



Modelling

WATER NEW ZEALAND | SPECIAL INTEREST GROUP



Modelling Symposium

2020

11 – 12 March 2020

Grand Mercure Hotel

Auckland

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Water New Zealand Modelling Symposium

11 – 12 March 2020, Grand Mercure Hotel, Rangitoto Room, Auckland

PROGRAMME

Day One – Wednesday 11 March

8.30-9.00	Registration / Tea and Coffee
9.00am	Welcome and Symposium Opening – <i>Nadia Nitsche, Chair, Modelling Group</i>
9.15am	Keynote Address – Dr Celine Cattoen-Gilbert – NIWA – Flow/Flood Forecasting
10.00am	Morning Tea – Foyer
10.30am	Word from one of our sponsors – Hydraulic Analysis Limited
10.45am	Guest Speaker – The Future of 2D Hydraulic Modelling: presentation of new sub-grid turbulence and elevation sampling approaches and impact on result accuracy – <i>Bill Syme – BMT Global</i>
11.15am	Bridging the gap between Modellers and Decision Makers – <i>Fatima Bashir – DHI</i>
11.45am	HEC-RAS Modelling: Using 1D and 2D models to model bridges with rapidly changing design processes – <i>Courtenay Giles – WSP</i>
12.15pm	Lunch – Vue Restaurant, Level 13, Grand Mercure
1.00pm	Three-way coupled stormwater model – <i>Girija Mulay – Stantec</i>
1.30pm	Development of a city-wide drainage model to assess system performance – <i>Bertrand Salmi – Water Technology</i>
2.00pm	Modelling in infrastructure investment for Sulphur Beach – <i>Hansol Lee & Jackie Zhou – Auckland Council</i>
2.30pm	Making Models work; small investments, big rewards – <i>Brendon Schicker – WSP</i>
3.00pm	Afternoon Tea – Foyer Please move to the front of the building as there will be a bus to transport us to Fluid Labs
3.15pm	Bus departs for Auckland University Fluid Labs <ul style="list-style-type: none"> • Please make sure you have closed in shoes • Will have nibbles and drinks after the visit
6.00pm	Bus will depart Auckland University for Grand Mercure
6.30pm	Dinner – The Conservatory, E1/17 Jellicoe St, North Viaduct, Auckland CBD



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PROGRAMME

Day Two – Thursday 12 March

8.30-9.00am	Tea and Coffee – Foyer
9.00am	Day 2 Opening comments – <i>Nadia Nitsche, Chair, Modelling Group</i>
9.05am	Keynote Address – Bertrand Salmi – Water Technology – Banyule Swamp, my neighbour, will you give me a glass of water?
9.45am	Word from one of our sponsors – JEFF BOOTH
10.00am	Morning Tea – Foyer
10.30am	Workshop – Andrew Pollard (BRANZ) and Lesley Smith (Water New Zealand) – Advancing models of residential water-use
12pm	Complexity in Modelling – <i>Ben Davies – Stantec</i>
12.30pm	Lunch – Vue Restaurant, Level 13 Grand Mercure
1.15pm	Modelling Group AGM
1.30pm	The use of Dynamic Freeboard – <i>Kristin Stokes – Jacobs</i>
2.00pm	Use of detailed flood models for options analysis – <i>Ivan Kholodov – Wellington Water</i>
2.30pm	Runoff estimation for an ungauged catchment – the Piha flood hazard modelling – <i>Kevin Fan – Auckland Council</i>
3.00pm	Afternoon Tea – Foyer
3.30pm	Word from one of our sponsors – DHI
3.45pm	Modelling long-term volume retention in a reuse rainwater tank – <i>Jahangir Islam – AECOM New Zealand</i>
4.15pm	Development and assessment of a reservoir sediment management routine for the soil and wate assessment tool – <i>Jayandra Shrestha – Canterbury University</i>
4.45pm	Detailed 2D Modelling for Puhoi – Tests on model parameters and software – <i>Jorge Astudillo, Link Zhao – Ewaters New Zealand</i>
5.15pm	Symposium Closed



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ATTENDEES

ATTENDEE	COMPANY
Abdulraman Bah	MAFFS
Andrew Sherson	Stantec New Zealand
Ben Davies	Stantec New Zealand
Bertrand Salmi	Water Technology Pty Ltd
Bill Syme	BMT Global
Brendon Schicker	WSP New Zealand
Brian Robinson	Hydraulic Analysis Ltd
Britta Jensen	Hydraulic Analysis Ltd
Catherine Dagan	Hydraulic Analysis Ltd
Cheryl Bai	Auckland Council
Courtenay Giles	WSP New Zealand
Elliot Egan	Hydraulic Analysis Ltd
Emma Rudge	Riley Consultants Ltd
Eng Lim	Palmerston North City Council
Fatima Bashir	DHI Water & Environment Ltd
Gareth Lynch	Riley Consultants Ltd
Girija Mulay	Stantec New Zealand
Habib Ahsan	Riley Consultants Ltd
Hansol Lee	Auckland Council



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The New Zealand Water & Wastewater Association Water Accord

Water New Zealand Modelling Group Symposium

11 – 12 March 2020, Grand Mercure Hotel, Auckland

ATTENDEES

ATTENDEE	COMPANY
Ivan Kholodov	Wellington Water Ltd
Jackie Zhou	Auckland Council
Jahangir Islam	AECOM New Zealand Ltd
James Mogridge	Tonkin + Taylor
Jasmine Kang	Tonkin + Taylor
Jayandra Shrestha	University of Canterbury
Jeff Booth	Jeff Booth Consulting
Jennyl Estil	Aurecon
Joong Lee	Hamilton City Council
Jorge Astudillo	Ewaters NZ
Kelsey Beckett	Tonkin + Taylor
Kerrie Ann Kirkwood	DHI Water & Environment Ltd
Kevin Fan	Auckland Council
Kirsten Henden	Awa Environmental
Kristin Stokes	Jacobs New Zealand Ltd
Link Zhao	Ewaters NZ
Mark Burch	Activated Carbon NZ Ltd
Martin Young	SUEZ Australia & New Zealand
Michelle Mak	Hydraulic Analysis Ltd
Nadia Nitsche	Wellington Water Ltd
Nick Caulton	GHD Ltd
Rebecca Ellmers	Hydraulic Analysis Ltd
Rene van Lierop	Hydraulic Analysis Ltd
Richard Brunton	Tonkin + Taylor



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ATTENDEES

ATTENDEE	COMPANY
Saurav Suniara	Horowhenua District Council
Suyash Joshi	Stantec New Zealand
Sarah Basheer	Tonkin + Taylor
Thomas Jamieson-Lucy	Riely Consultants Ltd
Katrina Guy	Water New Zealand
Renee Butler	Water New Zealand
Lesley Smith	Water New Zealand
Ciline Cattoen-Gilbert	NIWA
Andrew Pollard	BRANZ



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Abstracts

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Wednesday 11 March

1. The Future of 2D hydraulic Modelling: Presentation of new sub-grid turbulence and elevation sampling approaches and impact on result accuracy – *Bill Syme – BMT Global*
 - Wednesday 11 March @ 10.45am
2. Bridging the gap between Modellers and Decision Makers – *Fatima Bashir – DHI*
 - Wednesday 11 March @ 11.15am
3. HEC-RAS Modelling: using 1D and 2D models to model bridges with rapidly changing design process – *Courtenay Giles – WSP*
 - Wednesday 11 March @ 11.45am
4. Three-way coupled stormwater model – *Girija Mulay – Stantec*
 - Wednesday 11 March @ 1.00pm
5. Development of a city-wide drainage model to assess system performance – *Bertrand Salmi – Water Technology*
 - Wednesday 11 March @ 1.30pm
6. Modelling in infrastructure investment for Sulphur Beach – *Hansol Lee & Jackie Lee – Auckland Council*
 - Wednesday 11 March @ 2.00pm
7. Making models work; small investments, big rewards – *Brendon Schicker – WSP*
 - Wednesday 11 March @ 2.30pm

Thursday 12 March

8. Banyule Swamp, my neighbour, will you give me a glass of water? *Bertrand Salmi – Water Technology*
 - Thursday 12 March @ 9.05am
9. Complexity in Modelling – *Ben Davies – Stantec*
 - Thursday 12 March @ 12.00pm
10. The use of Dynamic Freeboard – *Kristin Stokes – Jacobs*
 - Thursday 12 March @ 1.30pm
11. Runoff estimation for an ungauged catchment – the Piha flood hazard modelling – *Kevin Fan – Auckland Council*
 - Thursday 12 March @ 2.30pm
12. Modelling long-term volume retention in a reuse rainwater tank – *Jahangir Islam – AECOM New Zealand*
 - Thursday 12 March @ 3.45pm
13. Development and assessment of a reservoir sediment management routine for the soil and water assessment tool – *Jayandra Shrestha – Canterbury University*
 - Thursday 12 March @ 4.15pm
14. Detailed 2D Modelling for Puhoi – Tests on model parameters and software – *Jorge Astudillo, Zhao Link – Ewaters New Zealand*
 - Thursday 12 March @ 4.45pm



1. The Future of 2D Hydraulic Modelling: Presentation of New Sub-Grid Turbulence and Elevation Sampling Approaches and Impact on Result Accuracy

Bill Syme¹ (Presenter), Dr Greg Collicutt¹

¹BMT

Two major enhancements in 2D hydraulic modelling that will change industry practices are presented in a non-technical manner through benchmark tests and real-world applications.

