vortices, excessive swirling at the intake and cavitation of the pump. Dismantling the pump and a check on the components revealed that this was in fact the case. The pump showed significant cavitation damage to the impeller and suction cover. At slow speeds cavitation noise was not evident, but at high speeds (high suction pipe velocities) there was cavitation noise.

The problem with suction pipe velocities was resolved by designing a new 500mm diameter suction pipe which reduced velocities to 2.4m/s, however this was still at the high end of the recommended range. It was not possible to install suction pipes larger than 500mm diameter due to space limitations.

The other critical aspect of the suction pipes is to have sufficient submergence to prevent vortices from the water surface. ANSI/HI also provides guidance on the submergence required which increases with the rise in velocity of the suction pipe bell-mouth. For the Tangare Drive pumps we increased the submergence from 1.4 to 1.6m. ANSI/HI also provides recommended set-out distances for the bell-mouth to the floor and walls of the wet well, which is critical to the performance.

It is also important that the suction piping delivers a smooth inlet flow to the pump suction with the velocity being constant or increasing as the flow approaches the pump. Flow disturbing fittings (partially open valves, tees, elbows) should not be installed closer than five suction pipe diameters from the pump.

CFD Modelling

In addition to modifying the suction pipes, consideration was given to the wet well geometry. The current wet well is divided into two sections with two suction pipes per section. The concern with the wet well was that each pump inlet is open with no dividing walls, which can result in adverse flow patterns due to cross-currents and non-uniform approach flows. We wanted to ascertain the performance of the pumps and determine whether there were any detrimental effects due to the wet well geometry, and so the pump supplier was commissioned to carry out Computational Fluid Dynamics (CFD) modelling of the new pump installation. The modelling simulations did not show any pump approach flow issues with inlet swirl or axial velocity distribution. The model showed that there were rotating flow patterns or weak vortices on the water surface, however these did not develop into vortices that persisted down to the level of the pump inlets. Significant vortexing was however occurring under the bell-mouths from the wet well floor and these vortices were drawn up into the pump suction pipe which could be damaging to the pump. In order to remedy this situation, flow splitters under the bell-mouths were included in the model which eliminated the vortexing.

Lessons Learned

The key lessons learned from the upgrade of the Tangare Drive pump station were:

- Where static heads govern, a low pump speed can result in higher energy consumption due to poor pump efficiency
- Suction pipe velocity and design are critical for pump performance, and adverse conditions can result in significant damage to the pump due to cavitation
- CFD modelling can be beneficial for large pump stations particularly where the installation does not comply with ANSI/HI standards and where there are non-standard wet well conditions

At the time of writing this article, Contractor Max Tarr Industrial was installing the first two of the four new suction pipes. Completion of the $1 million upgrade is programmed for October 2011. The upgrade will provide increased pumping capacity to PCC's main wastewater pump station and reliable pump operation which has been proven as a result of CFD modelling. ■

Driving Sustainability and Operational Improvement through Struvite Recovery

Bonita Dirk – Professional Engineer (Canada), Harlan Kelly – Professional Engineer (Canada) and John Crawford – Chartered Professional Engineer (New Zealand), Opus International Consultants

Many wastewater treatment plants around the world experience problems with struvite accumulating in equipment and piping causing operational issues. Struvite is a chemical compound that forms crystals made up of magnesium, ammonium and phosphates; all of which occur naturally in wastewater. When the precipitation of struvite is controlled, valuable slow-release fertiliser pellets can be recovered. As well, most sewage treatment plants which have biological nutrient removal abilities to give good effluent discharge quality need a carbon source to operate. One potential carbon source is volatile fatty acids (VFAs) which are available in some sludge digestion processes, such as autothermal thermophilic aerobic digestion (ATAD) and acid phase digesters in two stage anaerobic digestion.

Opus Dayton Knight, a Canadian branch of Opus International Consultants here in New Zealand, designed and successfully undertook a pilot test program, which was carried out at the City of Salmon Arm Water Pollution Control Centre, British Columbia, Canada, to demonstrate the ability to recover both phosphorus and VFA (carbon) using an ATAD process and a struvite crystalliser.

This work has been undertaken in conjunction with the University of British Columbia and Ostara.

It was initially expected that the struvite crystalliser would remove about 70% of the phosphorus and 25% of the ammonium from the ATAD centrate and would produce crystals, although the quality was unknown. In the end, the crystalliser removed about 80% of the phosphorus and 35% of the ammonium, and good quality crystals were produced. Although a slight but unexpected decrease in VFA concentration was observed through the crystalliser, batch tests demonstrated that the crystalliser effluent would stabilize the plant's phosphorus removal process. This pilot demonstrated the ability to recover multiple valuable assets from a waste stream while eliminating the need for metal salts.

"Removal of ammonia and phosphate from wastewater solids streams can be undertaken using crystallisers that form struvite (magnesium-ammonium-phosphate). Several previous studies investigated the application of crystallisers for the recovery of phosphates. These studies used various methods for thickening and separating solids after digestion, but none of the studies used ATAD or acid phase digestion for solids digestion."

Why is There a Need to Undertake Pilot Trials Like This?

The key issues related to undertaking the pilot study included the following:

- Based on known global reserves, we understand that the supply of phosphate may be exhausted by about 2050. Regardless, it is a non-renewable resource and all means of phosphorus recovery and reuse will be of growing importance, particularly to agricultural based economies.
- Plant modifications are constantly needed to reduce energy consumption and increase the level of treatment.
- Specifically for the Salmon Arm Water Pollution Control Centre (WPCC), the effluent receiving Shuswap Lake is very sensitive to phosphorus input, the City of Salmon Arm has hence elected to use enhanced biological nutrient removal (EBNR) to reduce phosphorus discharge. The same principle applies in a number of New Zealand situations where plants use EBNR to achieve high quality effluent due to the sensitive nature of the receiving waters.
- The Salmon Arm WPCC discharge consent allows only a very low phosphorus concentration to be discharged to the Shuswap Lake (0.5 mg/L based on a 12 month moving average). Again low phosphorus discharge consent levels are now being required in some areas of New Zealand.
- Biological Nutrient Removal wastewater treatment plants characteristically need a supplemental source of carbon to assist in biological phosphate uptake and nitrogen removal through

"Various pilot-scale studies have been done at facilities with and without biological nutrient removal processes."

denitrification, to avoid recycle of nitrite and nitrate back into the EBNR process streams.

- Large quantities of dissolved phosphate, ammonia and VFAs are found in thermophilic and acid phase digesters. The returned VFAs are an immediate source of carbon for the EBNR process, but the phosphate and ammonia must be removed before it can be used in the biological nutrient removal process.

Wastewater Treatment plants that discharge to sensitive receiving waters, often use EBNR processes to remove excess nutrients from the liquid stream. EBNR processes require a high energy carbon source for excess biological uptake of phosphorus and denitrification to achieve the desired results. Although solids streams are typically good sources of carbon at a wastewater treatment plant, the nutrient loads (specifically phosphorus) in these streams must be removed before they can be returned to the liquid treatment stream.

Removal of ammonia and phosphate from wastewater solids streams can be undertaken using crystallisers that form struvite (magnesium-ammonium-phosphate). Several previous studies investigated the application of crystallisers for the recovery of phosphates. These studies used various methods for thickening and separating solids after digestion, but none of the studies used ATAD or acid phase digestion for solids digestion.

Various pilot-scale studies have been done at facilities with and without biological nutrient removal processes. Where there is not a biological nutrient removal process, the phosphorus levels in the centrate are much lower and less struvite can be recovered.

Objectives of the Opus Pilot Trial

This nutrient recovery pilot test work at the City of Salmon Arm WPCC, British Columbia, Canada was designed to fulfil the following main objectives:

- To capture VFA from the crystalliser effluent for reuse in the biological nutrient removal process
- To remove excess phosphorus from the digester centrate so that the centrate can be returned to the biological nutrient removal process
- To recover dissolved phosphorus in the form of a saleable fertiliser using the UBC Crystalliser and associated equipment

Firstly, the pilot project was to demonstrate how the high concentrations of nutrients available in an ATAD or acid digester process can be recovered in the form of a valuable slow release fertiliser. This kind of fertiliser is often sought after for golf courses and is suitable on a larger scale for blending and sale for commercial use.

Secondly, ATAD digesters contain high concentrations of VFAs, which is the carbon source that can be beneficially used in the liquid treatment stream of an EBNR facility. The pilot study was to demonstrate that the treated centrate could be used to reduce or eliminate the need for other purchased carbon sources such as acetate.

Thirdly, at this facility ATAD centrate is normally returned to the EBNR process, but requires the addition of metal salts such as alum or ferric to remove excess nutrients so that they are not returned

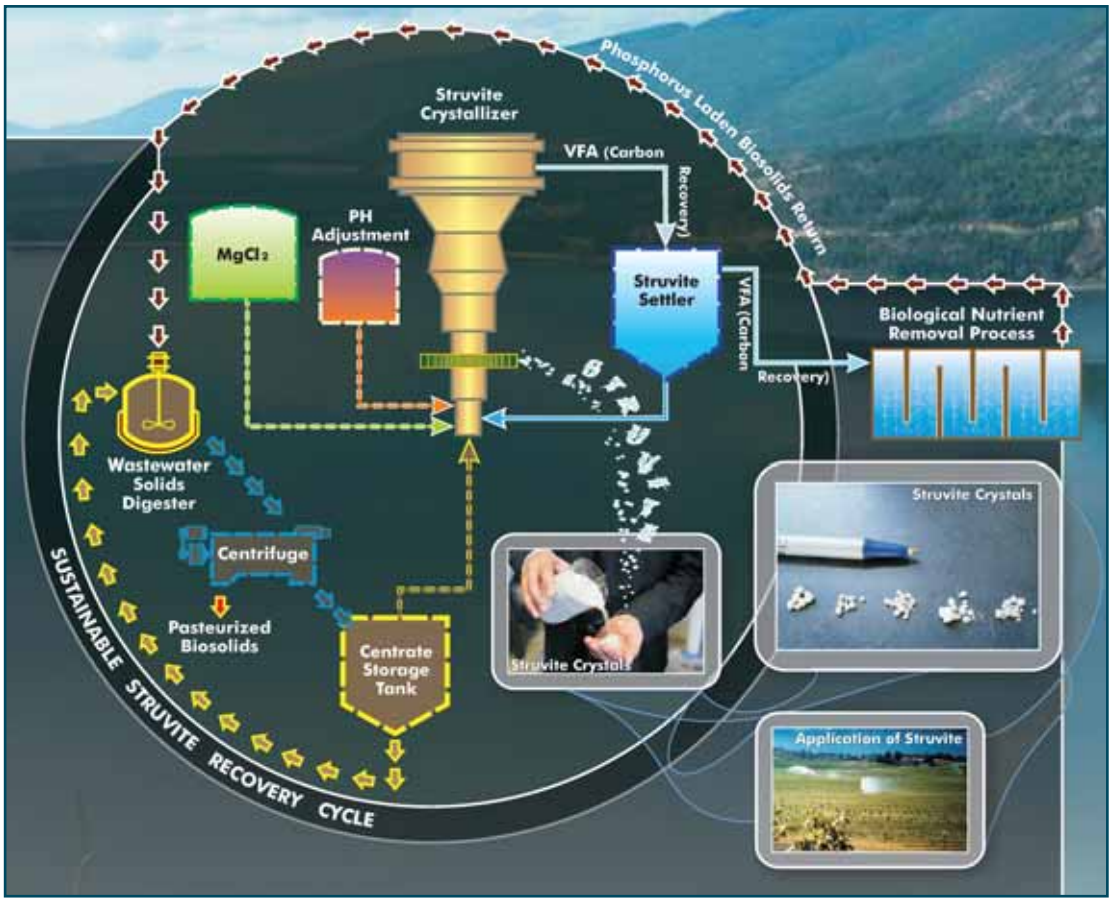


Figure 1 (left) – Process diagram, Figure 2 (above) – Struvite Crystals, Figure 3 (above centre) – Phosphate concentration, Figure 4 (above right) – Ammonium Nitrogen Concentration

to the process. The metal salts bind with phosphorus and settle out, becoming part of the solids stream. The pilot study was to demonstrate that use of the crystalliser to remove phosphorus in a beneficial form eliminates the need for the purchase of metal salts.

The Trial Methodology

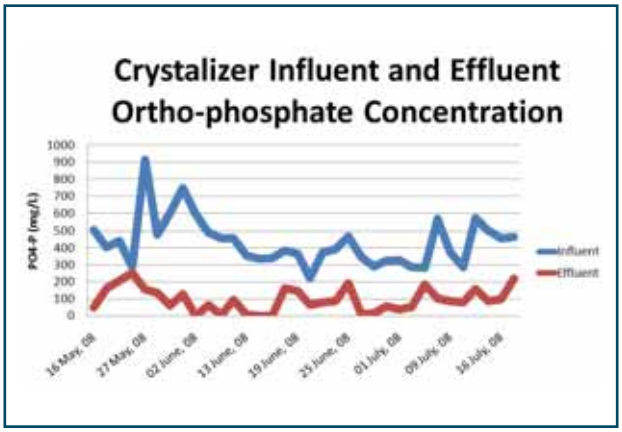
Effluent from the ATAD process was sent through the centrifuge, settled and then used in the pilot struvite crystalliser (see figure 1). The struvite crystalliser was used to capture the phosphorus while "batch tests" simulated the effect of returning the effluent to the treatment process. Phosphorus, magnesium, VFA, pH, temperature, conductivity, ammonium and total suspended solids were measured five times a week. The struvite crystalliser was run at a flow rate of 1.7 l/min – 10% of the regular centrate flow rate. The fertiliser pellets produced by the struvite crystalliser are made up of magnesium, ammonium and phosphate (see figure 2).

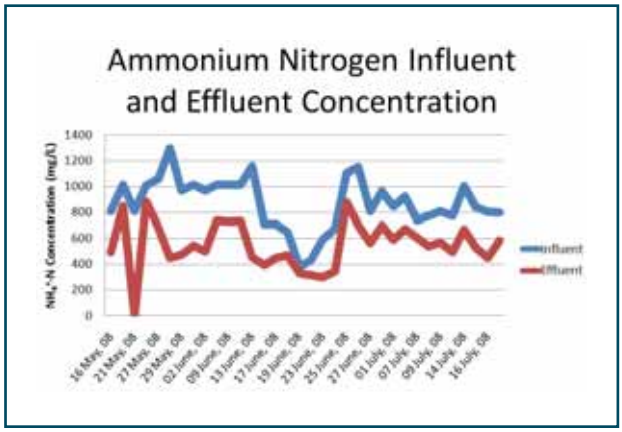
Trial Results

The pilot trial demonstrated the ability of the combined struvite crystalliser and the ATAD/acid digester to remove phosphorus from the centrate and make available the carbon for use in the nutrient removal process.

In addition to this high quality fertiliser pellets were produced throughout the study with sizes between 2mm and 3.6mm. These are a saleable product which could be used to recover cost for the treatment plant operator.

The reactor recovered on average 77% phosphate during the trial (see figure 3). This phosphate was turned into the fertiliser pellets and was hence removed from the liquid stream, allowing the carbon laden liquid to be used in the nutrient removal process at the plant and potentially reducing nuisance deposits of struvite in plant piping. On average 34% of ammonium – nitrogen was removed from the liquid and converted into the fertiliser pellets (see figure 4).





Where to From Here?

This project was a "proof of concept" that offers wastewater plant operators confidence in the ability of the combined technologies to improve the performance of their sludge handling and nutrient removal processes. The combination of these technologies is unique and uses an integrated approach providing a valuable end product. The struvite produced is a high quality, slow release fertiliser that is particularly valuable in locations where fertilization is critical (e.g. golf courses).

There are now a number of WWTPs in North America employing full scale struvite crystal production facilities with the product commercially marketed by the process provider, Ostara.