Mesh-Size Insensitive 2D Turbulence Solution

Turbulence within rivers plays a significant role in determining the mean flow velocity field and is integral to the overall energy loss mechanism. Unlike floodplains where depths are low and bed friction high, head-loss predictions for rivers can be sensitive to the treatment of turbulent eddy viscosity. With the continued advance of computational hardware, rivers are now frequently modelled in 2D using the depth averaged Navier-Stokes equations also known as the Shallow Water Equations (SWE). With this trend, some treatments of turbulent eddy viscosity can lead to mesh size result dependency and significant errors in the prediction of inundation levels on the surrounding floodplains.

The representation of sub-grid-scale turbulence (often referred to as eddy viscosity) has been an increasingly concerning issue as 2D element sizes become smaller and smaller. The traditional Smagorinsky and Constant eddy viscosity approaches can be highly dependent on element size and worse yet fail when the 2D element resolution is reduced less than the water depth.

2D solvers are increasingly being asked to model at smaller and smaller element sizes. Because of this, and importantly for models with varying element size (flexible meshes and quadtree grids), a mesh-size insensitive sub-grid-scale turbulence approach is needed. The benchmarking of a new approach is presented that allows modellers to vary cell size downwards across a grid or mesh without loss of accuracy. As a result, engineers and scientists can now confidently model at all scales using the same turbulence parameters.

Sub-Grid Elevation Sampling

2D SWE solvers typically store one elevation for the cell's storage and sometimes one elevation for each cell face. Investigations were made into enhancing the definition of a 2D cell's ground elevation data using a sub-grid elevation sampling method to better capture and use topography data at a finer scale than the mesh resolution.

Benchmarking has identified many benefits associated with the sub-grid elevation sampling approach. Sub-cell low flow paths are better represented, significantly improving the performance of whole of catchment direct rainfall 2D models. Also, disturbed flow fields and spurious additional head losses that can traditionally occur along a "saw-tooth" regular grid wet-dry boundary completely disappear. Results show that a deep-sided



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channel (such as a concrete lined stormwater drain) can now be accurately modelled using a coarse regular grid of any orientation with as few as one or two 2D cells covering the width of the drain. This finding potentially removes the need to model these channels in 1D or having to construct a time-consuming well-designed flexible mesh along the channel.

Summary

The ability to use a variable cell-size regular grid mesh with a cell size insensitive turbulence scheme, combined with sub-grid elevation sampling are presented. Collectively these major modelling enhancements result in significant accuracy improvements proving to be the next major advancement in 2D hydraulic modelling and potentially redefining industry practices.



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2. Bridging the gap between modellers and decision makers

Fatima Bashir – DHI Group

Hydraulic models have been used as efficient analytical and decision-making tools for several decades. If utilised well, they can be effective management tools, especially for urban networks. However, in most utilities there is a clear disparity between those using the models and decision makers, resulting in models not being fully utilised by stakeholders i.e. planners, managers, operation staff and field personnel.

What are the issues?

Traditional hydraulic modelling is a specialized skill requiring significant investment in terms of time and money. Therefore, most water utilities rely on modelling experts (often external consultants) to provide operational assessments of their urban networks. For long term planning and scenario assessments the flow of information between those with the modelling and software knowledge to those who make decisions works well. However, the knowledge is generally retained only by the specific people involved in the study with associated reports and maps then buried in a pile of electronic data.

Decisions that require specific information quickly are often not able to take advantage of information from modelling studies. Therefore, there is a general need in the industry for different types of decision makers to quickly and easily access simple modelling related information without requiring technical modelling knowledge.

How do we bridge the gap?

To address these needs, there are several user-friendly web applications and decision support systems, which allow water utilities to access relevant information to make faster and more informed decisions, radically improving the way they manage their daily operations and long-term plans. There is no need to install specialized software, information can be collated and targeted to specific needs and is easily accessible. Examples of how some applications are used to bridge the gap and utilize hydraulic models and the information collected to its maximum capabilities are presented including:

- **WaterNet Advisor** – An online application accessible from any electronic device, accesses complex modelling information while presenting it in a targeted easy to use manner, getting immediate answers. The application is aimed at field operators, planners and decision makers to access information and run scenarios to understand their system behavior.
- **Future City Flows (FCF)** – An innovative online solution for city planners, wastewater operators and decision makers to reduce flooding, discharge of untreated WW into the environment and wastewater treatment plant costs. It is an information and decision support system that is



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applicable in small and large cities and provides an effective tool for both short-term system optimization and long-term prevention. The system works by collecting real time data, running scenario modelling to strategically plan for long term preventions, using cost v.s. benefits analysis. FCF been tested in water utilities in Sweden with the largest being the city of Gothenburg, where FCF is currently being implemented in Real time mode to control and optimize the network in a sustainable manner. Pilot projects are currently in place in NZ and Australia.



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3. HEC-RAS Modelling: Using 1D and 2D models to model bridges with rapidly changing design processes

Courtenay Giles – WSP

Large roading projects often have an impact on rivers and streams. In order to assess the scale of these impacts hydraulic models are built. Due to the diverse requirements of these projects often one model is not sufficient for answering all of the design and consenting questions, however it is not efficient to have multiple models to interrogate in short timeframes. This presentation will summarise the investigations to choose a suitable streamlined process, comparing one-dimensional (1D) and two-dimensional (2D) approaches, and providing confidence in the results without excess analysis in short timeframes.

It is well known that different modelling approaches are better suited to answering the different complex hydraulic and flood risk questions. The initial questions in this project focused on design levels which later switched to flood hazard and potential scour. Other considerations were runtime and ease of model manipulation for rapidly changing designs.

A 1D HEC-RAS model of a stream was built to assess the impact building a bridge would have on the water depths in the channel. This model was based off a series of cross-sections derived from LiDAR data and the proposed bridge was added into the model using the bridge feature in HEC-RAS.

Knowing the 1D model would likely not provide enough detail of the flood hazard in the floodplain and address future consent requirements a 2D HEC-RAS model was also built. The terrain was manipulated to include the bridge alignment based off design drawings in the 2D model.

The models were run with the same design flows and the results were compared to see if altering the type of model resulted in significant changes to the results obtained. The 2D model provides a better representation of the flood extent that is likely to occur in the flood plain as the 1D model only shows flooding results to the extent of the cross-sections and no further. Terrain manipulation allowed for a more representative bridge as the abutment shape and embankments could also be included. While actual levels varied, the differences in water level were comparable and roughly followed the same trend for both models.

The 1D model only returns a water level for each cross-section in the model, so these results were less detailed. However overall, the ease with which a 1D model can be made and the significantly faster running time make this a more appealing method of testing multiple options or changing design throughout the process. Having recognised the requirement for a 2D model early in the process meant that the final preferred designs could be then added to the 2D model easily to confirm consent requirements and provide additional detail for the areas that mattered such as velocity close to piers and abutments. It is impossible to have the perfect model, but this presentation will cover the benefits and challenges of both models and how to pick the right modelling approach based on the project.