Within New Zealand the economic size of plant for full scale application of this type of technology favours the medium/larger municipal plants at the present time as, although there is an ongoing agricultural need for fertilisers here, the concept of using recovered phosphorus is not well known or accepted, and hence the economic value is, as yet, undefined. It is hence only in the medium/larger plants that the economic viability of such technology can be justified solely on the reduction of plant costs and reduced maintenance costs, through avoiding struvite formation problems in heat exchangers/and transfer/mixing piping, etc. A triple bottom line that includes environmental and societal benefits as well as the financial considerations should be included in selection decisions. ■

One Protocol, Faster Commissioning

Richard Coulter – Water and Wastewater Sector Manager, Schneider Electric and Lawrence Schaffler – Technical Writer, Freelance

Last Christmas delivered a special present for Gisborne residents – a new wastewater treatment plant that's transformed the city's 'sewerage issue' and thanks to Schneider Electric's automation and control solution, it arrived on schedule.

The new facility, with months spent planning and securing resource consents, couldn't have come soon enough for Peter McConnell, Gisborne District Council's manager for the project.

"We've never really had an adequate treatment plant. Waste used to be processed through a fairly basic milli-screening plant and then pumped down an outfall pipeline, exiting some two kilometres out to sea. An ugly 'plume' was usually visible at the end of the pipeline and with an easterly, onshore wind the smell was very unpleasant and a health risk."

All of those issues have disappeared with the new, fully-automated plant. At a cost of $39.5m it's the Council's largest-ever capital project. It uses a biological trickling filter and the change, says McConnell, has been dramatic.

"Tests on the old system revealed treated wastewater total oil and grease at 80 parts per million. Today the same tests show an 81% improvement to 15 parts per million."

How it Works

The three-stage process was a CH2M BECA design. Starting with the city's wastewater it is screened by one of two rotating drum screens (one is on duty, one on standby) and then passed through a vortex grit removal chamber. Grit and screened material is bagged and trucked to a landfill at Paeroa.

The remaining wastewater gravitates into a biological trickling filter pump station before being distributed through six rotating arms to trickle slowly through large plastic media blocks made up of twelve sheets of preformed plastic welded together.

Friendly micro-organisms grow on the plastic media (a bit like river rock slime), catching and treating waste as it passes through the system. Using the waste as a food source, more micro-organisms grow, transforming human waste into a non-offensive biomass.

"The three-stage process was a CH2M BECA design. Starting with the city's wastewater it is screened by one of two rotating drum screens (one is on duty, one on standby) and then passed through a vortex grit removal chamber. Grit and screened material is bagged and trucked to a landfill at Paeroa."

The resulting treated wastewater is pumped via a new outfall pump station to the existing marine outfall, nearly two kilometres out to sea.

The Build Team

Head contractor, HEB Construction's Mt Maunganui office, built the new facility in just over 12 months.

Hawkes Bay's Kinetic Electrical successfully tendered to undertake a total turnkey electrical contract, including installation of the main distribution boards, electrical wiring and ethernet communication bus cabling.

"Kinetic Electrical has a long standing and successful relationship with Schneider Electric and this level of understanding between the two key parties was critical to achieve trouble free project management of this installation," says Kinetic Electrical's Managing Director Darren Bambry. "When evaluating whether to submit a tender for this project, being able to 'team up' with Schneider was the deciding factor. Although the tender documents did not specify a Schneider system, we needed to have complete confidence with our automation subcontractor."

Schneider Electric provided the entire automation/control solution covering an 11 meter MCC distribution board (including a type tested design and co-ordination of the protection breakers, Tesys contactors, bus couplers, and source-change switches). At the

Opposite page – An aerial perspective showing the tight confines of the construction site, above left – Switch room with ethernet enabled VSDs and MCC, above right – Construction team inspecting flow from VSD controlled pumps flows to outfall

heart of the plant a Premium Level 4 PLC,with around 30 Altivar 61 and 71 variable speed drives, Advantys I/O, a Vijeo Citect SCADA system and an APC UPS – all communicating via Modbus TCP/IP Ethernet.

Hastings based Electrical Systems Development (ESD) was responsible for the system integration. ESD is a Schneider Electric systems integrator alliance partner.

ESD General Manager Peter Wrigley says the speedy commissioning of the facility was directly attributable to the use of single-protocol technology. "An automation solution for projects of this size typically takes around two months to configure and fine-tune. We were given 16 days and I honestly don't think we'd have been successful if we'd been using technology with different interfaces and communication protocols."

A key component of the job, he says, was programming the PLC using Schneider Electric's Unity Pro software. "The plant has quite a number of pumps, and fortunately, with Unity Pro, we were able to programme function blocks for one pump and simply copy-and-paste the code for the others. Very straight-forward and it saved a lot of time."

The Altivar drives orchestrate the facility's numerous pumps, including two 225kW behemoths in the outfall pump station. As is always the case with wastewater plants, says Wrigley, "a high level of redundancy is factored into the design in case anything fails. So we had to duplicate everything."

An added 'emergency stop' feature of the Altivar drives also contributed to the pace of commissioning. "There are a number of large, moving components in the plant and they have to be fitted with emergency stop buttons. Altivar drives have a dedicated power removal input, which means you can implement a CAT3 e-stop without having to interrupt the output of the drive. That also makes things a lot simpler for certification," says Wrigley.

Jonathan Broome, HEB Constructions' Water & Wastewater Manager, also commented on the team cooperation "Schneider came up with some ideas which produced both a cost saving and a future proofed system for the client. We then all worked as a team to deliver the project. It is one of the most satisfying projects that I have personally been involved in."

SCADA

Where Council staff at the old plant managed an intensive, hands-on operation, the new facility is completely automated and in fact is unattended at night and over weekends.

Keeping an eye on the operation is a Citect Vijeo SCADA system (with its own, redundant server). Part of its design is a paging system that alerts staff (even if they're off site) to any problems or anomalies in the plant.

Wrigley has also incorporated a Web Client Account for Council staff, allowing engineers to remotely view and monitor the site. He too is able to remotely monitor the facility and make adjustments to operating parameters, should that be necessary.

While the plant is fully automated, Wrigley has trained staff to use the new technology, including the development of comprehensive drop-down help menus in the SCADA system.

UPS

The plant's electrical load varies considerably according to the pumps' duty cycle. To meet the built-in redundancy design, power arrives via two 11kV lines which feed a pair of 1MVA transformers. Should both fail, a UPS takes over (to protect the PLC and the SCADA system) and fires up a 1 MVA generator.

Gisborne District Council is delighted with new plant. McConnell says it's worked out exactly as planned, and he was particularly impressed with the commitment of the installation and commissioning crews. "All credit to them – they pulled out all the stops to meet what was a pretty narrow window of opportunity."

"Since commissioning we have had to use the Schneider 24 hour support service to fine tune the large VSDs and have been particularly impressed with the prompt and quality service received." ■

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Onsite Wastewater and Potable Rainwater in a Reticulated Part of Auckland: It Can Be Done!

Craig Brown – Principal, CBC Wastewater

Auckland Council has recently granted all the necessary consents for the installation of an onsite wastewater treatment and irrigation system in a part of Auckland which is served by sewers. It is believed that this is the first such system in the Auckland region. The council also granted consent for a rainwater collection system for potable use on the same project, although there is a municipal piped water supply available. The property to benefit from these systems is a single residential dwelling in Howick, currently under construction.

"We were first contacted in August 2010 to advise on the options of reusing 'waste' water from the site (whether greywater or the full wastewater stream) and for collecting and using rainwater. After initial discussion with our client, it was decided that the preferred option was to treat the full wastewater stream and use it to irrigate the garden, using subsurface drip irrigation to the root zone of the proposed orchard, so as to make full use of the nutrients and water. It was also decided to apply for consent to use the rainwater for all uses, including drinking water."

The outcome of these consent applications was by no means certain and the design and assessment process took 11 months from the date the client first contacted CBC Wastewater. Half of that time was spent researching, designing the system and negotiating with council and other consultants. The remaining time was taken by council, processing the application. Council should absolutely be commended for approving the application in the end, despite some considerable initial reservations. It is hoped that – now that this system has been approved – future applications for onsite systems will not take as long. The delays added considerably to the expense of the project and there were many negative voices within council and the project team itself. If it were not for the commitment of our client and her project manager, the project would not have gone ahead. CBC Wastewater is aware of a number of 'alternative' infrastructure projects that were abandoned because of negative advice, delays and costs (arising from within the project team and within council). Such failures are self-perpetuating because they become the evidence for why it can't be done. This success now replaces those examples – it can be done.

There are other examples where onsite wastewater systems have been legally established in a sewered area – Michael Mobbs' Sustainable House in Sydney; Robert and Brenda Vale's Autonomous House in England (both subjects of books); and closer to home, a sustainable house in Hamilton. This latter project has not had the publicity it deserves (although it has been published in Build magazine). It might have been a useful resource when we were undertaking our project but we only heard about it recently. There is simply not enough space in this article to discuss why one would want to undertake such a project, but we will be writing about this in the near future as it is certainly a valid question. Please contact CBC Wastewater with any questions in the interim, or for references for the projects listed above. Also of interest is the Landcare Research office and laboratory facility in Auckland which has composting toilets and some rainwater use and Dorothy Wilson's house in Waitakere which has rainwater use and greywater recycling for toilet flushing.

We have been given permission to install monitoring equipment and to take periodic samples at the Howick house. It is hoped that a research organisation will come forward as a partner to monitor and analyse the performance of the water and wastewater systems. It is possible that monitoring can also be performed at the Hamilton house as part of the same research project as this has not yet happened. This would be interesting because the systems in that house are different from those in Howick. Again, please contact us to discuss the research opportunities.

The following text covers the design, application and consenting processes. It would be somewhat false to present these as separate strands, when in reality they were woven closely together, but we have done our best to order the material logically.

The Design, Application and Consenting Processes

We were first contacted in August 2010 to advise on the options of reusing 'waste' water from the site (whether greywater or the full wastewater stream) and for collecting and using rainwater. After initial discussion with our client, it was decided that the preferred option was to treat the full wastewater stream and use it to irrigate the garden, using subsurface drip irrigation to the root zone of the proposed orchard, so as to make full use of the nutrients and water. It was also decided to apply for consent to use the rainwater for all uses, including drinking water.

Greywater irrigation and limited (non-potable) rainwater use was regarded as the 'fall back' position if it proved not to be possible to gain consent. As the house design was to include a very large rainwater tank (actually built into a basement room of the house) it was felt that greywater recycling for toilet flushing – something that is relatively simple to consent – would not have been beneficial, because there would already be a water supply system in place which would have sufficient water to cover this use.

The author was aware of numerous anecdotal reports that council and/or the water supply organisations had previously refused consents for onsite wastewater reuse and rainwater use (even for non-potable purposes), but was also aware of council encouragement in some areas to use rainwater tanks in new developments, and that composting toilets had been installed at the Landcare Research Building. It was resolved to research and prepare as fully as possible before lodging an application, to pre-empt and, where possible, overcome any possible objections. Phone calls and emails to the

"These factors should ensure a good quality of water – far better than many rural rainwater systems – with almost no maintenance requirement."

relevant council managers, staff and planners proceeded as follows (this is somewhat simplified):

1. Auckland Regional Council were content that the application would meet the objectives and rules of the air, land and water plan; if the application required discharge consent, they would process it, provided that Manukau City Council (the territorial authority of the time) gave their blessing.
2. Manukau City Council referred the matter to Manukau Water (a council controlled organisation), who referred the matter to Watercare, who stated that they did not have a role in onsite systems and to contact the council.
3. It was becoming clear that due to the transition to a unitary authority (Auckland Council) and amalgamation of the water companies into one entity (Watercare), that the outgoing councils and water suppliers did not have the authority to make any decisions. At that time Auckland Council had not begun to operate and had not recruited the relevant staff, so it became necessary to wait for a number of weeks.
4. When Auckland Council did become operational it became clear that it had yet to develop any policy in the areas of rainwater use or onsite wastewater and was not likely to do so for some time. Because it was 'finding its feet' and because it had no policy, the advice given (by the policy team) was to put in an application and to see what the response was (by the building consents processing team).
5. Meanwhile, the ARC team that processed discharge consents became part of the Natural Resources and Specialist Input team in Auckland Council. They were still happy to agree to processing of the wastewater application under Technical Publication No. 58: Onsite Wastewater Systems: Design and Management Manual (TP 58), just as if it were in an unsewered part of the region, so long as the policy team gave their blessing.
6. As it was becoming clear that the policy division of Council was not in a position to give this blessing, nor indeed take any position, the approach became to focus on the existing laws, bylaws, district and regional plans (research into which had been progressing simultaneously), with the intention of making an application which tightly addressed all of these, on the assumption that if they could be addressed, it would be difficult for consent to be refused.
7. Further contact with Watercare yielded the response that it was Council's responsibility to decide how and whether to consent onsite rainwater tanks. An enquiry was also put to them regarding clause G13.3.3 of the Building Code (see Table 1) as to whether the requirement to connect to the sewer meant that there was a requirement to actually put any wastewater down it. Watercare sought advice and replied that it did not, which in effect meant that an onsite wastewater system was not excluded by the Building Code, so long as a connection was also made to the sewer. Watercare also stated that the onus was on council as to whether to consent an application.

Table 1 – Key clauses of the Building Code

G12.3.2	G13.3.3
A potable water supply system must be: • protected from contamination; and • installed in a manner that avoids the likelihood of contamination within the system and the *water main*; and • installed using components that will not contaminate the water	**Where a sewer connection is available, the drainage system shall be:** • connected to the *sewer*; and • the connection shall be made in a manner that avoids damage to the *sewer*; and • is to the approval of the *network utility operator*

Several Key Documents were Identified:

a. *The Building Code*: specifically elements of clauses G12 and G13 (see Table 1).

b. *The Manukau District Plan*: essentially this states that council has to provide a sewerage system in areas deemed 'serviced' and that a developer has to connect to it; it also states that where subdivisions occur council must consider the adequacy of effluent disposal systems and their maintenance. The plan also restricts council's discretion when considering onsite wastewater systems to whether the design is in accordance with TP58 – some other specifics are included as well, but these are also requirements of TP58, so if a design complies with TP58 then it should satisfy the District Plan requirements). Note: other District Plans may have different provisions.

c. *TP 58*: CBC Wastewater were familiar with this document through previous onsite wastewater system design work. By designing to TP58 in this case it would be possible to guarantee satisfaction of the District Plan requirements and avoid a discharge consent. This was deemed to be worthwhile; one consequence being that 'alternative' treatment systems were not considered in this case (because they would be outside of TP58 and thus would require a Discharge Consent and would not necessarily be deemed to satisfy the District Plan requirements.

d. It was noted that the *Auckland Metropolitan Drainage Act* was repealed in 2010 as part of the transition to an Auckland 'super-city'. This had been cited as an impediment to onsite systems previously, although we could only find a requirement in the Act not to pollute waterways with onsite systems, which of course is still a design principle, hence the Act may not have been an obstacle even if it had remained.

Rainwater Design

It was decided that the design of the rainwater system could meet section G12.3.2 (see Table 1) of the Building Code. The system designed utilised a 56,000 litre concrete water tank, constructed as a basement room of the house, with vacuum overflow (when the tank is full it overflows from the bottom, removing sediment), first flush diversion (the first several hundred litres of rainfall cleans the roof and is directed away from the tank), a floating out-take (so that water is collected from a zone slightly below the surface, where water quality is best). Details were also provided for roof and downpipe materials and leaf guards, etc. These factors should ensure a good quality of water – far better than many rural rainwater systems – with almost no maintenance requirement. To provide added assurance of water quality, a 10 micron filter followed by UV lamp was specified, with the UV lamp sized appropriately for the flow rate from the pump, so as to be able to deactivate oocysts and other pathogenic microorganisms. The UV lamp was to be the type which contained a sensor that would automatically shut-off the flow through the lamp in the event that insufficient UV was passing through the water. Overall the level of water treatment should at a minimum exceed that provided to a quarter of the New Zealand population on reticulated supplies (whose suppliers did not achieve protozoal-compliance. Refer to the Ministry of Health Annual Report on Drinking-Water in New Zealand 2009–2010). To provide further assurance of water availability a rainbank system was specified. This system reverts the water supply to the mains in the event that the tank becomes empty, the power or pump fails, or the UV lamp shuts down.