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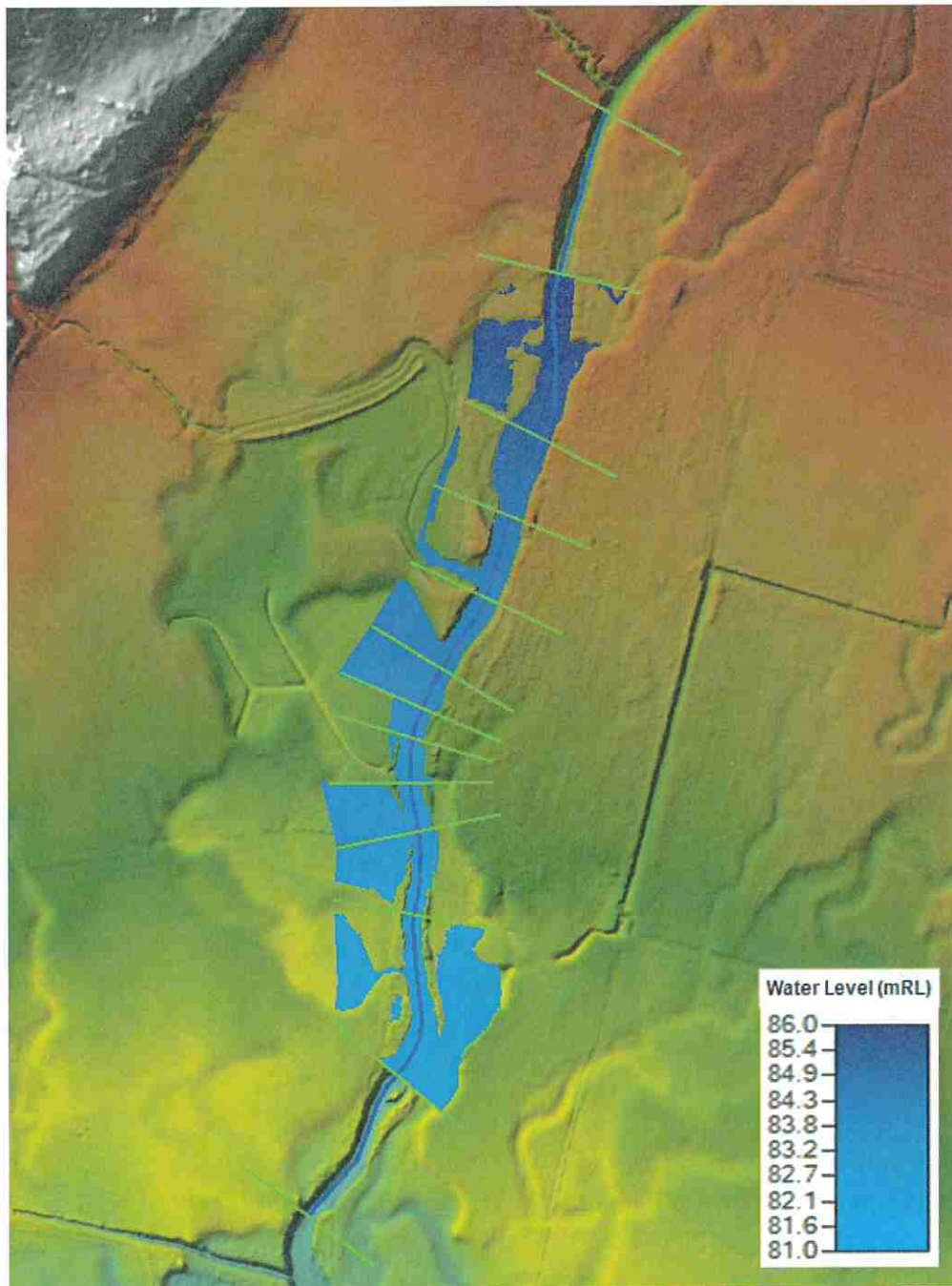


Figure 1: 1D model results for 100-year ARI



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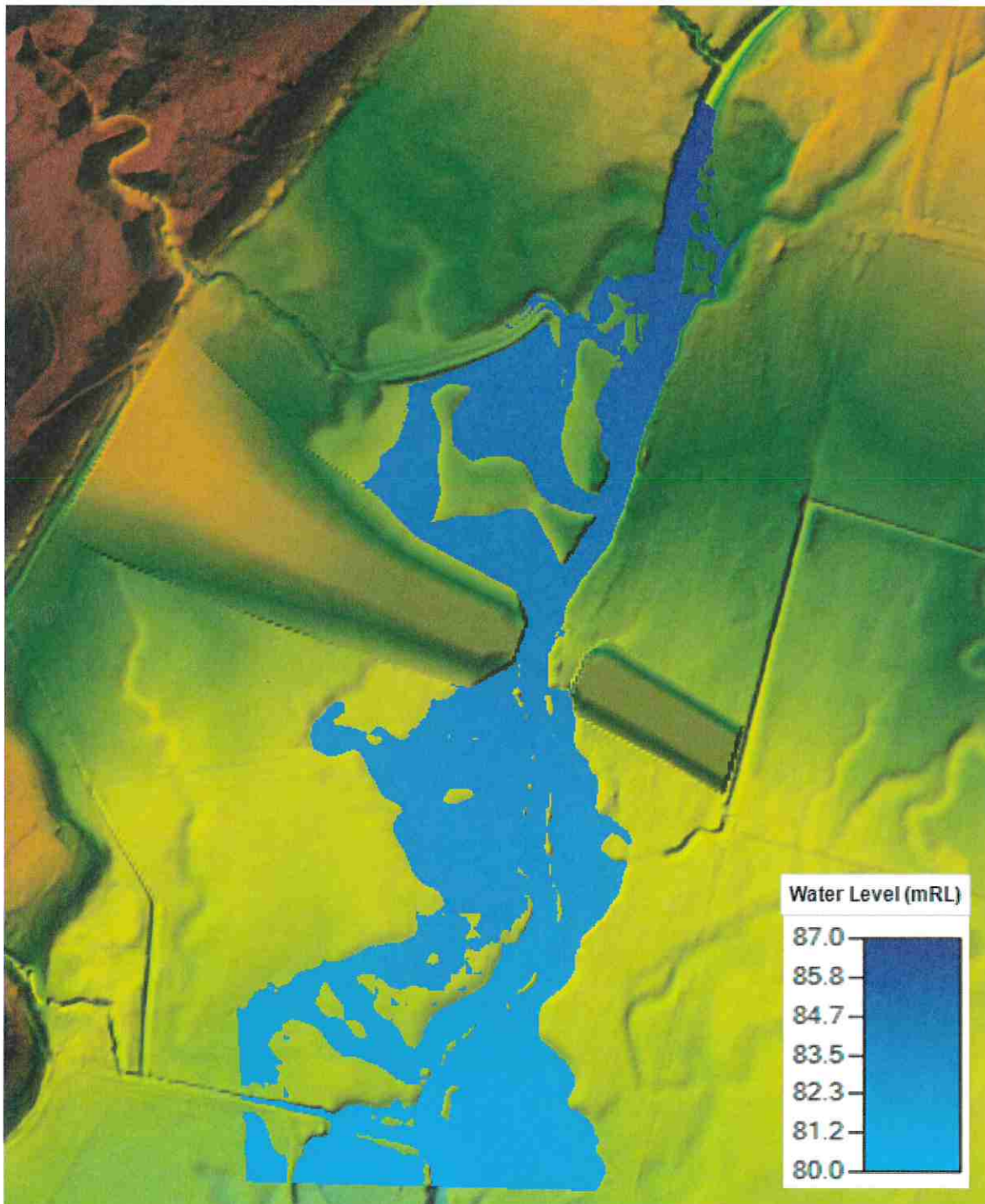


Figure 2: 2D model results for 100-year ARI



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4. Three-Way Coupled Stormwater Model

Girija Mulay

Councils across New Zealand are seeking a better understanding of their three waters networks, to enable them to make the best use of their existing assets, and plan for growth and changing environments and develop operational maintenance strategies. Stantec is currently working on several projects to assist councils achieve their strategic aims.

This paper will focus on three-way coupled stormwater model build projects in DHI Mike Flood. The objective of these projects includes the development of stormwater network models, validation, and the use of them to generate flood hazard maps. These models are a valuable tool but notoriously complex due to varied catchment hydrology and hydraulic conditions.

We will also review the key challenges of this process and discuss some of the methodologies and innovations Stantec utilised to streamline the processes, and the lessons learnt along the way. Whilst this paper will be discussing DHI Mike Flood, some of the lessons learned, and innovations, can be applied to a range of modelling projects. It will review how other software packages, such as ArcMap, QGIS and FEM, and non-modelling skill sets, can be utilised to support the modelling process.



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5. Development of a City-wide Drainage Model to Assess System Performance

Bertrand Salmi, Celine Marchenay, Water Technology

Melbourne Water (MW) is currently developing system performance assessment tools for their water, sewer and drainage networks, to enable the completion of a system wide assessment of performance and assist integrated water planning. With the existence of InfoWorks models for both the potable and sewer networks built and regularly calibrated over the last decade, MW is aiming to fill in the gaps by developing a one-dimension (1D) drainage network model in InfoWorks (Innovyze) of the Melbourne metropolitan area and urban growth.