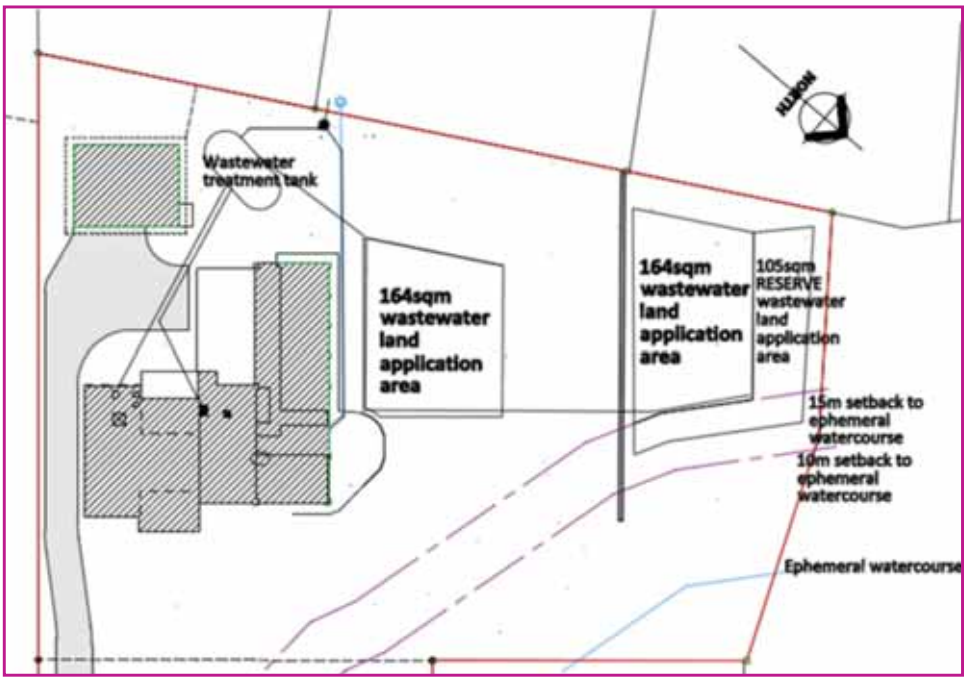
This design was specified by way of a letter and by showing the major components on the plan that accompanied the building consent application. Other elements included that a maintenance contract would be in place with the supplier of the UV lamp and filter and that the overflow from the rain tank would be piped to the council stormwater drain. Although the initial preference was to disperse the excess stormwater onsite using a rain garden or similar, the concerns of the engineers who handled the initial subdivision of the land were such that it was felt prudent to utilise the drain. It is noted that although it did not form part of the design or council requirements, it would be possible to utilise a portion (say a quarter) of the rain tank as a stormwater retention tank so that in storm events there is capacity to absorb the water and then slowly release it (down to three-quarters capacity). If every new property installed a tank configured in such a way it would not only provide a new water source (possibly avoiding or delaying the need for e.g. a dam in Riverhead), it would also reduce the need to upgrade stormwater pipe networks, contribute to a reduction in sediment and pollutants

washed out into the Hauraki Gulf during rain events and in some places would reduce sewage system overflows. It should be noted that one of the motivating factors for the landowner to pursue onsite systems is that she has seen the reticulated sewage system overflowing onto her land many times in the past following heavy rainfall.

Wastewater Design

The site in question was 4196m^2 so it would normally be relatively straightforward to design an irrigation system for such a site. However, the site had a watercourse running along one boundary, was relatively steep and had nine neighbours. The engineers who had designed the subdivision had put stormwater drains along one boundary, hence a 15m setback was required (as it was for the watercourse). A large retaining wall they had specified to stabilise the site also had drains to the stormwater system and therefore had to be accorded the same setback. The initial preferred design had a vermiculture treatment system with the wastewater irrigated via subsurface pressure compensating dripper lines onto north and west facing gentle slopes up close to the house where our client proposed to put an orchard.

Unfortunately for this plan, the subdivision engineers calculated that under saturated conditions the slopes could be unstable and



Drawing showing property boundaries and wastewater irrigation locations

recommended that the north-western half of the property not be used for wastewater application. We thought it unlikely that the addition of a relatively small volume of water (a maximum additional 3l/m^2/day) evenly dispersed over the areas indicated would be sufficient to cause saturation. Storm events can (exceptionally) drop as much as 100 times that amount over 24 hours over the

"This will add to the capital and operational costs. It is possible that soil moisture monitors will be installed as part of the research programme, hence the engineering assumptions that led to these changes can be tested."

whole slope (not just a portion of it). Notwithstanding those doubts, we undertook to revise the field locations to avoid these slopes. In order to remain within the TP58 guidelines and ease the consenting process it was necessary to change the treatment system (a packed bed reactor was selected) and add UV polishing, so as to be able to reduce some setbacks from 15m to 10m. This will add to the capital and operational costs. It is possible that soil moisture monitors will be installed as part of the research programme, hence the engineering assumptions that led to these changes can be tested.

Final Notes

The application was submitted in January. In March Council required an application be made (and fee paid) for exemption to the Building Code in relation to the works for the wastewater system – despite the legal opinion provided by Watercare that the proposal complied. This was eventually granted but in the interim the wastewater system had to be deleted from the building consent application so as to enable the building work to begin. Council also required a new land use consent application (the original application had been processed as part of the subdivision) including details of the wastewater system. We had thought that the resource management considerations were covered by the other applications, not least because the District Plan restricted the discretion in effect to whether the design complied with TP58, but the planners wanted to be able to consider this. Thankfully Council did not insist on consultation with neighbours as this would have added further delays and expense. Both the land use consent and building code exemption were granted in July. Building was already underway by then and the wastewater system could well be installed by the time this article is published. ■

Craig Brown

Craig does onsite wastewater design work with CBC Wastewater. He also has a multi-faceted role for ECOplus, a New Zealand manufacturer of onsite greywater recycling systems and he is a Senior Teaching Associate in Ergonomics/Human Factors at Massey University where he has research interests in Eco Ergonomics. In preparation for his PhD, he's looking for research opportunities around the role of human factors in sustainable water systems.

He would be pleased to receive any questions about the project by email: craig@cbcwastewater.co.nz or via his blog: www.watermiles.org

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The Effects of Transport and Storage on Escherichia coli Concentrations in Water Samples

Mike Crump – Water Quality Laboratory Manager, NIWA

Introduction

NIWA's National Rivers Water Quality Network (NRWQN, Davies-Colley et al. 2011) conducts monthly sampling of 77 sites on 35 major river systems throughout New Zealand. It includes assessment of Escherichia coli (E. coli) as an indicator of faecal contamination from human and animal sources. With most sampling sites being a long distance from the laboratory the samples are delivered by courier overnight or in some cases (e.g. South Island sites where the field collection staff cannot get to the courier depot on the day of collection) delivery can take two days to reach the base laboratory in Hamilton. For E. coli analysis this is outside the APHA (2005) recommended transport times of six hours maximum for compliance purposes and 24 hours for non-compliance purposes. A number of studies looking at the effects of holding times on E. coli concentrations in surface waters have been conducted by overseas researchers (Aulenbach (2009), Selvakmar et al (2004) and Guardabassi (2002)) but we considered it important to do a New Zealand-specific study under our particular conditions.

This article investigates the effects of transport time on E. coli counts in river waters and raw sewage.

Sample Sites

Three river sites were chosen for collection of samples for E. coli analysis – the Waikato River at Wellington Street, Hamilton East, the Waipa River at Ngaruawahia and the Tukituki River (Red Bridge) at Havelock North. A raw sewage effluent from the Ruakura Research Station, Hamilton was also sampled. Samples were collected during February, March and April 2011 and taken back to the NIWA Water Quality Laboratory as quickly as possible for analysis.

Sampling Procedure

Samples were collected from the right banks of the Waikato and Waipa Rivers using a 10L plastic bucket. The Tukituki River samples were collected from midstream with a 2L bucket attached to a long cord being lowered from the bridge four times and each aliquot collected into the 10L bucket. Both the 2L and 10L buckets had been treated with 4% sodium hypochlorite solution followed by six rinses with RO/DI (town supply water purified by passing through a reverse osmosis membrane followed by Ion Exchange cartridges) prior to being used. When travelling to sites the buckets were covered with aluminium foil to prevent contamination. The buckets were rinsed three times with the sample to be collected and then filled as much as possible. The liquid was stirred constantly with a glass rod (pre-treated with hypochlorite) while the samples were being collected. The sample collector wore latex gloves and plunged the sample bottle (plastic sterile 100mL container) below the water surface and allowed the container to fill, leaving 25–50mm of air space in the top. For each river site 37 100mL samples were collected (35 for analysis plus two spare in case of breakage).

The Ruakura raw sewage was collected directly into the 100mL sterile bottle from the outlet pipe at the NIWA treatment ponds leaving a 25–50mm headspace in the top of the container. Two containers of sample were required for each 72 hour experiment (one being a spare in case of breakage). Immediately following collection the samples were placed in a 45L Rubbermaid chilly bin containing a 3.5kg bag of ice ('party ice' available from local garages) to keep the samples chilled. These bins were returned to the laboratory as quickly as possible after collection and analysed immediately. Delivery times to the laboratory were within two hours for the local sites (Waikato River, Waipa River and Ruakura raw sewage) while the return trip from the Tukituki River site took approximately five hours.

HOBO temperature loggers (HOBO Pro v2) were placed inside the chilly bins (under the lid and in the bottom) and also on top of the lid in order to assess the chilling of the samples with reference to ambient temperatures. Due to the limited number of temperature loggers only two chilly bins were used for each experiment.

Experimental Programme

The procedure used is as follows:

Experiment (Exp)	Design
1. Waikato River 2. Waipa River 3. Tukituki River 4. Ruakura raw sewage	Ice left in bag, samples stored in the Water Quality Laboratory (WQL)
5. Waikato River 6. Waikato River 7. Ruakura raw sewage	Ice dispersed, samples stored in the WQL Ice left in bag, samples stored in the WQL Ice dispersed, sample stored in the WQL
8. Ruakura raw sewage 9. Waikato River	Ice left in bag, samples stored in the bike shed

Notes

Experiments 4, 5, 6 and 7

While the vast majority of NRWQN E. coli samples that the Hamilton Water Quality Laboratory receives have been put into chilly bins where the ice is left in its bag, in some cases the sample collectors break open the bag and disperse the ice around the samples. Testing was carried out to see if either technique had any influence on the results obtained when samples are stored for up to 72 hours.

Experiments 8 and 9

If water samples are delayed in transit they may be stored in a courier depot until delivery can be completed. In such cases they may be subjected to a greater temperature variation than in the NIWA Hamilton Water Quality Laboratory. Waikato River water and Ruakura raw sewage samples were therefore collected and stored in the bike shed on the NIWA Hamilton campus in order to simulate conditions in a courier depot. The shed has little insulation and it is well known that high temperatures are reached inside it during summer.

Analysis

A sample volume of 100mL was mixed with the Colilert reagent, poured into the Colilert tray and sealed the tray with the Colilert sealer. The sealed Colilert trays were placed in a 35°C incubator. After 24 hours the number of large and small wells for each plate that fluoresced under UV light was recorded and the data put into the manufacturer's table to estimate the MPN.

At each of the time intervals chosen (immediately upon return to the lab (T0) and six hours (T6), 12 hours (T12), 24 hours (T24), 36 hours (T36), 48 hours (T48) and 72 hours (T72) after T0) five replicates of the samples were analysed. Each of the river samples were analysed 'straight' i.e., 100mL of sample undiluted was poured into the plate. For the Ruakura raw sewage samples 1,000 times and 10,000 times dilutions were required to obtain acceptable counts using the Colilert method. Following the initial analysis the remaining samples were kept in chilly bins and placed in the NIWA Hamilton Water Quality Laboratory for storage except for one experiment (to determine the effects of a higher ambient storage temperature) where the chilly bins were placed in the staff bike shed on the NIWA Hamilton campus.

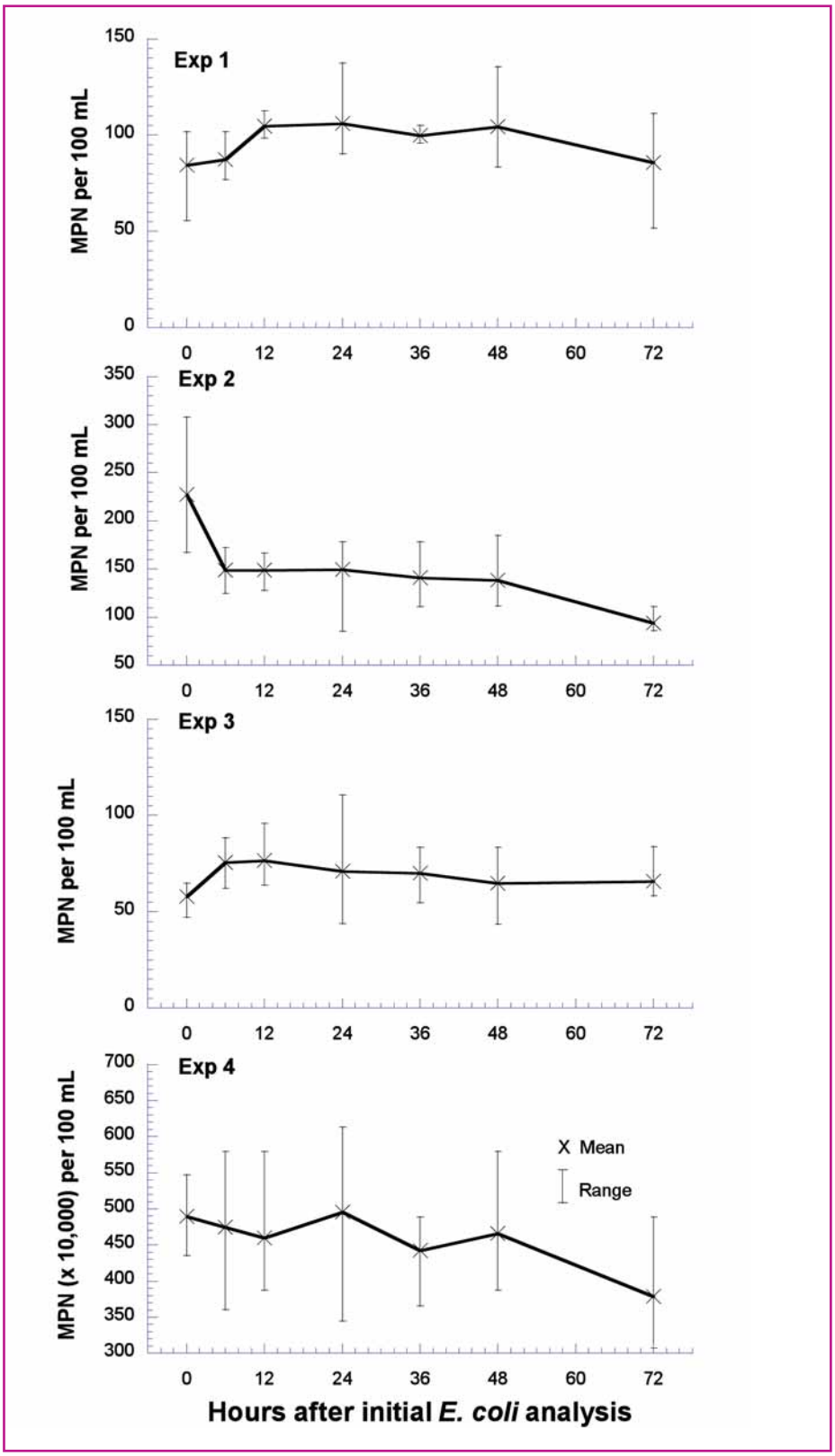

Figure 1 – E. coli counts versus time for: Exp 1, Waikato River samples; Exp 2, Waipa River samples; Exp 3, Tukituki River samples; Exp 4, Ruakura raw sewage sample

Results

Experiments 1, 2 and 3 show the effects of storage on E. coli counts for the river sites. No substantial change in E. coli counts was observed for the Waikato and Tukituki River samples stored up to 72 hours after the initial testing of the samples upon receipt at the laboratory. The Waipa River results showed a substantial decrease in E.coli counts from T0 to T72 largely due to the decrease from T0 to T6 hours. The results were similar from

"The Waipa River results showed a substantial decrease in E.coli counts from T0 to T72 largely due to the decrease from T0 to T6 hours. The results were similar from T6 to T72. The E. coli counts for the Ruakura raw sewage sample (Exp 4) showed no substantial change after 72 hours in storage."

T6 to T72. The E. coli counts for the Ruakura raw sewage sample (Exp 4) showed no substantial change after 72 hours in storage.

Figure 2 shows the temperature plots as measured by the HOBO temperature loggers for Exp 1. Loggers were placed in each of the bins used in all experiments and similar responses were observed. In each of the chilly bins used for Exp 1–4 the coolant was one 3.5kg bag of ice placed intact in the bin. Temperatures in the bottom of the chilly bins dropped to about 5°C to 7°C when ice was added and reached 10°C (the maximum transport temperature recommended by APHA) after 30–40 hours in storage. Ambient room temperatures ranged from 15°C to 23°C.

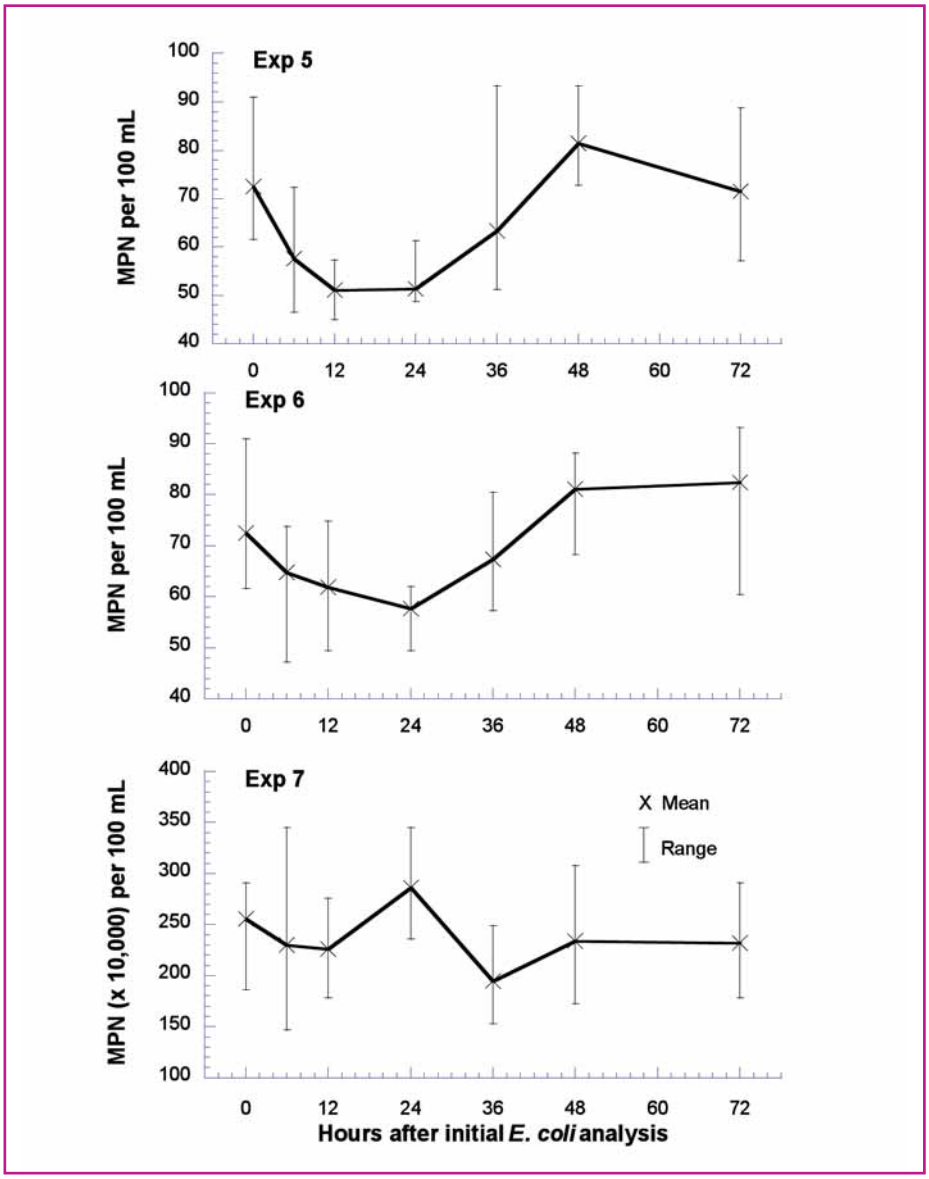

Figure 3 – E.coli counts versus Time for: Exp 5, Waikato River samples (ice dispersed); Exp 6, Waikato River samples (ice left in bag); Exp 7, Ruakura raw sewage sample (ice dispersed)

Figure 2 – Temperature log for Waikato River samples

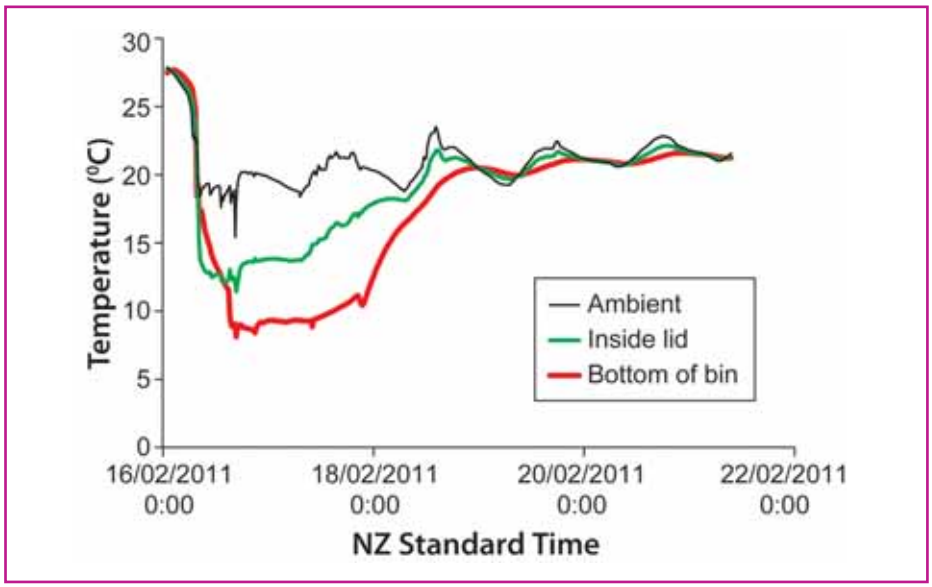

Figure 3 (Exp 5, 6 and 7) and Figure 1 (Exp 4) show E.coli results for Waikato River and Ruakura raw sewage samples where the ice was either left in its bag or broken up and spread around the samples.

The Waikato River and Ruakura raw sewage samples gave no substantial change in E. coli results over 72 hours storage time irrespective of whether the ice coolant was left in its bag or broken up and dispersed around the samples. The E. coli counts in the two Ruakura raw sewage samples had substantially different initial (T0) E. coli values. Sampling was carried out by allowing the sewage to flow to waste for a few minutes and collecting the samples consecutively. It appears the E. coli concentration in the sewage was changing during sampling. In both chilly bins where the ice was broken up and dispersed around the samples the minimum temperatures recorded by the HOBO loggers were lower than in the bins where

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"The Waikato River and Ruakura raw sewage samples gave no substantial change in E. coli results over 72 hours storage time irrespective of whether the ice coolant was left in its bag or broken up and dispersed around the samples. The E. coli counts in the two Ruakura raw sewage samples had substantially different initial (T0) E. coli values."

the ice was left in its bag (0.5°C and 0.7°C versus 3.8°C and 2.0°C). The time taken for the temperature in the bottom of the chilly bin to reach 10°C was similar in three of the bins (32–34 hours) with the bin containing Ruakura raw sewage (ice left in the bag) taking 40 hours to reach 10°C. The ambient room temperature for these experiments varied between 15–24°C.

E. coli testing of Waikato River and Ruakura raw sewage samples stored in the bike shed gave consistent E. coli results up to 48 hours after the initial analysis and then showed a substantial decrease when analysed after 72 hours in storage (refer Figure 4).

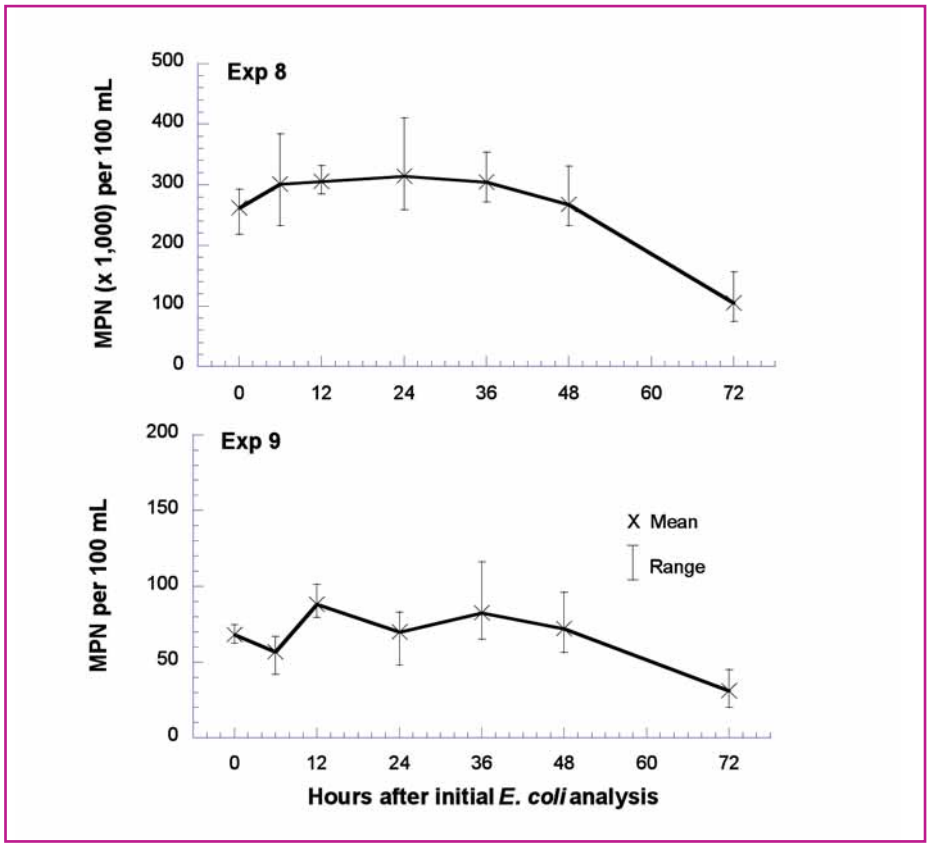
The HOBO temperature logger plots show the time taken for the temperature in the bottom of the chilly bin to reach 10°C was 29 and 36 hours for the Waikato River and Ruakura raw sewage samples respectively. Ambient room temperatures ranged between 13–33°C.

Conclusions

This article has discussed the effects of transport time and storage on river waters and raw sewage analysed for E. coli. The main points observed during this testing were:

a. That a 3.5kg bag of ice placed in a 45L chilly bin is sufficient to keep river and raw sewage samples chilled to <10°C for up to a maximum of about 40 hours following collection while the chilly bin is stored at ambient temperatures between 15–23°C. The lid must be kept closed for this storage time.
b. That under these conditions, river and raw sewage samples analysed for E. coli showed no substantial differences in counts when analysed up to 72 hours after receipt at the laboratory.
c. That although APHA recommends a maximum temperature for storage of water samples in transit of 10°C this temperature was reached between 30–40 hours after ice was added to the chilly bins. No substantial differences in E. coli counts were observed for samples analysed 48 and 72 hours after receipt at the laboratory where sample temperatures were between 15–18°C.
d. That when the ambient storage temperature was increased (13–33°) river and raw sewage samples analysed for E. coli showed no substantial differences in counts when stored up to 48 hours after receipt at the laboratory. After 72 hours in storage E. coli counts showed a substantial decrease when compared to E. coli counts for samples stored up to 48 hours. ■

Figure 4 – E. coli counts versus time for: Exp 8, Ruakura raw sewage sample (stored in bike shed); Exp 9, Waikato River samples (stored in bike shed)



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Stormwater Design Challenges – Hampton Downs Motorsport Park

Dr Sean Finnigan – Senior Environmental Engineer & Associate, Fraser Thomas Ltd

Introduction

The Hampton Downs Motorsport Park is based on the concept of a 'motorsport town' and was the dream of two kiwi motorsport enthusiasts. Fraser Thomas Ltd (FTL) has managed this project from inception through consenting and implementation and has undertaken the majority of the engineering design work. It has been an exciting and challenging project on many levels with a dynamic brief, difficult sub-soil and weather conditions, tight timeframes and financial pressures requiring an intensely responsive design approach.

This article describes the stormwater design challenges involved in consenting and constructing this new and unique motorsport complex and associated Business Park, covering some 90ha of land at Hampton Downs, North Waikato. The stormwater work involved development of guidelines for stormwater control, treatment and monitoring requirements; determination of hydrological characteristics of the relevant catchments; detailed design of stormwater conveyance, treatment and detention measures; environmental effects assessment and development of associated risk management and mitigation measures and the preparation of a comprehensive Stormwater Management Plan to address the above aspects.

Background

The Motorsport Park site is located between State Highway 1 and the Waikato River, 4km south of Meremere, and is constructed on former grazing land, which included significant areas of low lying flats, extensively drained by a network of excavated drains some 1.5m deep.

The motorsport circuit is being developed within a sub-catchment of the Waipapa stream and occupies a total area of 69.2ha ('motorsport catchment'). It comprises an approximately 3.8km motorsport circuit with pit garages and associated ancillary facilities, including spectator seating, convention centre/restaurant, driver training school, concrete skid pan, apartment blocks and carparking etc. The existing topography has largely been preserved, with stormwater piped under the racetrack where necessary. However, stormwater sub-catchments within the main complex have been significantly modified, primarily due to the presence of the racetrack running through the catchment.

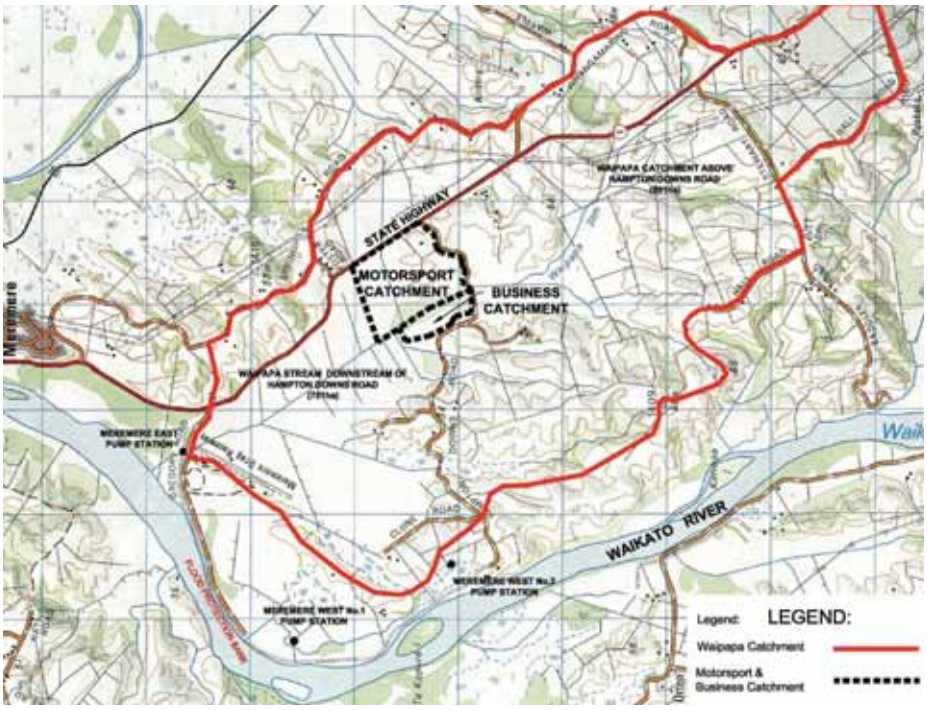
The Business Park is being developed immediately west of the Motorsport Park and occupies a total area of 16.6ha ('business catchment'). Structural fill has been placed on it to raise the ground level to generally achieve the 1% AEP (annual exceedance probability) minimum floor level, whilst the ground will be contoured to ensure the site continues to drain to the Waipapa Stream via engineered grassed swales. The Business Park will be used for light industrial activities that will generally support motorsport park activities.