This project is the first stone to building a living drainage network model to be updated, calibrated over time and used to assess the performance of the system under current and future scenarios. The first lot of priority catchments modelled and preliminary assessed over a range of scenarios included the Patterson River, Elster Creek, Mordialloc Creek, Kananook Creek and the Mornington peninsula. The 1D drainage model includes all the MW underground drainage trunk mains, open drains, natural waterways and retarding basins within the catchment extent. It was run for the 5-year ARI design events using the Australian Rainfall and Runoff 1987 including spatial variability in order to identify the deficiencies in the network which is supposed to be design for and carry the 5-year ARI design storm. The model was verified against the MW 5-year ARI design flow values available from previous flood studies throughout the catchment. The existing conditions system performance was then assessed and presented in the form of thematic maps of pipe surcharges and maximum flow against pipe full capacity based on the Manning's equation. The existing conditions system performance assessment revealed specific hotspots where the drainage network is surcharged causing or not overland flooding (extent not assessed in this study) under the 5-year ARI. The 1D drainage model was assessed over a range future scenarios including climate change and increase in population in line with the Victoria in Future 6 million (2031), 8 million (2051) and 10 million (2061) predictions to assess the needs for future infrastructure upgrade.



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6. Modelling in Infrastructure Investment for Sulphur Beach

Hansol Lee (Auckland Council), Jackie Zhou (Auckland Council)

Sulphur Beach is a low-lying area within the Waiurutoa Stormwater Catchment, located at Northcote Point, on the northern side of the Harbour Bridge in Auckland. The area is bounded by Belle Vue Avenue to the North, State Highway 1 to the East, and Richmond Avenue to the West covering about 50 hectares and 290 properties. The edges of Sulphur Beach was developed prior to the reclamation of the Sulphur Beach foreshore for the Northern Motorway (State Highway 1). The Sulphur Beach area experiences both pluvial flooding as well as coastal inundation from the Waitemata Harbour during extremely high tides or a tidal surge in conjunction with moderately high tides. Approximately 24 habitable buildings are predicted to flood in the 100 year ARI storm event under Maximum Probable Development (MPD) with Climate Change (CC) scenario and 2 properties are subject to regular coastal inundation at least 3-4 time per year without wave effects. Both pluvial flooding and coastal inundation are expected to worsen with the effects of climate change.

Since 2009, a series of studies have been conducted to predict the flood risks and to develop possible flood mitigation options for Sulphur Beach. Modelling has always been a significant component in each of the studies; the first catchment model was completed in 2009 using MOUSE software (version 2005), the next model in 2012 using Mike Urban (Version 2011) and the latest model built in 2016 using Infoworks ICM (Version 7.5). The models have progressed from an all 1D model to a fully coupled 1D-2D model.

This presentation focuses on how the introduction of modelling and evolution of modelling methodologies has helped catchment planning and infrastructure investment decision making in Sulphur Beach. Different types of models over the years and how each model has provided value at the time will be discussed in the presentation. The limitations of each model in each stage will be also discussed.

The presentation also focuses on how the latest 1D-2D coupled model was utilised to incorporate sufficient detail that allows prediction of flood risks and effects of infrastructure upgrades more reliably compared to previous models. By doing complex modelling and scenarios tests on various tidal boundary and rainfall (joint probability approach), the issues and project benefits were quantified to support a solid business case that it will protect the local community as well as meet the best interest of wider communities and rate payers.

Lastly the presentation outlines the implemented physical work at Sulphur Beach to mitigate coastal inundation based on the modelling study, currently performing to be effective. Further modelling works are currently underway for the mitigation of pluvial flooding.



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7. MAKING MODELS WORK: SMALL INVESTMENTS, BIG REWARDS

B. Schicker, M. Groves, C. Mills and L. Foster (WSP)

Increased computing power has resulted in computer models able to analyze large and complex networks in more ways than ever before. This has enabled better understanding of the constraints and issues present in the system, trialing multiple options and quantifying their effects, and prioritizing capital and operational investment.

Many councils throughout New Zealand have or are in the process of developing their own models for their three waters networks. This provides significant opportunity for making the most out of the available funding for projects that can effectively capitalize on these models. Some projects are clear candidates for this, such as planned capital works, as well as others which are less obvious; for example, temporary works design.

The ability to influence the cost of a project is highest in the earliest stages of a project. To optimize efficient investment of available funding, models need to be incorporated in the planning and conceptual design stage and updated with appropriate data as the project progresses. Investing in good quality data, such as level surveys and flow monitoring, to increase confidence should be considered by their potential benefits. This can highlight whether the project needs to proceed, if the scope can be reduced, or if the current scope is insufficient.

Use of a model allows increased certainty that the proposed solution is resolving the correct problem, or if there are other factors or constraints present that have not been accounted for and need to be addressed. Valuing the model as a central decision-making tool ensures that the model is used frequently and effectively and does not sit idle on a metaphorical shelf for years never achieving its full potential.

The presentation covers both stormwater and wastewater projects that WSP have undertaken where the model (sometimes existing) has been used to provide the client with a significant return on their initial investment. In many of the examples, some of which would not be immediately obvious, the benefits realized from the model more than offset the outlay of developing the model in a single project. This presentation aims to highlight the ways in which models can be effective tools to efficiently prioritize available funding streams, especially when they form a small investment cost relative to the intended capital works they will support.



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8. Banyule Swamp, my neighbour, will you give me a glass of water?

Bertrand Salmi, Water Technology

The Banyule Billabong has been identified as one of the priority billabongs within the Yarra catchment currently suffering the impacts from flow regulation, urbanization and changing climate. Previous studies concluded that the frequency and duration of inundation is insufficient to protect the billabong ecological health, prompting Melbourne Water and Banyule City Council to conduct a successful watering trial in 2016 with help from Victorian Environmental Water Holder. Water was pumped from the Yarra River into the billabong to protect its marsh and meadow zones.

Council and Melbourne Water are now looking to develop a long-term solution. Previous studies identified that excess water from Banyule Swamp – located north of the billabong – may be re-directed towards Banyule Billabong, to allow more frequent inundations of the billabong. The main concerns around this option are centred around timing of the water delivery, potential impact on Banyule Swamp and quality of the water, which may be high in nutrients.

The aim of this study is to understand possible interaction between existing water regime, water quality and vegetation in the Banyule Swamp to develop a long-term solution to both improve the ecological health of the Banyule Billabong and encourage wader habitat in Banyule Swamp, as Latham's Snipe visits the site. A monitoring program was thus invited to gain understanding of the water quality and level fluctuations in Banyule Swamp.

Preliminary catchment analysis identified the main sources of water to the Swamp and bathymetric characteristics of the Swamp. The results suggest that levels may fluctuate significantly during prolonged drought period. This will need to be considered when considering Banyule Swamp as a potential source of water for Banyule Billabong.

Hydraulic modelling was undertaken to identify key overland flow paths and estimate the trigger points above which Banyule Swamp received overland flows from adjacent creeks. This ultimately informed the water balance analysis – validated against data from the monitoring program – used to understand the hydrological regime of Banyule Swamp and its suitability as a back-up source of Banyule Billabong.



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9. COMPLEXITY IN MODELLING

Ben Davies, Stantec New Zealand

More and more these days, we find that the wealth of data becoming available is overwhelming. Big data is here, and we are encouraged at every turn to make use of every byte.

But there is a balance between model accuracy and model complexity. Although an accurate model is good, the law of unintended consequences warns that an intervention in a complex system tends to create unanticipated and often undesirable outcomes.

Modelling depends on data, but more importantly it depends on assumptions. You can add data to make the model a more accurate representation of the actual system, but every time we do this, we need to make assumptions about the new data. And every new assumption is a chink in the armour, a hole where a fatal error can creep in.

An example is property data – there are more and more accurate data sets across entire cities on buildings, (floor area, number of floors, number of bedrooms) and how the property is used (not just domestic or commercial, now we see if it is healthcare, fast food, offices).

In water supply modelling, this data can be used to add detail into the model. We can provide demand breakdowns by customer type, set up different domestic demands based on number of bedrooms in each house, apply commercial patterns based on the type of business...we can do this and more.

But there are assumptions in every one of these details. E.g., we might assume every office building uses water between 8am and 6pm only. Or we might assume people in a 5-bed house use as much water per person as people in a 3-bed house. Or we might assume they use less. Either way, we must make an assumption.

Often there is no way to test these assumptions. In water networks, the only test we really have for anything is calibration, and over and over when we add this type of sophisticated detail into a model, we usually find three things:

- The assumptions often result in a conflict with field data.
- The complexity of the model is increased to the point where obvious errors can be harder to recognise.
- When we finally find a way to shoehorn the assumptions into the model, we find they make absolutely no difference to the calibration.

Water networks are invisible. The only evidence we really have that anything is correct is calibration and complicating our models with additional details with little to no evidence is a recipe for disaster.



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In this paper will outline other examples we have found of detrimental complexity and set out some rules of thumb which I have found useful to decide where we should draw the line between accuracy and complexity in our models.



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10. THE USE OF DYNAMIC FREEBOARD

Kristin Stokes (Jacobs NZ Ltd), Ben Fountain, Nadia Nitsche (Wellington Water)

Flood maps are developed for a range of uses, including high-level hazard identification, catchment planning, infrastructure planning and District Plan hazards management.

Hazards, such as blocked culverts, sediment build up and wave generation that are known to occur during a flood are difficult to include in the base design models that determine the Flood Maps. It is important in the management of flood risks that these hazards are also represented in the maps. The application of freeboard is added to the maps to cover such hazards. Often when these additional hazards are not understood, a standard 500mm is added to the final flood maps as per the Building Code.

In the recent flood mapping programme that Wellington Water are undertaking, a better understanding of the freeboard was preferred. In order to quantify some of the additional hazards to flooding, sensitivity runs were carried out using the verified hydraulic models. The sensitivity runs varied depending on the catchment but typically include testing the sensitivity of the model results to inlet blockages, culvert blockages, variation in the design rainfall event, increased roughness or altered tailwater/sea level assumptions. The results of the sensitivity runs are used to determine the appropriate freeboard depths to represent the additional hazard.

Once the depths were understood – a dynamic freeboard model run was undertaken to determine the final flood hazard depth. Dynamic freeboard uses the maximum depth plus the adopted freeboard as an initial condition for the dynamic freeboard run. The model is run for a short time period, typically 5 minutes, and the maximum depth results from the run provide the final flood hazard depth layer used for recommended building levels. A process was developed which included GIS processing to dissolve adjacent elements with the same initial condition water level. This processing reduced the total number of initial condition polygons while ensuring there are no 'donut' or multipart features. The process also included modifying the hydraulic model to remove 1D elements as a 2D simulation was found to be more stable and produced consistent and reliable results across a range of models.

This paper discusses the methodology used to determine the dynamic freeboard applied. The method is based on assessing the sensitivity of modelled flood depths to incidents such as inlet blockage that are likely to occur in a particular flood but the locations and magnitudes of these occurrences will vary with each event.



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11. Use of detailed flood models for options analysis

Ivan Kholodov – Wellington Water

Large flooding events causing socially unacceptable loss and damage to private and public spaces appear to become a regular occurrence. This, as well as greater public awareness about climate change effect of exacerbating flood risks, puts pressure on regional and district authorities to better understand and manage these risks.

Wellington Region due to its unique location and terrain is one of the most exposed regions of New Zealand to floods. The impact of flooding becomes more prominent as the region has experienced particularly repaid economic and housing developments over the last decade. Furthermore, several low laying residential areas are exposed to the additional risk of sea level rise.

In the past, the provision of drainage to manage runoff was fragmented and provided to meet the needs of individual parcels of land development. The new approach for providing of drainage infrastructure is to consider catchments holistically where problem areas across the region identified and prioritized and appropriate solutions to address highest priority problems are selected.

To meet these challenges, Wellington Water Ltd (WWL) on behalf of its stakeholder councils is working on a programme to model flooding in all urban areas within Wellington region. To adequately represent flood risks at individual property level and overland flowpaths, WWL decided to model with a very detailed mesh and incorporate all network components including sumps. Such high detail makes simulation runs very long. While for flood mapping long simulation runs are not a problem as flood mapping is not done on regular basis, for master planning and optioneering purposes, long runs pose significant challenge in terms of programme delivery and project budgets.

The challenge for WWL is how to use detailed models in an efficient way for planning purposes without impacting the programme. Author's previous experience in using water supply and wastewater models to do optioneering and master planning by running multiple iterations to arrive at optimal result, appear to be inappropriate for the highly detailed stormwater models due to simulation time requirements making a purely iterative approach impractical. In order to provide better efficiency without compromising the detail, several methods were trialed to optimize the optioneering process.

Presented in this paper are the methods trialed to optimize the use of WWL detailed flood models so that useful, high level data, informing infrastructure capacity and priority requirements, is obtained within practical period.



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12. Runoff Estimation for An Ungauged Catchment – The Piha Flood Hazard Modelling

Kevin Fan (Auckland Council), Nick Brown (Auckland Council)

In February 2018, Piha has experienced torrential rain and significant flooding, leaving the local community devastated and gaining heavy political attention. In response to the rain event, Auckland Council has since out detailed flood investigation and remedial optioneering studies to develop a better flood management system for Piha. Flood hazard modelling has played a vital role as part of the investigation to better understand the flooding risks and testing potential remedial options.

Given the catchment characteristics and how flooding has progressed and affected Piha, it was initially thought that a 2D model with high mesh resolution was best suited to replicate the event. However, as the Piha Stream Catchment had no long-term flow gauge, it is challenging to prove that the estimations of runoff volume are accurate. In order to gain confidence in the flood model and in the best interest of Auckland Council, various method has been tested for estimating runoff volume and flows. This presentation will focus on describing the various methods used for estimating runoff volume and their effects on the ungauged Piha Stream Catchment.

The techniques are demonstrated by using different modelling methods (direct rainfall method vs traditional modelling techniques); different spatial and seasonal variations of curve number (CN); different sub catchment loading methods to assess the effects of peak flows, volumes and lag times and then compared with the known flooding records.

The study demonstrated how modelling methodology and the selection of hydrological parameters affects the results. The study has also revealed potential seasonal variations in the catchment and discovered how runoff is sensitive to some parameters that may otherwise be overlooked.

Some finding of this study were found interesting and unique compared to other catchments in the Auckland Region. For example, the modelled peak flow rates were found significantly higher than results from TP108 graphical method in Piha, due to its distinctive catchment topographical characteristics.



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13. MODELLING LONG-TERM VOLUME RETENTION IN A REUSE RAINWATER TANK

Jahangir Islam (AECOM New Zealand)

Auckland faces significant regional conveyance and treatment capacity issues and the extent of combined sewer overflows (CSOs) from the city's combined sewer system. Rainwater reuse tanks could be effective in reducing CSO's by rerouting stormwater currently directly entering the combined sewer network. The use of domestic rainwater tanks in urban areas could provide considerable reductions in potable mains water demand and roof stormwater runoff.

The use of reuse rainwater tanks for the supply of non-potable water in urban areas was found to have two substantial water saving benefits. First, when rainwater tank is used for toilet flushing, laundry and outdoor water uses, tank water is constantly being drawn down. As a result most of roof runoff from small storm events is captured by the tank which results in considerable reductions in stormwater runoff. Second, as toilet flushing, laundry and outdoor water are sourced from the rainwater tank, the mains water demand and CSO's can be considerably reduced. The uptake of rainwater tanks for non-potable uses provides resilience to the overall domestic water supply system and could offset new water sources being required thus offsetting capital investment.

A continuous simulation modelling investigation has been carried out to undertake a quantitative performance assessment of rainwater tanks in terms of reductions in frequency, magnitude, and volume of runoff flows downstream resulting in reduced stormwater runoff, reduced volume placed upon CSOs and potable mains water volume savings. The model results provide relationships between the roof runoff peak flow and volume reductions, roof areas and rainwater tank sizes.

MIKE URBAN modelling software was used for the continuous simulation modelling investigation. The MOUSE Model B (Kinematic Wave approach) hydrological model was used to generate continuous stormwater flows from the impervious roof surfaces using 10 years of continuous 5-minute interval rainfall data from the Wairau rainfall gauge.

Typical domestic rainwater tanks in urban residential areas with sizes ranging from 2000 to 4000 litres were used for continuous simulation modelling investigation. Typical urban household roof areas ranging from 100 to 200 m² connected to the rainwater tanks were considered to capture roof runoff by the tank for non-potable water use i.e. toilet flushing, laundry and outdoor uses.

Long-term continuous simulation modelling demonstrates that the use of reuse rainwater tanks for the supply of non-potable water in urban areas has been found to be effective at controlling frequent small storm flows and could provide substantial mains water saving benefits and reduced CSO operation in combined stormwater drainage areas. This analysis provides annual average roof runoff and potable water volume reduction due to use of reuse rainwater tanks for a typical household.



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Further modelling investigations would be undertaken on a catchment wide in order to quantify better performance assessment of reuse rainwater tanks which then could provide a basis for designing rainwater tank devices to meet targeted reductions in mains water demand, CSOs and stormwater runoff to achieve improved ecological outcomes in freshwater and receiving water systems.



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14. Development and assessment of a reservoir sediment management routine (ResSMan) for the Soil and Water Assessment Tool (SWAT)

Shrestha, J.P., Pahlow, M., Cochrane, T.A.,

University of Canterbury

Aims

Sedimentation causes the reduction of significant storage volume of a reservoir, loss of hydropower generation and downstream impacts. The impacts of climate change and land use change on runoff and sediment yield will further affect the sediment deposition in reservoirs and hydropower generation. Therefore, a single simulation model with capabilities to simulate hydrological processes, sediment management techniques and hydropower production at a river basin level is needed. Thus, the main objectives of this study is to develop a full Reservoir Sediment Management routine (ResSMan) integrated into the physically based Soil and Water Assessment Tool (SWAT) (Arnold et al., 1998).