The Waipapa Stream is the receiving environment for stormwater runoff from the Motorsport Park. The stream and its tributaries are highly modified by agricultural practices and flood control works, with the aquatic biological resources (i.e. low macroinvertebrate community scores and low fish diversity) reflecting the nature of these impacts on the physical habitats that remain.

The relative locations of these catchments and the site location are shown on Figure 1, while Figure 2 provides a schematic plan of the development.

"This area posed some specific design challenges, relating to providing for the collection and treatment of stormwater runoff from the track pits area, where race cars would be routinely stopping for refuelling, tyre changes and servicing, etc. Various drainage collection options were investigated for this area, leading to selection of the Gatic slot drainage system as the preferred option, followed by treatment in an Ecosep grit/oil separator."

Figure 1 – Waipapa Stream Catchment and Site Location Plan



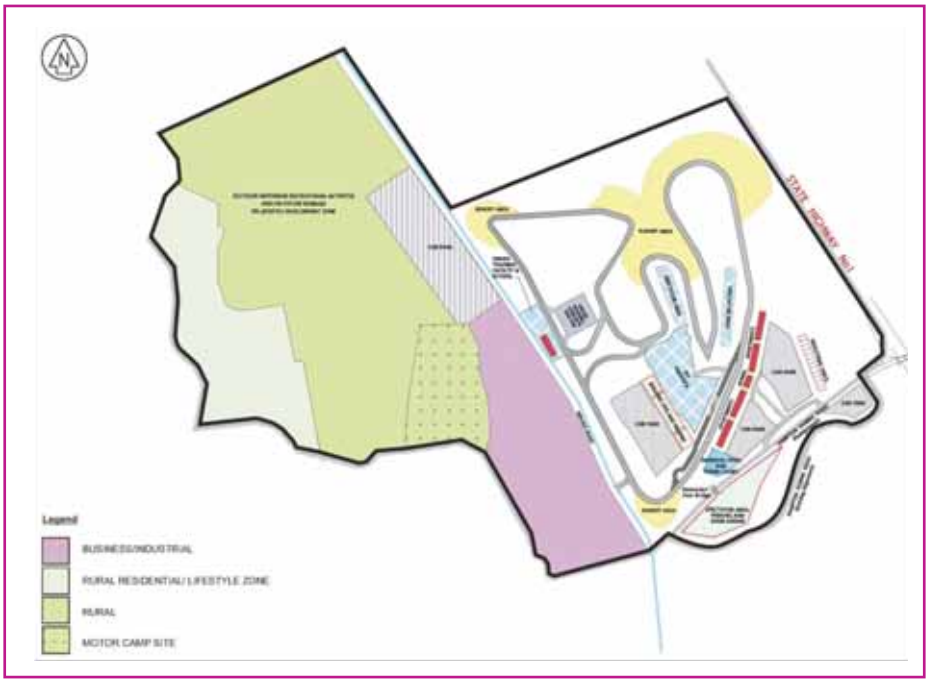


Figure 2 – Motorsport Park – Schematic Plan

GP Farms purchased the site in December 2003. The consenting process began in mid-2004, with both Waikato Regional and District Council consents being granted in November 2006.

Earthworks began in February 2007, with one of the major challenges being the occurrence of large areas of soft soils, predominantly peat, which required preloading involving 220,000m^3 of cut/fill in low lying areas of the circuit to induce consolidation. A second major challenge involved winter works through two of the wettest winters of the decade, due to very tight time and financial constraints.

Construction of the motorsport complex and associated stormwater system was largely completed in October 2009, with the track officially opened in January 2010. It has been in heavy use since then. A proposed future extension of the track is to be constructed along with the Business Park in the near future.

Stormwater Management Principles

Effective stormwater treatment and detention is provided for both the motorsport and business catchments through the adoption of a 'treatment train' approach, targeting the removal of litter, grease/oil and other hydrocarbons, suspended solids and heavy metals (e.g. from racing car tyres, brake linings, etc.) from stormwater runoff, using suitable devices such as grit/oil separators, swales and wetlands.

National circuit opened 24 January 2010

Stormwater management measures have been designed in accordance with Waikato and Auckland Regional Council (ARC) guidelines to satisfy stormwater quantity, quality and channel protection requirements, ensuring that post-development flows do not exceed pre-development flows; sediment and other contaminants are adequately removed; and downstream erosion of the Waipapa stream does not increase.

Appropriate spill containment and emergency equipment and facilities are being provided to deal with any incidents that may contaminate stormwater runoff within the development, while appropriate stormwater monitoring requirements have also been formulated. The Stormwater Management Plan developed from these principles, was approved by Waikato Regional and District Councils in November 2008.

Stormwater Management System

An overview of the stormwater management system is provided in Table 1.

Table 1 – Stormwater Management System Details

Catchment	Description	Catchment Area (ha) (Imp, %)	Swale	Wetland			Other	Discharge Point
				Treatment	Detention	Area (ha), Volume (m^3)		
A	Industrial units, carparking, possible future kart track	12.8ha (48%)	Yes	Yes	Yes	0.90ha; 8,610m^3		Perimeter open channel drain along eastern boundary
B	Significant portion of circuit, apartments, most of spectator/ carparking areas, pits	18.6ha (51%)	Yes	Yes	Yes	Two (B2, B3) 3.11ha, 20,630m^3	Ecosep grit/oil interceptor for pit drainage	Perimeter open channel drain along northern boundary
C	Significant portion of circuit, large carparking/ showroom area	18.5ha (43%)	Yes	Yes	Yes	C2: 0.63ha, 5,330m^3; C3+C4: 3.55ha, 22,300m^3)		Perimeter open channel drain along northern boundary
D	Reception/ conference centre and showroom/ carparking area	4.8ha (67%)	Yes	No	No			Waipapa Stream
E	Part circuit, driver training facility/school	11.9ha (27%)	Yes	Yes	No	0.44ha; 1,580m^3		Waipapa Stream
H	Carparking	1.5ha (64%)	Yes	No	No	0.09ha, 780m^3		Table drain along Hampton Downs Rd
I	Business park	16.6ha (79%)	Yes	Yes	Yes	Two: I1: 0.93ha, 5,850m^3; I2: 1.13ha, 11,890m^3		Waipapa Stream

Note: Impervious percentages include allowance for the wetland surface area as impervious cover.

Conventional Drainage

Conventional drainage systems comprising concrete kerb and channel, open drains and piped reticulation complement the swale drainage network, with the former being installed in areas where swales are not suitable or due to other design constraints.

Pit Drainage – Slot Drains and Grit/Oil Removal

This area posed some specific design challenges, relating to providing for the collection and treatment of stormwater runoff from the track pits area, where race cars would be routinely stopping for refuelling, tyre changes and servicing, etc. Various drainage collection options were investigated for this area, leading to selection of the Gatic slot drainage system as the preferred option, followed by treatment in an Ecosep grit/oil separator.

The Gatic slot drainage system comprises individual 3m long units with a narrow 10mm wide slot at the top and an underlying hexagonal drainage section or variable width (100–300mm), as shown in Figure 3.

This system has a number of specific characteristics making it suitable for this application, including safety (single unit of minimal surface area with no removable components), efficient drainage, low cost installation, durability and ease of maintenance. Overall, it was considered a functional, practical and elegant solution, albeit at higher cost compared with other similar systems and GP Farms strongly endorsed this selection.

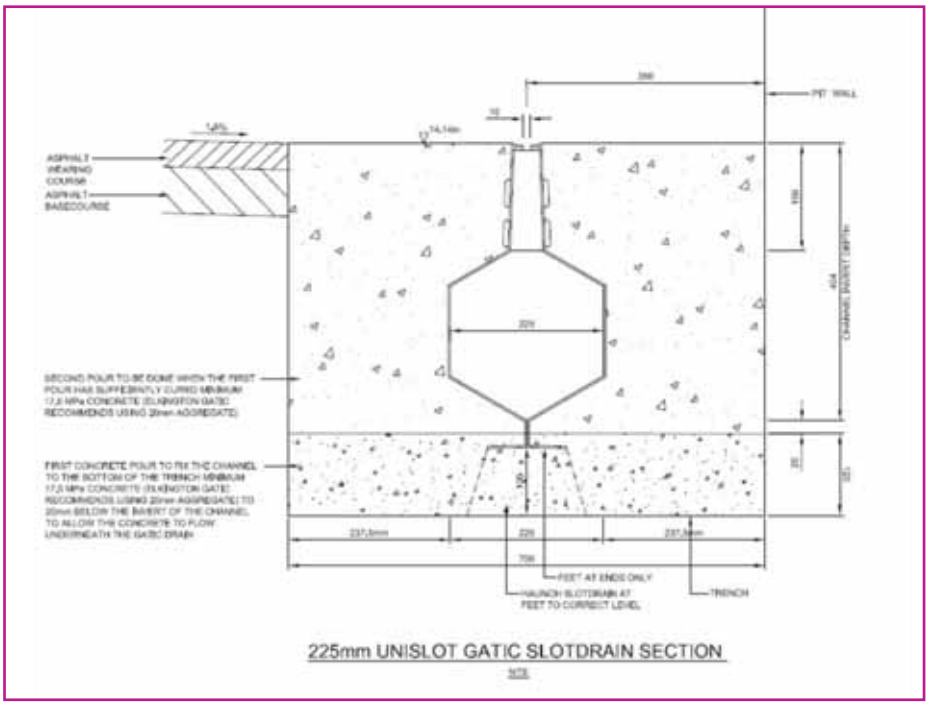


Figure 3 – Gatic Slot Drain Section

However, the supplier then advised that the only available Gatic drainage in New Zealand would be sufficient to collect

"The wetlands are all located near the bottom of their respective catchments and provide water quantity, water quality and erosion control functions."

up to approximately the 2 year storm event and it would take 6–8 weeks to import larger capacity drains from Europe, which was not acceptable to GP Farms. Hence, a specific overland flow/flooding analysis was undertaken of larger storm events for the pit lane geometry, which found that ponding of up to 20–30mm might occur in the 100 year event, which gave a freeboard to the pits building of 170mm, which was considered acceptable. This assessment together with it being unlikely to hold a race event during storm events of 50mm/h or more gave GP Farms sufficient confidence to proceed with this system. However, the importance of maintaining an overland flowpath from the pit lane was reinforced and incorporated more strongly into the drainage system design. The slot drainage system has been installed and is now operational.

The NS-10 Ecosep system was recommended for the pits area, comprising a two chamber grit and oil separator, capable of treating flows up to 10L/s and achieving separation of oil and water to 5ppm. Heavy duty lids were specified, due to this device being located in a trafficable area, while a high flow bypass also had to be provided with very tight tolerances for the pipes and Ecosep system to the Pits building. This has been installed and in operation for some time without any problems.

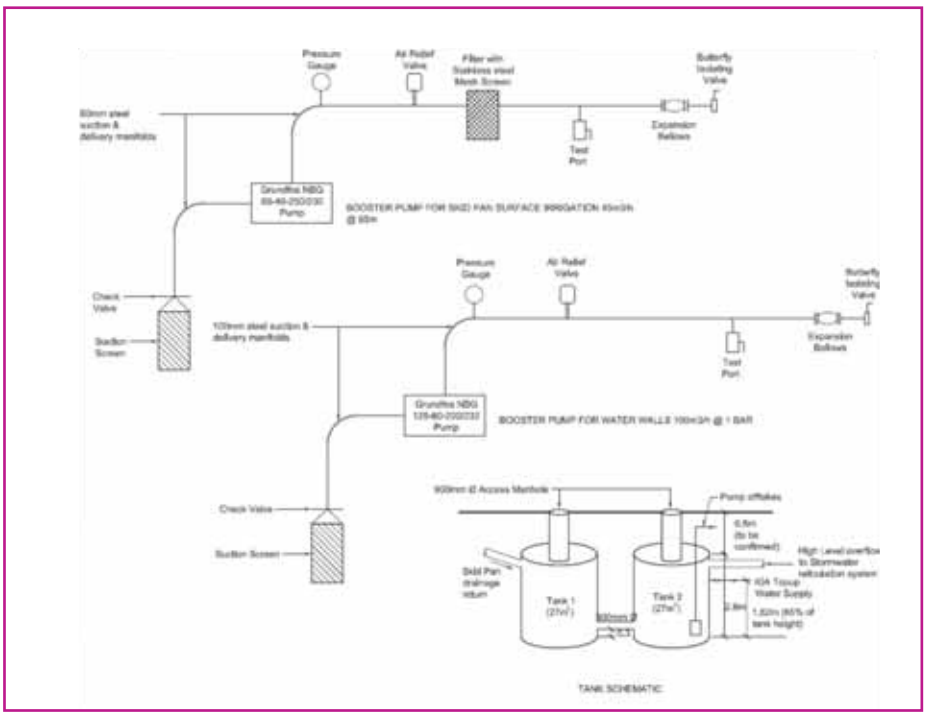
Skid Pan Runoff Capture and Reuse

The skid pan comprises a large, paved area (~0.50ha) forming a U-shaped circuit where drivers can be trained in car manoeuvres in controlled wet or aquaplane conditions. The concept was based on incorporating a number of water walls into the skidpan to create a 'chicane' for cars to drive through and perimeter water sprinklers to maintain a shallow film of water across the skidpan surface to provide ideal aquaplane conditions.

Skid pan design incorporated a water reuse system, whereby the skid pan grades at 0.5–1.0% to one end, where surface runoff is collected in catchpits and conveyed to underground storage tanks, from where it is pumped on demand to two water walls and perimeter water sprinklers, as shown in Figure 4.

Analysis of this system involved undertaking a detailed water balance, taking into account the facility operating regime (20 days/month, 4h/day over 6 month summer season), average monthly rainfall, the variable demands of the water walls (10s per min at 100m^3/hr) and sprinklers (3min on, 10min off at 45m^3/hr) and estimated evaporative/windblown losses of 65%. This analysis determined the optimum tank storage to comprise two 27m^3 tanks, with "topup" from the water supply system kicking in when the water level drops to 65% of tank capacity.

Figure 4 – Skid Pan Stormwater Reuse System Schematic



Runoff reuse may reduce water topup requirements by around 590m^3/yr (25% of total topup water), resulting in significant cost savings to the Motorsport complex, as they have to pay for the topup water, which is sourced from the Te Kauwhata Irrigation Society's screened non-potable water supply system.

Swales

The swales have a dual function. The bottom 100mm portion is designed for treatment of the 'water quality volume' storm to ARC TP10 standards, while the entire swale itself is designed for conveyance of both primary and secondary stormwater flows (i.e. 1% AEP storms from the contributing catchment). Swales were also designed for safety considerations, so that the product of velocity x flow depth[1] for the 1% AEP storm was less than 0.4m^2/s. Scour/erosion protection measures were provided at swale discharge points.

Wetlands

The wetlands are all located near the bottom of their respective catchments and provide water quantity, water quality and erosion control functions. They include a sediment forebay for stormwater treatment and permanent water quality volume with banded bathymetry (i.e. alternating shallow and deep sections) and live storage to provide extended detention and storm peak flow attenuation. In terms of water quality, these wetlands provide contingency treatment and adsorption of any residual contaminants from upgradient areas served by swales as well as treating runoff from their respective direct contributing catchments. The wetland system is shown on Figure 5. The wetland area is 10.8ha, with a total volume of 77,000m^3.

Wetland detention was not provided in all sub-catchments, as this was not practical. Instead, wetlands B, C and I2 were oversized to compensate for the lack of detention elsewhere, with HMS modelling being undertaken to check the design objectives were achieved.

Wetlands B2 and C3 are located within the circuit, which acts as the wetland embankment in each case, with modelling demonstrating that peak water levels should be maintained well clear of the track. These wetlands are joined to wetlands B3 and C4 by flow balancing pipes due to hydraulic constraints, so that

Figure 5 – Swale and Wetland Stormwater Management Measures

wetlands B2+B3 and C3+C4 are essentially single wetlands.