Method

The ResSMan routine replaces the existing simplified reservoir routine of the SWAT model. The new routine has capabilities to predict the accumulation of trapped sediment, its impacts on the storage capacity of a reservoir, and hydropower generation under user-specified operation policies. Furthermore, it allows for simulating the removal of sediment by flushing (by passing water and sediment through flush gates located at the low level of a dam) and sluicing (passing sediment before suspended sediment solids settle in the reservoir). The process of flushing in the ResSMan routine comprises three phases: drawdown of water surface level, removal of sediment by flushing through gates at the base of the dam, and refilling the reservoir (Figure 1).

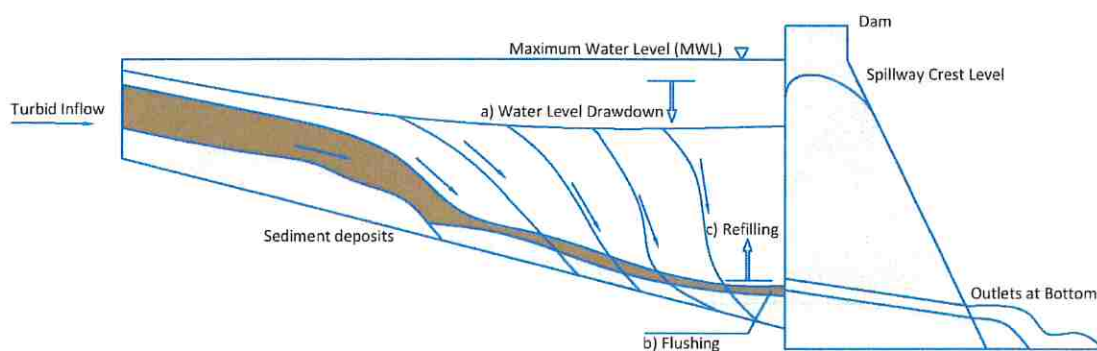


Figure 3: Flushing process to remove reservoir sediment deposits (a) water level drawdown, (b) flushing, (c) refilling reservoir.



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The routine assumes that sediment deposits uniformly within the reservoir cross section and that deposited sediment can be removed only when the flushing channel attains its long term capacity ratio (LTCR). LTCR is the ratio of the storage capacity of a reservoir that can be sustained due to flushing in the long term, to the original capacity of a reservoir. Similarly, the drawdown for sluicing initiates either on the user-specified initiation date of drawdown, or when the criterion of minimum reservoir inflow is met. Once the drawdown is started, the routine will try to achieve and keep the reservoir water level at target sluicing level, thereby releasing water through the low level outlets. Hence, opening the low level gates during sluicing allows the sediment-laden flood to pass at high velocity, and closing the gates refills the reservoir after sluicing. The user inputs required for the routine are i) volume-area-elevation curve, ii) hydropower plant characteristics like maximum/minimum operating level, tailwater level, plant efficiency, design flow of a plant and installed capacity, iii) rule curves, iv) outlet capacity curves, v) flushing specification data and vi) sluicing specification data.

A case study application of the ResSMan routine was carried out for the Nam Kong 3 reservoir with a catchment area of 646 km², situated in the Sekong River basin in Lao PDR. The simulation of flushing and sluicing was carried yearly for specified dates from 2000 to 2005. The SedSim model, (Wild & Loucks, 2012) a one-dimensional deterministic daily time step simulation model to simulate flow, sediment, hydropower production and various reservoir sediment management techniques (Wild et al., 2015), was used to evaluate of the performance of the developed routine.

Results

The performance of the ResSMan routine was assessed for the Nam Kong 3 case for the time period 2000-2005 by comparing with results obtained from the SedSim model. The ResSMan routine and SedSim model output were closely correlated for sediment outflow for both flushing (Figure 2) and sluicing (Figure 3). The coefficient of determination R^2 was 0.99 in both cases.

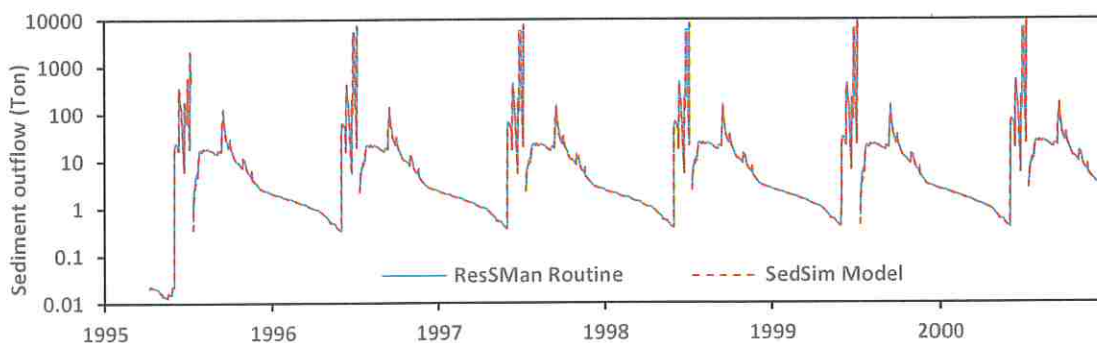


Figure 2: Comparison of the ResSMan routine with the SedSim Model for sediment outflow from the reservoir due to flushing.

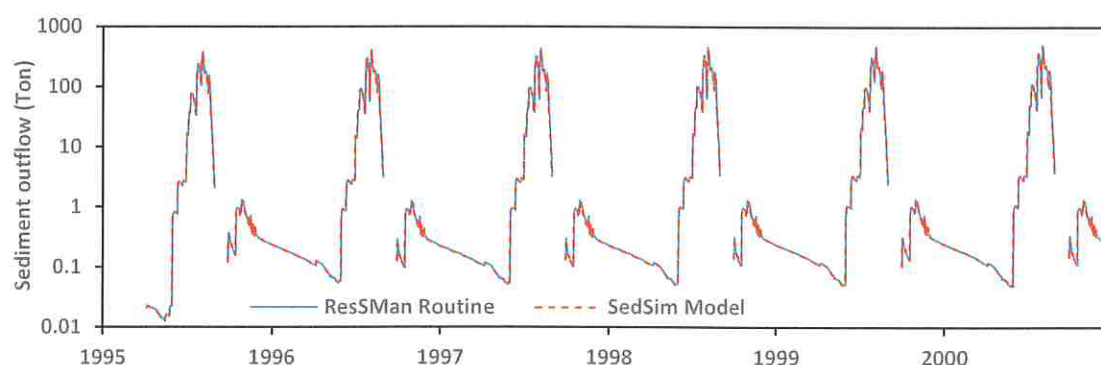


Figure 3: Comparison of the ResSMan routine with the SedSim Model for sediment outflow from the reservoir due to sluicing.

The ResSMan SWAT routine will be useful to assess and manage reservoir sedimentation under different climate change and land use change scenarios.

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15. Detailed 2D Modelling for Puhoi – Tests on Model Parameters and Software

Jorge Astudillo, Link Zhao (Ewaters New Zealand Limited)

Computer power, data capturing technology and modelling software continues to develop rapidly over the years, enabling new ways of modelling that is often data hungry. Whilst it shapes positive changes to the modelling industry, it also brings challenges when deciding what modelling tools to use and how to maximise the use of data and computer power. Despite the exciting improvements and convincing visuals from the latest technology, it is still important to be skeptical and ask how good the models really are.

Rain-on-cell type of models are proven to be an effective tool for rapid flood assessment, especially in rural areas, for its simplicity and quick turn over time comparing to traditional models. The downside of these models is that they are often too coarse for the accuracies required when describing local flood hazards. However, the recent 2016 LiDAR data in the Auckland Region makes it possible to implement 2D models with high mesh resolution that captures most relevant hydraulic features without significant manual inputs. This allows faster model build and better details for larger rural watersheds where high resolution 2D flood modelling of this scale wasn't possible.

The presentation uses the Puhoi Catchment (58km²) in the Auckland Region as a case study, discussing how improvements have been made to a 2D model, using a range of tools and processes. In addition to the improvements made, confidence was gained in the model by performing a series of sensitivity analysis, assessing various hydraulic and hydrological parameters. Aspects such the river roughness, tidal zone features, low flow channel, mesh resolution, river storage, among others, have shown to be important for the quality of the final model outputs.

The Puhoi Catchment has also been used to assess the performance of various modelling software, in the aim of understanding potential software induced uncertainties. Tests were carried out using simplified but realistic model parameters and an approach that considers rain-on-cell models with high 2D resolution, using the same basic assumptions and data inputs.

The presentation will focus on the outputs and comparisons from various tests, and how each parameter, approach or software affects the model results. At the end of the day, there will be inherent differences from the various modelling approaches, from the numerical engines to the selection of parameters.