Wetland design had to take into account the track layout and safety concerns over vehicles 'flying' off the track into the wetlands. Safety barriers comprising tyre walls and Armco barriers have been installed around the track in strategic locations to minimise this potential, while the permanent water areas, particularly the deeper sections, have been located behind these barriers as much as practical to further reduce the associated safety hazard.

Motorsport Circuit Wetlands: top – Wetland B WQV, above – Wetland E Forebay

Overland Flowpaths

In general, the swale and wetland system forms the overland flowpath network through the Motorsport Park, with 1% AEP flows being piped under the track in critical locations. The main piped reticulation system serving catchment B is also sized to take the 1% AEP flows. No overland flows will occur across the motorsport track up to and including the 1% AEP event.

Hydrology

A HEC-HMS model was set up for the motorsport, business and Waipapa stream catchments, with peak flows and volumes calculated using the ARC TP108/TP10 SCS methodology employing rainfall data for the site sourced from HIRDs v2.

Peak Flows and Volumes

Modelling predicted post-development, unattenuated flows from the motorsport/business catchments to be some 2.3–3.3 times greater than pre-development flows, primarily due to the large increase in the imperviousness of the motorsport catchment from 1% to 45% and of the business catchment from 0% to 79%. However, modelling showed that the combined wetland system would reduce peak flows to 74–93% of pre-development levels, primarily due to the detention storage provided for catchments B, C and I.

Combined motorsport/business catchment pre-development peak flows constitute a significant proportion (6.7–7.1%) of total Waipapa catchment peak flows, reducing to 5.1–6.6% post-development. Hence, it can be expected that development of the Motorsport Park with the wetland detention measures proposed should lead to a small but measurable reduction in peak flows in the Waipapa stream catchment.

"Motorsport circuits have the potential for incidents that may result in the release of large quantities of contaminants that could potentially enter the stormwater system. The main incidents of concern in this context relate to hydrocarbon spills (e.g. fuel, oil) along the race circuit and associated areas, particularly the pits, resulting from human error, mechanical problems, accidents, etc."

Modelling predicted that while motorsport and business catchment post-development storm volumes are likely to increase by as much as 1.4–2.0 times for different storm events, these flows will be discharged over at least a 2.5 times longer time period of 60h, compared with pre-development (24h), resulting in the post-development storm volumes within any 24h period being smaller than for pre-development.

The combined effects of peak flow reduction and delayed volume discharges should slightly improve the flooding situation which occurs at times on the Flats in the lower Waipapa stream, as the pump stations controlling stormwater discharges from this area (described below) effectively have to deal with less stormwater within a 24 hour period.

Flooding of the Waipapa Flats

A flood protection bank which runs from State Highway 1 along the true right bank of the Waikato River to the end of Hampton Downs Rd, prevents the flooding by the Waikato River of the land to the east of the flood protection bank. The flood protection bank contains two separate drainage schemes, with the Motorsport Park located within the Meremere East Drainage Scheme, which contains the Waipapa Stream catchment.

This catchment, as shown on Figure 1, is approximately 19.9km^2 in area, 9,000m in length and gently sloping (0.61%). It is intensively farmed and has highly modified drainage. Approximately a third of the catchment comprises low lying flats through which drainage channels have been constructed, particularly in the area downstream of Hampton Downs Road.

The natural low level of the land coupled to land settlement that has resulted from the farming and drainage activities, precludes a gravity outlet to the Waikato River and all water is required to be discharged by pumping. The main pump station (Meremere East pump station) is located on the Waipapa Stream adjacent to the Meremere Drag Raceway. Waikato Regional Council have advised that the stopbank crest level opposite the Meremere East pump station is 7.42 (Moturiki datum[2]), as surveyed in 1998. Back drainage of the Waikato River into the Flats is prevented by flap gates on the discharge pipes from the pumps. The embankment and pump station were built as part of the Lower Waikato and Waipa Flood Control Scheme. Hence, any flooding which occurs in the area is from the Waipapa Stream itself and not the Waikato River.

A detailed flooding assessment was undertaken of this area, involving a topographical analysis and consideration of pumped outflows from the Flats area. This study estimated the 1% AEP flood levels to be:

- 3.71m (pumps off, no initial ponding)
- 3.60m (pumps on, no initial ponding)

This assessment recommended adopting the more conservative 3.71m RL flood level for the Flats and this was accepted by Waikato Regional and District Councils. The implications of the 3.71m RL 1% AEP flood level on the Motorsport and Business catchments are that stormwater is expected to back up within the main wetlands – A, B2, B3, C3, C4, I1 and I2, with all of these wetlands except for I1 having significant surplus capacity.

The motorsport circuit itself should not be overtopped (4.0m RL), while all buildings and other important infrastructure (e.g. carparks) are located above 4.0m RL and hence should be protected from flooding.

Hence, no additional measures were proposed to protect the stormwater management system or the Motorsport Park from such flooding events.

Motorsport Complex Management

Operation and Maintenance

An Operation and Maintenance (O&M) Manual is to be prepared for the Motorsport Park stormwater management system on completion of construction, in accordance with consent requirements. The O&M manual will form part of an Environmental Management Plan for the site, which will also include a site specific Spill Response Plan.

Incidents and Emergency Events

Motorsport circuits have the potential for incidents that may result in the release of large quantities of contaminants that could potentially enter the stormwater system. The main incidents of concern in this context relate to hydrocarbon spills (e.g. fuel, oil) along the race circuit and associated areas, particularly the pits, resulting from human error, mechanical problems, accidents, etc.

Stormwater management facilities are equipped with hydrocarbon removal facilities as near to the source as possible and within the wetland forebays. In addition, spillage containment facilities have been provided around the motorsport park

"Most of the proposed stormwater management measures have now been constructed and are in operation. The stormwater system is understood to be working well and there have been no non-compliance issues to date."

at appropriate locations, including in the pit areas and at critical road sections. Spillages will be dealt with using 'dry' methods, where practicable, avoiding hosing down contaminants into the stormwater system. Motorsport Park staff have been trained in how to handle any incidents so as to avoid stormwater contamination.

Monitoring and Contingency Measures

Consent conditions require that there shall be no conspicuous oil, grease, scums or foams present after reasonable mixing, in any permanently flowing watercourse, as a result of the exercise of this consent and that the discharge shall not contain concentrations of hazardous substances that may cause significant adverse effects on aquatic life or the suitability of the water for human consumption after treatment. The point of compliance is the combined discharge from wetlands A, B and C to the perimeter open channel drain.

Routine and non-routine monitoring systems were developed along with corresponding mitigation and contingency measures in response to these conditions.

Conclusions

The motorsport development presented a dynamic and unique stormwater problem, requiring the application of both conventional and low impact stormwater design methods and the application of first principles in working through some of the finer details. It has been an exciting and challenging project to work on that was developed in a very dynamic way.

Most of the proposed stormwater management measures have now been constructed and are in operation. The stormwater system is understood to be working well and there have been no non-compliance issues to date. ■

References

Auckland Regional Council, Technical Publication 10 (TP10), second edition, May 2003

Fraser Thomas Ltd (November 2008), "Hampton Motorsport Park – Stormwater Management Plan", Version 2, report prepared for GP Farms Ltd

Kingett Mitchell Ltd (September 2004), "Hampton Downs Proposed Motorsport Park – Freshwater Ecology Report"

New South Wales Government (2001), "Floodplain Management Manual: the Management of Flood Liable Land"

Footnotes

1 This can be derived from the NSW Floodplain Management Manual (2001) and strictly is applicable for flood depths of up to 0.2m, although it is in use by some Councils in New Zealand as a more general guideline without an upper limit.

2 Moturiki datum can be converted to Auckland datum by subtracting 9mm.

Customer Demand Management – Models for Delivery

Gord Stewart – Director, AQUAS Consultants Ltd

One size does not fit all when it comes to promoting efficient water use. The district, city, and regional efforts described here show that various approaches are possible when implementing customer demand management programmes.

Regulations, education and financial incentives all have a part to play in changing water use attitudes and practices of residents and businesses. Councils should use measures and instruments that meet their particular needs and tailor them to suit the local situation.

Getting to Grips with Gardening

Kapiti Coast District Council's Sustainable Water Use Strategy 2003 embraced demand management as an integral part of water supply services. The Strategy set per capita peak water use targets which have served as a design assumption for capital works and operations.

The strategy also confirmed water use drivers in the district and Council has refined its water conservation programme accordingly. Unlike other coastal areas where water use spikes during holiday periods with the influx of seasonal residents and visitors, demand on the Kapiti Coast is significant in the late spring and early summer.

"We have a large retired population in the district," says Ben Thompson, the Council's Water Use Coordinator. "Gardening is a popular activity and much of the soil around the district doesn't retain water very well. Add to this wind in areas that aren't sheltered and the choice of plants and grasses and it all means pretty significant outdoor water use."

District Plan Change 75, adopted in 2009, was an innovative response to this. It requires all new households on reticulated supply to include onsite systems for non-potable water for toilet flushing and outdoor use.

Homes can have either a 10,000 litre tank for outdoor use and toilet flushing or a 4,000 litre tank for the same uses, plus a greywater reuse system for garden irrigation. If residents have an alternative solution they prefer, they can propose it through the discretionary consent process. The solution of choice has been the 10,000 litre tank.

Kapiti Coast efforts now include a range of activities, services, regulations and incentives, all set out in their Water Conservation Plan adopted in September 2010.

As water use 'champion' within the Council, Thompson is charged with spearheading implementation of the plan. He is a part of the Council's Strategies and Partnerships Group and reports to the Sustainable Development Manager. He works across council, in the community and with industry to support efforts to bring about change.

"We don't just get on a soap box about conserving water," says Thompson. "We take a practical approach and strive to offer useful resources and services."

Two of these would be their 'Green Plumber' and 'Green Gardener' services. Another would be their work in schools, delivered by a part-time Water Education Advisor.

The 'Green Plumber' is, in fact, a retired plumber now working part-time for the council, with his involvement modelled on Tauranga City Council's domestic water advisory service. Along with replacing leaking tap washers, installing inexpensive water-saving devices and giving advice, he assists customers required to repair a leak under the Water Supply Bylaw 2010.

"The emphasis was on efficient water use, with assistance provided to residential customers for repair of internal leaks and installation of simple water-saving devices (such as a cistern weight for old, single-flush toilets). The Waterline programme continues today with a broader three waters approach and an emphasis on providing self-help tools for customers."

The 'Green Gardener' also does home visits, in her case offering landscaping advice to suit residents' needs and expectations. She will also provide advice to residents wishing to apply for an interest-free loan from the Council for the purchase and installation of an onsite system for non-potable water (choices include a 5,000 or 10,000 litre tank or a greywater diversion device). This financial incentive, launching in the spring, allows for repayment of the loan as a targeted rate on the property over 10 years.

The Green Plumber and Green Gardener are both on hand at the Sustainable Home and Garden Show, an annual late-March event running since 2005. It's billed as a 'place to obtain good advice, good ideas and suitable water-saving products for the home and garden.'

Recognising the potential of metering and volume pricing to help achieve water use targets, the Council recently established a Charging Regime Advisory Group. Key issues they will address are; how much will it cost, how effective will it be and what pricing structure will be equitable and get the savings desired. The group is to report back to the Council by June next year.

Beyond customer water use, the plan addresses a number of other initiatives, including the Council's own water use, system leaks and losses, and monitoring and reporting ('Better data, better

Left – Kapiti Coast's Sustainable Home and Garden Show provides a perfect setting for hands-on education, Right – Tauranga's Source to Sea Advisors are easily identified driving their 'tap' cars around town

results'). The full plan can be viewed on the Council's website. The *Helpful Information* section below notes the link.

Pay As You Go

While Tauranga City Council is a 'poster child' for successful implementation of universal metering and volume pricing, demand management efforts started out with a focus on education. The Waterline Educational Programme was launched in 1997, six years prior to universal metering.

The emphasis was on efficient water use, with assistance provided to residential customers for repair of internal leaks and installation of simple water-saving devices (such as a cistern weight for old, single-flush toilets). The Waterline programme continues today with a broader three waters approach and an emphasis on providing self-help tools for customers.

But, first, more on metering. Tauranga is a growing city of 110,000. Population has doubled in the last 20 years, is projected to double again by 2050 and it's a popular holiday destination.

"With this, there was a real concern about runaway demand and the costs of providing greater capacity," says Peter Bahrs, Water Supply Manager in Tauranga's City Waters division. "Other drivers for metering included the overarching requirement of the RMA to manage water sustainably and the desire for fairness and equity – consumers should only pay for what they use. Finally, meters would provide a mechanism for measuring and managing demand."

And manage demand it has! The combined impact of universal metering and Waterline educational efforts include:

- Reduction in peak demand of 30%
- Reduction in average demand of 25%, with residential average day use now at 197 l/p/d
- Corresponding reduction in wastewater volumes, easing pressure on the city for renewal of discharge consents
- No summer water restrictions since metering (required annually prior to), in spite of a 27% increase in population during the period
- Deferment of water and wastewater infrastructure capital costs, with average savings 2002 to 2032 estimated at $4.7 million per year

"Metering and education go hand-in-hand," says Christine Keith, Waterline Education Coordinator. "Our efforts to change water use practices are more successful because of the financial incentive for conservation."

Joining Keith on the Waterline team are a full-time Source to Sea Advisor, two part-time Source to Sea Advisors and a part-time, contract School Educator. As head of the Waterline team, Keith reports to City Waters' Customer and Systems Support Manager who, in turn, reports to the General Manager, City Waters.

'Source to Sea' is an apt moniker as the Waterline programme has recently broadened its scope to cover the 'three waters' – stormwater and wastewater (and related pollution) in addition to water supply. One of the Source to Sea Advisors focuses on presentations for groups ranging from RSA members and school parent groups to sports groups and girl guides. She is also working on a programme for early childhood education and looking ahead to education of secondary and tertiary students (for the latter plugging into related programmes such as marine studies and environmental management).

The other Source to Sea Advisors carry on in the early tradition, but also strive for three waters education and now operate in more of a self-help advice capacity. So while they still replace leaky tap washers and install cistern weights in old toilets, they also work with residents to identify gully traps that aren't compliant, encourage them to read their own meters and promote a simple home water-audit tool.

Residents who do the audit can receive a certificate which is honored at a dozen local businesses that have agreed to provide the best discount available on water-efficient fixtures and appliances. The annual Tauranga Home Show and other public events provide further opportunities for the Waterline team to promote their message.

Waterline staff work closely across teams in City Waters and with the Water Billing department. High meter readings lead to a letter going out to residents to check for leaks and one of the Source to Sea Advisors is in touch as well if that is deemed appropriate.

In the school holidays Source to Sea Advisors have recently been working with school caretakers to audit water use and make

changes where needed (with recommendations to retrofit high water use urinals an easy win).

"Without education it's easy to think water just comes from a tap." says Keith. "With our Source to Sea approach we try to educate residents about where our water comes from and where it goes after we use it so they know it's not a resource we can take for granted."

Beyond metering and education, Tauranga's demand management initiatives include pressure and leakage management and a water efficiency plan which focuses on water consumed by Council activities.

Others jurisdictions around the country exploring universal metering would do well to read the paper Water Metering – The Tauranga Journey prepared by John Sternberg and Peter Bahrs. Details for obtaining this document are noted in the Helpful Information section at the end of the article.

Strength in Numbers

Drought conditions in the Waikato in summer 2008 got everyone's attention and served as a trigger to explore a regional water conservation campaign. To kick-start the effort, Waikato Regional Council's communications manager invited her colleagues and water supply specialists from Hamilton City Council and each of the nine district councils in the region to a meeting.

At the conclusion of good discussions, the group was asked three questions:

- Is water use and conservation a pressing issue?
- Do we need to do more to address it?
- Would there be advantages to all of us working together?

With the answer to all three questions a resounding 'yes', the Regional Council offered to fund preparation of a campaign plan which individual councils could then assess and decide if they wished to participate.

AQUAS Consultants had previously done work for the Regional Council, Hamilton City and several of the district councils and I was asked to participate in the initial meeting and to prepare the campaign plan. The plan documented current water use issues, activities and resources around the region and looked for common ground as a basis for a cooperative effort.

The proposed plan – with an initial focus on residential water use – had two levels, a core set of activities and resources available to all

Smart Water Use educational messages in Council newsletters and local newspapers serve as a reminder for water-saving practices

participating councils with costs shared on a population basis and further services (at additional costs) that councils could opt into as they saw fit.

Hamilton City Council was already pursuing water conservation initiatives, but to their credit they participated in the regional effort. Their funding share meant that costs were modest for smaller councils. In the end, all councils in the region participated in the campaign coordinated by AQUAS Consultants on their behalf.

Core activities and resources in the campaign included:

- Adoption of 'Smart Water Use' branding with the logo appearing on all resource materials and available to councils for their own use locally.
- Smart Water Use radio spots – developed and funded by Waikato Regional Council – running regularly on stations around the region from mid-December to the end of February.
- A web-based interactive calculator to estimate household water use, kindly provided by North Shore City Council and adapted for use in the region.
- A simple home water audit form to help residents identify where they could install inexpensive water-saving devices on taps, toilets and showers – to save water, power and money.
- A range of educational 'inserts', articles, graphics and a poster for council use on websites, newsletters and in the print media (particularly community newspapers). These were provided on two CDs during the campaign period.
- Discounts arranged on water-saving devices for gardening and outdoor use available through selected retailers. Waikato Regional Council distributed a special four-page Smart Water Use issue of their Envirocare publication which included the discount vouchers. All councils were provided with the artwork for their own local advertising.

Additional activities offered early in the campaign included two 'Smart Water Use in the Garden' workshops hosted, fittingly, at Hamilton Gardens. The morning workshop was an information and training session for garden centre staff and landscapers, while the afternoon session catered to council staff and contractors. Both workshops were facilitated by Mark Dean of Naturally Native New Zealand Plants Ltd, with a charge for participation in the latter session covering costs for the day. A 'Smart Water Use in Gardening' handbook was provided to participants at both sessions.

A further workshop for Council staff at the end of the campaign addressed 'Strategies for Water-Use Efficiency – Indoors'. There was no charge for this, with presenters Evan Brookie of Eco Water Solutions Ltd and Steven Roberts of Watersmart Limited donating their time and expertise.

There have been some nice spin-offs from the 2009 targeted campaign. Councils continue to use the Smart Water Use branding and resources provided. Hamilton's water restriction levels have been adopted by next door neighbour Waikato District Council. Waipa District Council now has its own water conservator on staff. And there has been further innovative sub-regional collaboration as noted below.

Team Work Down on the Farm

Rural water schemes have their own particular challenges, especially when farms are on the line. Hauraki District Council is well aware of this with some 300 dairy farms on town supply.

In 2006, Council was looking at significant costs to expand and upgrade their rural water supplies. With this in mind, Ian Troughton, third generation dairy farmer and long-time representative for the Plains Ward on Council, said, "We should really have a good look at how we're using the water we've already got."

This led to a water use study on a dozen farms and a pilot educational campaign, supported by both Hauraki and Thames

Effective water-loss alert devices include (clockwise from top left): A **pilot light** on a pump that sends water from storage out onto the farm; a **pressure gauge** on the line supplying water out to paddocks; a **wireless tank level monitor**, and a water **flow indicator**. (When water flow indicators are spliced into water lines they can show when leaks are occurring and help to isolate their location.)

DairyNZ encourages the installation of simple water-loss alert devices on farm water supply systems to help reduce water loss

Coromandel District Councils. 'Smart Water Use on Dairy Farms' is now a national programme of DairyNZ. AQUAS Consultants assist with its delivery, with educational materials available to dairy farmers around the country and support provided so far to councils in Northland, Bay of Plenty, Waikato and Horizons regions to promote the programme and resources. Local newspapers have been very supportive in spreading the word by running regular columns and articles provided to them.

There has been a special push recently by Thames Coromandel District Council to promote water use efficiency and reduce water loss in dairy farming operations. Driven by resource consent applications for two water schemes in the Thames Valley, Council has worked alongside DairyNZ and Fonterra to encourage farmers to use the Smart Water Use tools and resources.

Hauraki District Council joined in recently to co-host with the others a Smart Water Use Ideas Exchange at the Muddy River Café in Turua. It was a brainstorm en masse with more than 60 dairy farmers in attendance. It was wonderful to see so many good, practical ideas shared at the session. Local farmers have made great strides in water efficiency and the Ideas Exchange event really showed this.

Drawing on Community Resources

Councils around the Waikato are responding to the call for more efficient water use driven by the Waikato Regional Plan: Variation No 6 – Water Allocation. Waikato District Council, for one, has prepared a Water Demand Management Action Plan and is now in the process of implementing it.

Based on the premise that everything doesn't have to be done in house, the Council is looking to collaborate with community groups for programme delivery.

"There are organisations around the district that have real credibility and respect in their communities," says Richard Bax, General Manager Water & Facilities. "We're going to work with them

"It was wonderful to see so many good, practical ideas shared at the session. Local farmers have made great strides in water efficiency and the Ideas Exchange event really showed this."

instead of taking it all on ourselves. Pilot projects will allow us to make a start, assess progress and revise our approach as needed."

Following discussions with the District Council, the Whaingaroa Environment Centre applied for and has been awarded a three year grant under Waikato Regional Council's Environmental Initiatives Fund to undertake water and energy conservation efforts in the Raglan area. Waikato District Council has also asked the Huntly Energy Efficiency Trust for a proposal to do work in the Huntly-Ngaruawahia area. For both organisations, it will be an extension of their current activities and involve water conservation education and residential audits to identify opportunities for simple water-saving retrofits for taps, toilets and showers.

There are many routes to success in customer demand management. They can include good cooperation amongst specialist staff within councils, collaboration between councils and with industry, effective involvement of community organisations and resources, and positive and supportive educational efforts to promote sustainable water use.

Helpful Information

- *Handbook of Water Use and Conservation*, by Amy Vickers, WaterPlow Press 2001. Details at www.waterplowpress.com
- *Kapiti Coast District Council Water Conservation Plan* (2010). Available at www.kcdc.govt.nz/Documents/ Downloads/Water-Supply/Water-Conservation-Plan.pdf
- *The Case for Demand Management in Council Water Supplies*, *Water New Zealand*, 2009. Available at www.waternz.org.nz/demandmanagement
- *Smart Water Use* residential and dairy farm programmes, contact AQUAS Consultants on 07 888 6299 or info@aquas.co.nz
- *Water Metering – The Tauranga Journey* (2010), paper by John Sternberg and Peter Bahrs, Tauranga City Council. Available at http://www.tauranga.govt.nz/council-services/water-drainage/water-supply/tabid/167/qid/2806/tctl/1049_ViewQuestion/Default.aspx

Gord Stewart heads up AQUAS Consultants, now based in Matamata. As a water use and conservation specialist, Gord has worked on a range of projects for district, city, and regional councils and for industry clients. He is the author of *Water New Zealand*'s publication, The Case for Demand Management in Council Water Supplies.

"Oxfam's community approach to involve Haitians in the sanitation projects aims to make them responsible for their own water services. People will be able to return to the traditional system of paying for water, without which the national water agency would not be able to build a permanent and sustainable system."

Oxfam in Haiti for Global Handwashing Day

Oxfam New Zealand

Last March, fourteen months after the earthquake that devastated Haiti, Oxfam handed operation of water and sanitation programmes in the Delmas and Léogane camps back to the communities it had been serving.

The handover was part of a strategy to transition power and resources back to the people of Haiti, empowering them with the necessary capacities, tools and resources to continue having access to water, sanitation and hygiene (WASH).

In the three months prior to the handover, Oxfam staff collaborated closely with communities in Delmas and Léogane to provide them with the tools and training to manage existing sanitation facilities and the water infrastructures. The transition was undertaken in consultation with the communities, local authorities and grassroots organisations.

Before the hand-back, Oxfam distributed water filters to families living in the camps, donated bladders and water tanks to site committees, and installed tanks to gather rainwater in different camps. Camp committees, which were provided with hygiene and cleaning kits by Oxfam, are now responsible for maintenance and cleaning of the showers and latrines. As part of the transition, Oxfam held discussions with communities and established committees responsible for water and sanitation in each area. The committees received training on managing water sales, chlorination and solid waste management in the camps. In some areas, water trucking services were gradually stopped and manual pumps were rehabilitated. Where possible, existing public water infrastructure was restored.

Oxfam's community approach to involve Haitians in the sanitation projects aims to make them responsible for their own water services. People will be able to return to the traditional system of paying for

Above and left – Global Handwashing Day in Haiti

water, without which the national water agency would not be able to build a permanent and sustainable system. At the same time, the system Oxfam has put in place has additional benefits – the price to be paid (i.e. the minimum price paid before the earthquake) includes a fee for the collection of solid waste twice a week. So with this new system, Oxfam says it achieves the empowerment of the Haitian population while also supporting the national water agency in its responsibilities to improve sanitation conditions in camps and communities.

Far from leaving the camps altogether, Oxfam has continued to build the capacity of the communities it works to take ownership of the facilities in the area they inhabit. A mobile team of Oxfam water experts have stayed on to monitor and maintain WASH infrastructures and guarantee the quality of services within the camps. The mobile team has the capacity to intervene in the case of any new cases of disease outbreaks.

The organisation continues to study ways to implement rainwater recovery systems at the community level.

The ongoing education Oxfam has provided in sanitation and hygiene has had a demonstrated mitigating effect on subsequent cholera outbreaks in Haiti.

Oxfam and its partners work together to address the root causes of poverty in the developing world and recognise that a fundamental first step is the supply of clean drinking water.

Visit Oxfam's stall at the *Water New Zealand* Conference in Rotorua, 9–11 November, to sign up for the Oxfam Water Challenge and raise money for vital WASH work in developing communities. www.oxfam.org.nz/water ■

"Far from leaving the camps altogether, Oxfam has continued to build the capacity of the communities it works to take ownership of the facilities in the area they inhabit."

Managing Catchment Water Quality and Quantity

Dr Phillip Jordan – Senior Hydrologist and Practice Leader for Catchment Modelling and Kate Austin – Water Resources Engineer, SKM

A water quality and quantity tool that models the amount of water and contaminants flowing into rivers, wetlands, lakes or estuaries is being used on the World Heritage listed Great Barrier Reef of Australia's Queensland coast to reverse the decline in water quality on the reef.

The Source Catchments Model (formerly known as WaterCAST and e2) is a spatially distributed water quality and quantity model developed by the eWater Cooperative Research Centre (CRC). It simulates the effect of climate and catchment properties (such as land use) on water quantity (runoff) and quality (contaminant loads) through unregulated catchments and into receiving water bodies.

Catchment managers are required to forecast the quantity and quality of available water resources in catchments subject to many influences including bushfires, changing climatic conditions, diverse water management approaches and varied land use activities. This work is complicated by the interactions between these physical drivers on the catchments and by the expectations of the people that live and work in those catchments, such that they will continue to serve both their needs and the needs of the ecosystems. Catchment managers therefore need objective scientific evidence that the plans they are implementing will achieve great outcomes for their catchments and the communities that they support.

The Source Catchments Model is comprised of a collection of models, data and knowledge for rainfall-runoff and water quality modelling. It has been widely applied to model loads of sediment, total nitrogen and total phosphorus and has also been used to model other contaminants such as salinity, coliforms, pathogens and pesticides. Source Catchments models can support whole-of-catchment management and decision making.

The majority of existing models (such as SWAT, HSPF and Lucicat) rely on a single (or few) rainfall runoff – and water quality model. An advantage of Source Catchments is that the user is able to select the appropriate rainfall-runoff model and water quality model from a wide range of component models, which provides the modeller with great flexibility to make the model reflect the physical response of the catchment. Additionally, users are able to create and customise plug-in models if required.

A library of parameter values for constituent generation models is available to expedite model set up and benchmark performance. The parameter estimation model (PEST) has been applied with Source Catchments to efficiently calibrate the model to observed data and provide quantitative estimates of uncertainty.

> "The model has been developed so that it works well at a catchment scale."

The Source Catchments Model also has an advantage over other models in that it is well documented, has a user friendly interface and provides parameter guidance for catchments established from applications. It can be less data intensive than some other commercially available water quantity and quality models.

The Source Catchments Model allows users to:

- Determine the volume and quality of runoff entering creeks, rivers and water bodies due to rainfall (and groundwater if using the surface water-groundwater interaction module)
- Predict the volume of flow and contaminant loading at any point in a catchment
- Investigate the impacts of potential changes in climate, land use, bushfires or diversions on water quantity and quality throughout the catchment
- Assess the combined impact of multiple changes
- Identify key sources of catchment contaminants
- Determine locations for works to improve water quality

As one of only two consultant partners to the eWater CRC, SKM has been Product Leader in the development of Source Catchments and also applied the model to a number of real-world project applications including:

- Nerang River freshwater health assessment study for Queensland's Gold Coast City Council. A model was developed of the mid and upper sections of the Nerang River catchment to assess current management actions and to develop future management actions for ecosystem and catchment health.
- Protecting Sydney's water supply for the Sydney Catchment Management Authority, involving the development of a model of the Nattai River Catchment flow and contaminant loads entering Lake Burragorang (Sydney's main drinking water supply). The project considered a large range of contaminant sources including sewage discharges, septic tanks, urban areas, agriculture, farm dams and steep terrain to identify the location of diffuse contaminant sources and assess the relative importance of point sources of contaminants across the catchment.
- Model to predict flows in the Googong Catchment for ActewAGL in the Australian Capital Territory, involving the development of a model to predict inflows to Googong Reservoir to allow separate accounting for the impact of changes in groundwater extractions, land use and farm dams impacts over time on the historic reduction in inflows.

Applications for Source Catchments

The Source Catchments Model offers users a highly flexible, fully integrated modelling framework to simulate spatially distributed rainfall-runoff and water quality across catchments.

Source Catchments is part of the eWater Source suite of products and is interoperable with a range of river system, urban and ecological modelling tools. Software is available free until July 2011.

One of the reasons the Source Catchments Model has been so successful is because it has evolved following extensive testing in a multitude of catchments to inform the process in each one, according to what happens in the catchment and what happens in the landscape. The model then accurately measures how water quality and quantity objectives are managed in each catchment.

Integration Needed

The model has been developed so that it works well at a catchment scale. It balances the need for mathematical sophistication against a requirement that a modeller is able to use the software without being overwhelmed by too much upfront complexity. ■

Panoramo Family Now Complete

Austeck

Founded in 1958, IBAK has many years of experience in producing top-of-the-line CCTV equipment and is acknowledged as a world leader in pipeline inspection technology. Its latest Panoramo series has lived up to the company's reputation and showcases its innovative, cutting edge design.

Panoramo SI

Unlike a video film from a conventional pan and rotate camera, which only shows the section of view saved at the time of filming, the Panorama SI software provides an all-round inspection of the manhole. This means that, after the fact, the inspector can stop at any position in the manhole and perform a continuous, unrestricted 360 degree pan.

Additional features such as the zoom and illumination utilities allow the inspector control over the footage without having to interact with the down-hole hardware in any way.

At the same time, an unfolded view of the manhole can be generated which gives a rapid overview of the structure and enables the user to view the entire depth of the shaft in a glance and 'jump' to positions of interest with a single mouse click. Further to this, the introduction of the 'Point Cloud' measuring tool enables 3D 'off the wall' measurement of objects such as debris, benching depths, inlet and outlet diameters and step irons with pinpoint accuracy.

The IBAK Panorama SI can be used for manholes, wet wells and inspection shafts of 300mm diameter upward.

"Additional features such as the zoom and illumination utilities allow the inspector control over the footage without having to interact with the down-hole hardware in any way. At the same time, an unfolded view of the manhole can be generated which gives a rapid overview of the structure and enables the user to view the entire depth of the shaft in a glance and 'jump' to positions of interest with a single mouse click."