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1. Dr Celine Catteon-Gilbert, NIWA
2. Bill Syme, BMT Global
3. Fatima Bashir, DHI
4. Courtenay Giles, WSP
5. Girija Mulay, Stantec
6. Bertrand Salmi, Water Technology
7. Hansol Lee, Auckland Council
8. Jackie Zhou, Auckland Council
9. Brendon Schicker, WSP
10. Ben Davies, Stantec
11. Kristin Stokes, Jacobs
12. Ivan Kholodov, Wellington Water
13. Kevin Fan, Auckland Council
14. Jahangir Islam, AECOM New Zealand
15. Jayandra Shrestha, Canterbury University
16. Jorge Astudillo, Ewaters New Zealand
17. Link Zhao, Ewaters New Zealand



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Dr Celine Catteon-Gilbert, NIWA



Dr. Céline Catteon-Gilbert will be presenting a keynote address for the Water New Zealand Modelling Group Symposium on shaping a nationwide approach for river flow and flood forecasting. Céline is a hydrological forecasting scientist at NIWA, a principal investigator of a 2017 Natural Hazards Research Platform fund for “Enhanced probabilistic flood forecasting”, and since 2016, the leader of “forecasting floods and hazards”, a NIWA strategic science investment fund. In 2017, she obtained a NIWA Excellence Awards for Early Career Science runner-up. Céline leads a team of forecasters, hydrological modellers, research software engineers and GIS specialists in developing a flow forecasting model for New Zealand. With an engineering degree in applied mathematics, Ph.D. in theoretical physics and experience as a High-Performance Computing support consultant (NeSI) before joining NIWA, she has a passion and a drive for interdisciplinary research. She enjoys developing an active role in the international ensemble flow forecasting research community by getting involved in science and session committees at international conferences.

Céline is delighted to present her and her team’s exciting work on the NZ river flow forecast research project producing an hourly forecast for the next 48 hours, for nearly 60,000 rivers across New Zealand¹. She will discuss advances and challenges in water forecasting from global to local scales, from quantifying uncertainties using ensembles to forecast communication for decision-making.

¹ <https://niwa.co.nz/climate/research-projects/river-flow-forecasting>



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Bill Syme, BMT Global

Bill has 35 years' experience working on riverine, estuarine and coastal studies, of which most have been in the flood hydraulics field. During this time, he has successfully managed and led a wide range of flood and flood risk management studies in Australia and overseas. The widely used TUFLOW hydrodynamic modelling software was developed by Bill starting in 1989. Today, Bill is BMT's Software Business Lead, managing TUFLOW Products and associated services. He also continues to provide specialist flood modelling and flood risk management advice and was the Project Manager for the award-winning Brisbane River Flood Study Hydraulic Assessment.



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Fatima Bashir, DHI

Urban Water Engineer, DHI New Zealand

An experienced Water Engineer with more than six years of experience within the water industry. She has worked in a city council as well as in engineering consultancies.

Fatima is skilled in hydraulic modelling, analytics, project management and asset management. Her recent work includes modelling investigations for urban water networks for three waters, water demand management assessments, and inflow and infiltration management.

Fatima is currently based in the Auckland office of DHI NZ.



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Courtenay Giles, WSP

Graduate Water Resources Engineer
WSP

Courtenay is a relatively new member of the modelling world. She joined WSP in early 2019 after completing her Natural Resources Engineering degree at the University of Canterbury in 2018. Her honours project was on water quality analysis and stream responses to urbanisation. This prompted her to pursue water resources as her career path. Since joining the WSP Water Resources team in the Wellington office she has been fortunate enough to begin learning and working with software's such as HEC-RAS, the MIKE suite and TUFLOW. She is eager to share her findings from the past year of working with modelling software as well as learn from others in attendance.



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Girija Mulay, Stantec

Girija started her professional career as an Associate Civil Engineer in 2011 and joined Wastewater Network Modelling team at MWH Global ResourceNet India Pvt. Ltd, Pune. She deliberately set out to gain as much varied experience and made strong background in scope and cost estimation, planning survey, model build, verification, flood risk assessment, options development, UID assessment.

She has distinctive experience of modelling SuDS measures such as water butts and permeable pavements. During her professional career at MWH Global she got awarded and recognised for her mentorship, improving efficiency of the team by creating methodology documents and tools, project quality and promoted to Civil Engineer in 2014.

After successful completion of six years Girija joined Mott Macdonald - GDC Mumbai in 2017 and started working as a Senior Engineer – Modelling. The aim was to set a new wastewater network modelling team at GDC. It has a challenge being as a leader to recruit right people and assign right job to the team. She is up skilling her leadership by training graduate modeller and by delivering projects on time, within budget and with quality.

She has worked for UK water industry over the seven years and gained experience of undertaking various projects PR14&19 Growth studies, PR14 Flooding Enhancement Studies, Drainage Area Planning, Development Impact Assessment, Developer Services, SUDS, Climate Change, and Creep modelling, CAP, DG5 Flooding Schemes, Drainage Area Study using InfoWorks CS, ICM, MapInfo, QGIS software.

She is member of CIWEM now. She has published in refereed journal about her work in genetic modelling and hydrologic and hydraulic analysis and presented in international conference World Aqua Congress 2016, New Delhi.

Now she is passionately involved in network modelling projects of NZ water industry joining Stantec, Wellington by Jan 2019.



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Bertrand Salmi, Water Technology

Bertrand Salmi is an experienced environmental and water engineer, who has worked in consultancy and in local government. Bertrand currently works for Water Technology, a surface water, groundwater, coastal and waterway management consultant. Bertrand has an engineering title but has an ecological degree. As a result, Bertrand often leads hydraulic and environmental studies, often leading multi-disciplinary teams. This suits him, as Bertrand has relevant experience in many facets of hydraulic and water quality modelling and a keen interest in eco-hydrology. Bertrand is also the “Legal Market Coordinator” at Water Technology, working in the background to ensure his directors shine during panel, tribunal and supreme court hearings.



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Hansol Lee, Auckland Council

Hansol Lee is a Senior Healthy Waters Specialist at Auckland Council, with over seven years of experience in both the local government and the private sector. She is an experienced modeller able to undertake hydraulic modelling in all three waters, with particular affinity for stormwater modelling and specialty in InfoWorks ICM. Hansol has experience in developing numerous complex stormwater models as well as optioneering and conceptual designs for flood mitigation projects in Auckland.



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Jackie Zhou, Auckland Council

Jackie Zhou is a Principal Waterways Planning Engineer at Auckland Council. He has over 11 years of experience in water resources and stormwater management both in local authority and private sector. Jackie is a Chartered Professional Engineer (CPEng) and has extensive experience in hydraulic analysis, data manipulation and assessment, model development, issue identification, optioneering and conceptual design, as well as project management.



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Brendon Schicker, WSP

Brendon Schicker is a water engineer based in Christchurch working for WSP, formerly Opus. Brendon specializes in stormwater and wastewater design and hydraulic modelling using the InfoWorks suite of software, with over 7 years of experience working in the engineering sector.



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Ben Davies, Stantec

Ben Davies is a water networks specialist with Stantec Wellington. He has 20 years' experience in water networks, the first 10 of which were spent in the UK. Projects included leakage studies, district metering, and many other tasks in which a key skill was interpreting modelling reports into real world information. On his return to New Zealand, he moved into network master planning, with a number of ongoing studies for the likes of Wellington, Tauranga, Palmerston North and Hastings, along with international work in Saudi Arabia.



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Kristin Stocks, Jacobs New Zealand



Kristin is a hydrologist and hydraulic modeller, experienced in modelling rivers, urban stormwater networks and carrying out flood investigations. She has ten years of experience working as a consultant using Mike FLOOD, Innovyze ICM and HEC to understand issues around resilience to flooding. Kristin is currently a Senior Modeller on the Wellington Water Modelling Panel which is running a multi-year programme to develop stormwater models of all urban catchments in Wellington, Porirua and Lower and Upper Hutt



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Ivan Kholodov, Wellington Water

Ivan is currently a senior hydraulic modeller at Wellington Water Ltd where he normally provides stormwater modelling advise to Investigations and Land Development groups. Ivan has 15 years of experience in the water industry where he started as a chemical engineer and evolving through several roles into a hydraulic modeller. He has experience in water and wastewater treatment, water quality compliance as well as water, wastewater and stormwater network modelling.

Outside of his profession Ivan is passionate about linguistics with particular interest in Arabic and related dialects.



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Kevin Fan, Auckland Council

Kevin Fan is a Senior Healthy Waters Specialist at Auckland Council. He has 20 years diverse engineering experience in the Auckland region including hydrological modelling, catchment planning and project management.