Panoramo 2

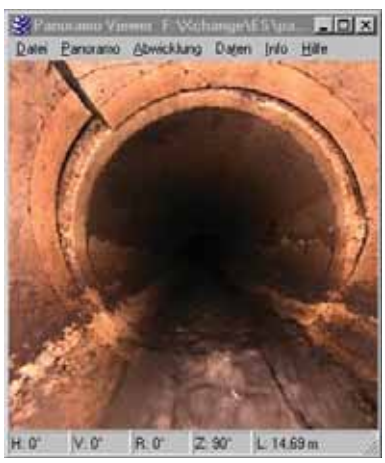
Like the Panoramo SI, the Panoramo uses two integrated scanning units at the front and rear end – each consisting of a 186 degree fisheye lens and a high resolution digital camera. The images are taken by the two cameras at 5cm intervals in the pipe and combined to give a 360 degree image. With a cable length of 500m, kilometres of pipeline can be inspected from a manhole. This, coupled with the system's ability to traverse at speeds of up to 350mm/sec, makes for exceptional productivity. Surveys of entire sections are completed in minutes. An additional benefit is the elimination of all moving parts from the cameras, minimising the wear and tear issues common to all other camera systems. The Panoramo can inspect lines from 200mm up.

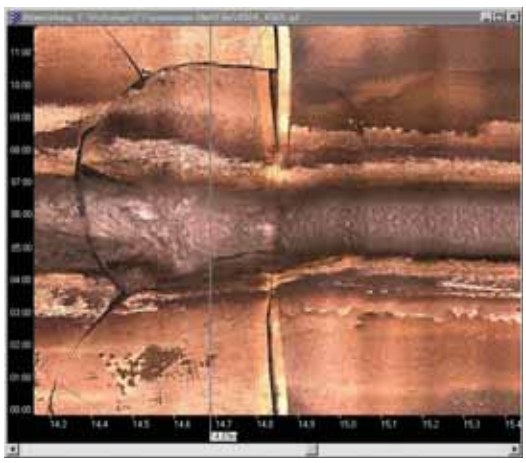
Panoramo 150

Conceptually similar to its sister products, the new Panoramo 150 provides an operating CCTV solution for 150 mm diameter relined pipes and upward. The product has a steering function, utilises LED lighting which further increases its longevity, and completes the Panoramo range. ■

For more information on IBAK Panoramo products contact Austeck on +62 9338 7688, info@austeck.com or www.austeck.com or visit us at the *Water New Zealand Annual Conference & Expo*, 09–11 November 2011, Stand 172 & 173

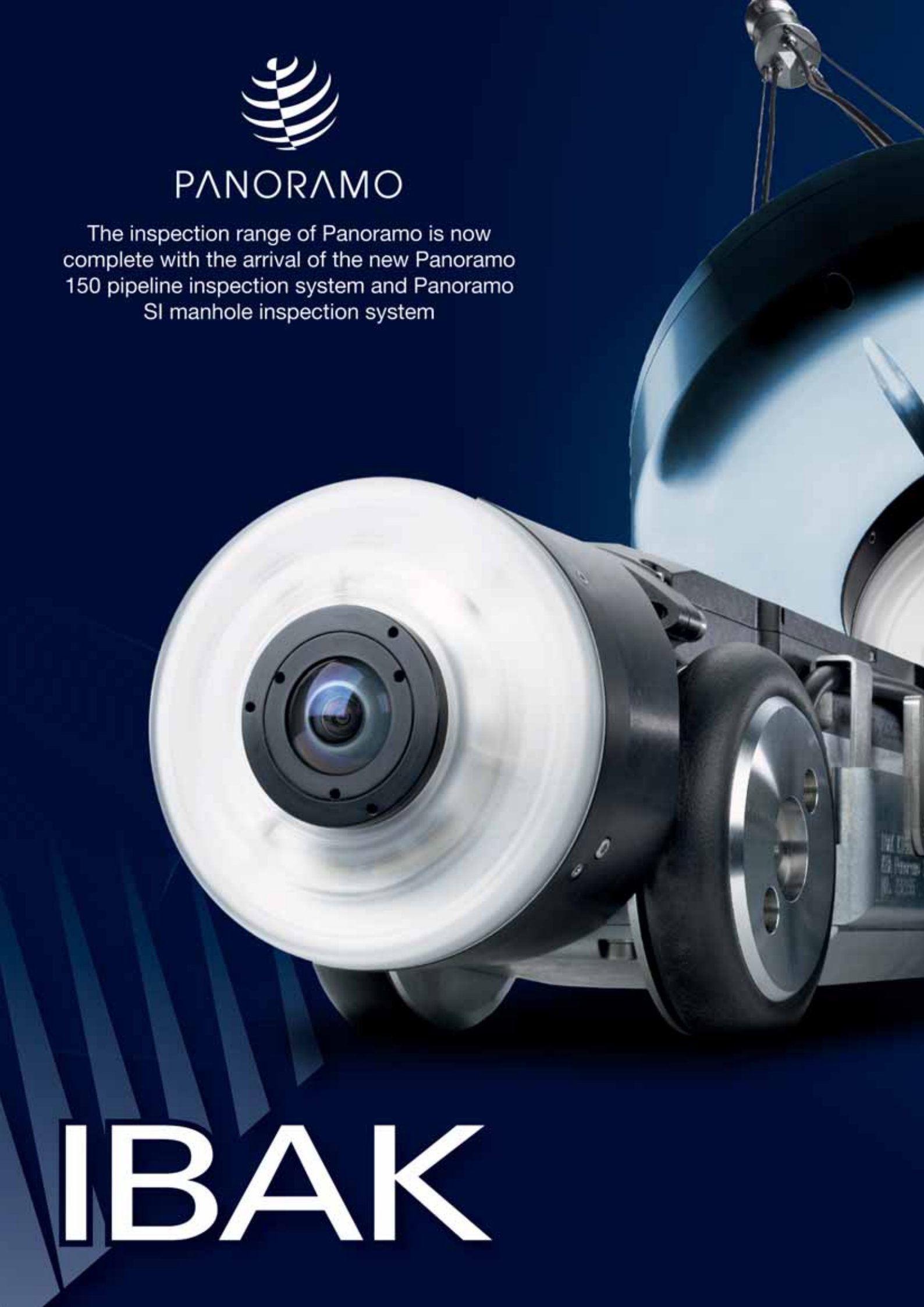
Above – Panaramo 2 and Panaramo 150, above left – Panaramo SI, below (left to right) Panaramo 3D and 2D perspectives





PANORAMO

The inspection range of Panoramo is now complete with the arrival of the new Panoramo 150 pipeline inspection system and Panoramo SI manhole inspection system



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Harrison Grierson Appoints Margaret Devlin as First Independent Director

Harrison Grierson

Margaret Devlin

Harrison Grierson is pleased to announce the appointment of Margaret Devlin as an independent director to the Harrison Grierson Consultants Board.

It is the first time in the employee-owned company's history that Harrison Grierson has appointed an external director.

Chairman Gary Clark welcomed the appointment saying "We are pleased to be adding an independent, experienced and highly qualified individual to our Board. Margaret is a respected business leader who will bring fresh perspectives. She has a successful track record and the right combination of executive, financial and operational expertise that I am confident will help us fine-tune and execute Harrison Grierson's growth strategy."

Mrs Devlin comes to Harrison Grierson with over 20 years experience working at senior executive and director level in both the infrastructure and retail sectors in New Zealand and the United Kingdom. She is currently Chair of EPIC Limited, CF Reese Limited, Scott Sheet Metal Manufacturing and Deputy Chair of WEL Networks Limited. She is also a director of City Care, Moto International Holdings Limited, Midland Health Network, and *Water New Zealand*.

"Margaret is a respected business leader who will bring fresh perspectives. She has a successful track record and the right combination of executive, financial and operational expertise that I am confident will help us fine-tune and execute Harrison Grierson's growth strategy."

Harrison Grierson is one of Australasia's leading advisory and design organisations offering strategic advice and providing multi-disciplinary professional services including engineering, surveying, planning, urban design and landscape architecture. Harrison Grierson works in four key market sectors; Land and Buildings, Water and the Environment, Utilities and Transport. Founded in 1885, it has over 200 employees, with offices in Auckland, Manukau, Tauranga, Whakatane, Wellington, Christchurch, Brisbane and Townsville. ■

For more information visit www.harrisongrierson.com or email g.clark@harrisongrierson.com

Biolytix Wastewater System in New Zealand Continues

Ecogent

When the award winning Australian onsite wastewater system Biolytix announced its shock liquidation in January this year, the recently appointed General Manager of Biolytix in New Zealand, Karl Geiseler, wondered what this would mean for New Zealand. Karl knew there was still a huge demand for the Biolytix wastewater system and that there were hundreds of happy customers here.

Biolytix went into voluntary liquidation only two months into Karl's tenure. Being 100% owned by the Australian head office, Biolytix Water New Zealand was then wound down as the liquidators tried to recover what they could.

Uncertainty quickly turned into opportunity, as Karl and the owners of Ecogent, a long standing Environmental Engineering business in New Zealand, made an offer to the liquidators for the intellectual property and the rights to manufacture here. This was accepted and Biolytix Limited, was established to continue supplying Biolytix wastewater systems in New Zealand. "What I find most satisfying is that we were able to supply a Biolytix system to all New Zealanders who had paid a deposit." says Karl.

To get things running the production team trained under the guidance of the Biolytix inventor in Queensland in the manufacture, installation and servicing of the Bio-Pods. "We've taken what was already one of the most energy efficient onsite wastewater products on the market and slashed its carbon footprint even further by not having to freight them from Australia." says Karl.

The Biolytix onsite wastewater system is housed in a single 3000 litre injection moulded polypropylene tank making it one of the most compact wastewater systems on the market. It works as a filter bed immediately separating the solid organic matter from the liquid in domestic wastewater. Worms and other organisms breakdown the organic matter and the resulting vermicompost creates an organic filter which further cleanses the wastewater that percolates through it. The filter bed is maintained in an aerobic condition and no odours are generated, without noise and very little electricity consumed in the process.

The result is a consistently high quality secondary treated effluent. The Biolytix system was trialled at the OSET testing facility. Treated effluent from the trial unit comfortably met secondary treated levels with the appraisal report noting that the Biolytix "used as little as 5% or less of the electricity of some other systems measured."

The process is easily scalable to cater to larger volumes for multiple houses or commercial projects and can be adapted to a decentralised concept for subdivisions with a unit at each property pumping via a small bore pressure sewer network to communal land dispersal systems.

"We want to focus on the basics – on supplying and supporting what we know is an excellent product. We are committed to continuing the Biolytix vision to have the most environmentally friendly and sustainable onsite wastewater treatment system." Karl says.

To find out more visit their website www.biolytix.com, call them on 0800 700 818 or email info@biolytix.com

Peristaltic Pumps in Hamilton City Council Save Time and Money

Watson Marlow

Hamilton City Council produces and delivers a-grade water to its 130,000 residents and surrounding districts which the plant operators are proud of. They are also proud that they strive to optimise their process for the effective and efficient use of ratepayer money.

Hamilton's drinking water is sourced from Waikato River and goes through a typical treatment process. After the water is initially screened to remove large debris it enters a coagulation process where raw water settles in tanks allowing unwanted materials to be removed. Polymer is added to the raw water to aid this process at flow rates of 150–200L/hr, 24 hours a day, 365 days of the year.

The plant previously had four diaphragm pumps that were more than 40 years old for this service. While these pumps were almost antique items, there was a string of drawbacks. Maintenance required a skilled fitter-tuner which was time consuming and costly, and because spares parts were difficult to source, the council had resorted to having replacement diaphragms made in-house. The pumps were also fitted with several ancillary items that also needed servicing, along with more complex integration of stroke and speed management into the PLC.

Sven Ericksen, the Council's Team Leader – Asset Maintenance, was looking for a logical replacement pump that met the needs of product delivery in the most cost effective manner, while simplifying asset complexity and ensuring maximum reliability. The Watson-Marlow 620DuN/RE peristaltic pump was put to the test for a month and met all of their expectations.

"There are numerous advantages of the Watson-Marlow pump" states Sven. "Seeing the rotating pumphead enables the operator to acknowledge that the pump is delivering the polymer at about the right flow rate, the pump was seamless to integrate into our system, and best of all you just need two index fingers and a thumb to change out the tube, saving us time and money."

On the subject of the tube, during the trial back in October this pump was fitted with a 12mm Marprene Loadsure tubing element with Cam and Groove fittings that lock into the pumphead. This same tube is still occluding in their pump, giving 7+ months of maintenance-free service.

The peristaltic motion is also key to ensuring that the polymer is not altered during the pumping process. Polyelectolyte is a viscous long-chain molecule, that can be prone to crystallisation and/or gelling. Due to its composition, shear can easily break the molecular chains. The Watson-Marlow pump has an open flow path with no intrusions from check valves or other items which makes the design inherently capable of moving shear-sensitive, viscous or particulate fluids with no damage. Also because the pump is self-priming and can run dry, there is no concern about crystallisation of the polymer.

Hamilton City Council is currently in the process of replacing all of its polymer diaphragm pumps with Watson-Marlow pumps and is looking to optimise other areas of the plant with peristaltic technology. ■

First NexION 300 ICP-MS in New Zealand showcases the Services Provided by Analytical Research Laboratories

ArlLab

ARL Manager Michael White, Technical Director Peter Lorentz and Quality Manager Gary Glenn with their NexION 300D ICP-MS instrument

The agricultural industry traditionally represents only a small percentage of all inductively coupled plasma mass spectrometers (ICP-MS) being used today. However, there is a growing demand for the detection of lower levels of trace and heavy metals in plant materials, soils, water and effluent samples. This need is particularly driven by increased environmental concerns and compliance. Whereas other analytical techniques struggle to meet the desired lower limits of detection for key elements, ICP-MS is a proven performer. It is therefore clear that laboratories serving the agricultural sector, must invest in state-of-the-art trace and heavy metal analytical capabilities like ICP-MS to keep up with the growing demands of their customers.

"We were very impressed with the design of the instrument, but were a little concerned about investing in brand new technology. However, it was the performance of the instrument, its ease of use and the fact that it required very little maintenance compared to the other instruments that made it the favourable choice."

One such company that has realised the importance of having cutting-edge technology is Analytical Research Laboratories (ARL) Ltd, a division of Ravensdown, the large fertiliser and farm inputs farmer owned co-operative with headquarters in Christchurch, New Zealand.

Based in Napier, ARL decided to invest in a new ICP-MS system. It took about 18 months to go through the selection process but they finally came to the conclusion in September 2010 that the Perkin Elmer NexION technology best fitted their needs. In the words of Michael White, ARL Laboratory Manager, who led the selection process, together with colleagues Gary Glenn, QC Manager and Peter Lorentz, Technical Director:

"We were very impressed with the design of the instrument, but were a little concerned about investing in brand new technology. However, it was the performance of the instrument, its ease of use and the fact that it required very little maintenance compared to the other instruments that made it the favourable choice. The decision was not easy, but after careful consideration we chose the NexION 300D."

ARL's primary focus is a comprehensive analytical testing service to its Australasian stakeholders to help them maximise the use of farm inputs such as fertilisers to enhance pasture growth, animal production and agricultural crop yields. The service encompasses comprehensive test suites for plant material, soil, water and wastewater necessary for critical on farm decision making.

"Water, wastewater and farm effluent analysis is a rapidly growing part of agribusiness. Whether it is for compliance or just being concerned about the environmental impact of their land use on waterways, farmers are increasingly submitting samples for analysis" says Peter Lorentz. Because ARL provides a comprehensive suite of IANZ accredited tests for water and wastewater they are keen to grow this part of their business by extending their scope beyond the agricultural community to target other industries. There is no question that it is their goal to be the leader in the very competitive world of contract analysis by being at the forefront of analytical technology. ■

For more info visit www.ravensdown.co.nz/Services/ARL/Default.htm

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

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
Marlborough Convention Centre, Blenheim, New Zealand
For more information visit www.wine-marlborough.co.nz

Asia Water 2012 – 7th ASIAWATER Expo & Forum
27 – 29 March 2012
Kuala Lumpur Convention Centre, Malaysia
For more information visit www.asiawater.merebo.com

Australian Water Association – OzWater Association
8 – 10 May 2012
Sydney Convention and Exhibition Centre, Darling Harbour, Sydney, Australia
For more information visit www.awa.org

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