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Jahangir Islam, AECOM New Zealand

Jahangir Islam is an Associate Director at AECOM in New Zealand. Jahangir is an experienced hydraulic modeller and Chartered Professional Engineer with over 30 years of work experience in a wide variety of environmental management projects including stormwater catchment planning, hydrological and hydraulic modelling, stormwater quality improvement and remedial options investigations.



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Jaydandra Shrestha, Canterbury University

Jaydandra Shrestha has had several years of international experience in hydrology, water resources and civil engineering.

Currently study at Canterbury University for his PhD in Civil Engineering. This follows on from his Master of Science in Hydropower Development from Norway, bachelor's in civil engineering & Manager for Nepal. Where he started his higher education with a Diploma in Civil Engineering,

Jaydandra also speaks 6 languages.



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Jorge Astudillo, Ewaters New Zealand

Civil Engineering degree, Major in Hydraulics, Sanitary and Environmental Engineering, Universidad de Chile (University of Chile), Chile, 2005.

Jorge is a Principal Hydraulic Engineering expert in hydrological and hydraulic analysis, with extensive experience in numerical modelling and optioning designs. He started working as a Research Engineer in the National Hydraulic Institute of Chile while finishing his 6 years degree and worked there for few years. There, he led a number of studies by integrating complex numerical and physical modelling, which allow him to complete a comprehensive understanding of the physical process involved in Water Resources researches, and the practical implementation of engineering solutions and resolution.

Jorge has settled in New Zealand since 2007, and in here he has led several research projects on urban and rural water systems, modelling, network analysis, optioning design and viability analysis, involving largely his speciality in hydraulic and hydrology, sediment transport, river engineering and numerical modelling applications. He has enriched his experience in New Zealand by working for leading engineering companies and major clients for several years, and while with Ewaters New Zealand, he had the opportunity to work on-site in several projects for major cities in New Zealand and China, including Auckland, Whangarei, Shanghai, Chongqing and Tianjin, among others.

Jorge's 16 years of experience, in Chile, China and New Zealand, includes complex and major projects, with a wide range subjects and methods. He is adept at integrating the latest technologies to assist efficient and targeted approaches for wet infrastructure and catchment management. He has a reputation for high quality work, innovative time saving approaches and timely delivery.



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Link Zhao

Master of Engineering, Hydrology and Water Resources, Hohai University, China, 2011

Master of Engineering, Computer Science and Statistics, University of Lille I, France, 2012

Link Zhao, who holds double master degrees in both Water Resources and Computer Science, is a senior hydraulic engineer with extensive experience in water system planning, storm water management, numerical modelling and flood forecasting.

He started working as a water resources engineer and planner in Shanghai Water Planning Institute since 2011 and acted as both a main team member and a project leader in various water system modelling, planning and management projects. In 2017, he settled in New Zealand and continued his career as a hydraulics engineer and modeller, participating in several research projects on urban and rural water systems modelling, flood forecasting system development using his enriched GIS analysis, programming and various model software skills.



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Workshop

Facilitated by Andrew Polland (BRANZ) & Lesley Smith (Water New Zealand)

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Advancing Models of residential water-use workshop

BACKGROUND

BRANZ and Water New Zealand are on a mission to understand household water use patterns across New Zealand – something that simply does not exist in New Zealand at present.

Over the last two years BRANZ has been working on a project that aims to deliver robust information specific to New Zealand households. As well as understanding HOW, WHEN and WHERE water is used, it will also investigate socio-demographic characteristics, appliances, housing typologies and sizes and other household and regional characteristics.

A broad selection of households around New Zealand have responded to questionnaires, had daily water consumption habits monitored, and a further sub-group have had detailed usage patterns modelled. All of this has led to a rich data set that could be used to plug significant gaps in our understanding of residential water use.

PURPOSE

The modelling community are invited to share in and shape the next steps to help realise the potential of this important data set. This workshop aims to;

a) Identity how industry can use this data effectively

This includes identifying how to communicate but also how to deal with the volume of data provided in 10 second intervals

b) Shape the project outputs to ensure the information can support engineering calculations, models and forecast

What metrics are needed? How do we deal with unique issues of individual homes? Metrics on their own can be problematic – one of the dominant features is when/for how long people are away from their property. How should problem identification (leaks) be addressed? What about characteristics of the consistency of water use?



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Site Visit

Auckland University, Water Engineering Laboratory, 32 Khyber Pass Road, Grafton

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Our research

Some current research projects include:

- Experimental study of abutment scour countermeasures, undertaken in collaboration with US colleagues
- An investigation of the phenomenon of sediment transport on the smallest scale – looking at turbulent flow entraining single bed particles
- A project aimed to identify and understand the mechanics involved in the formation and growth of submerged particle waves
- Physical model study of hydraulic issues relating to a canal estate development
- Investigating flow and depositional processes of clay-rich turbidity currents
- Laboratory study of patterns in gravel-beds and the surrounding flow field



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Water Engineering Laboratory

The Water Engineering Laboratory is located within the Department of Civil and Environmental Engineering. We are a hub for experimental, field and numerical initiatives to tackle our water resources problems. We are a world-leading academic research and consulting laboratory, hosting a range of sophisticated equipment that measures flow depths and velocities based on acoustic, ultrasonic, laser and imaging systems, as well as underwater topographies and forces on objects. Our expertise includes:

- River, coastal and estuarine hydrodynamics and sediment transport
- Civil engineering hydraulics and hydraulic modelling
- River and coastal engineering
- Ecohydraulics
- Catchment hydrology

Facilities and instruments

Our water is supplied through a reservoir – header tank ring main system (one 250 mm supply line, three 150 mm supply lines and one 100 mm high pressure supply line). We can supply a maximum flow 250 l/s to anywhere in the laboratory. All laboratory supply lines are equipped with Krohne magflow meters. We have two calibration pits of 5.3 m² and 21 m² for accurate flow measurements in addition to the magflow metres. The head at laboratory floor level is 14.2 m, and a high-pressure pump delivers 22 l/s @ 150 m head.

The Water Engineering Laboratory is comprised of a variety of Open Channel Flumes, Wave Flumes and modelling space.



Modelling Group
WATER NEW ZEALAND



Water New Zealand Modelling Symposium
11 – 12 March 2020, Grand Mercure Hotel, Auckland

Menus

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Modelling Group
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Wednesday 11 March – Grand Mercure

Morning Tea - foyer

- Coconut Chia Pudding | passion fruit | homemade granola | vanilla

Afternoon Tea - foyer

- Assorted Homemade Cookies

Buffet Lunch – Vue Restaurant, Level 13 Grand Mercure

- Bread – artisan bread rolls and home-made butter

Salad

- Garden salad | baby cos lettuce | radicchio | cucumber | radish | Sicilian olive
- Raw Beetroot Salad | kale | toasted almond | goat's cheese
- Green Bean Salad | almond | feta | rocket | raisin

Hot Selection

- Apple and miso glazed pork belly | roasted butternut | cashew
- Oven baked market fish | spiced cauliflower | pepper | turmeric
- Seasonal steam vegetables
- Vegetarian Green Curry | broccoli | green beans

Sweet

- Coffee infused mousse cake
- Lemon swiss rolls
- Seasonal fruit platter

Cheese

- Selection of cheeses, crackers, nuts and dried fruit



Modelling Group
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Thursday 12 March – Grand Mercure

Morning Tea - foyer

- Savour scone | smoked bacon | cheddar | caramelized onion (vegetarian option available)

Afternoon Tea – foyer

- Lamington | chocolate crumble | lemon

Buffet Lunch – Vue Restaurant, Level 13 Grand Mercure

- Bread – artisan bread rolls and home-made butter

Salad

- Garden salad | baby cos lettuce | radicchio | cucumber | radish | Sicilian olive
- Roasted pumpkin and kumara | barley | goat's cheese | romaine lettuce
- Quinoa Broccoli Slaw | garlic | almond | mustard

Hot Selection

- Grilled romesco chicken | capsicum | almond | red wine
- Seared fish of the day | ginger | spring onion | soy sauce
- Seasonal steam vegetables
- Lasagne | eggplant | courgette | tomato | basil | olive

Sweet

- Dark chocolate brownie
- Mille-feuille
- Seasonal fruit platter

Cheese

- Selection of cheeses, crackers, nuts and dried fruit



Modelling Group
WATER NEW ZEALAND



1-17 Jellicoe Street, North Wharf, Wynyard Quarter, Auckland

Function Menu

Let's start with these, while we wait for people to show up - 6.30pm to 7.30pm

- Marinated Olives – Olives marinated in lemon, thyme, ginger and red chillies
- Salt & pepper Squid.

When people have arrived move onto - 7.30pm onwards

- **Wharf Platter** - Pan-fried tiger prawns in fermented chilli butter, our classic prawns and fish bites, lemon pepper squid, green lip mussels with cream sauce, poisson cru, grilled catch of the day.
- **Conservatory Platter** - Char-grilled beef eye fillet, lamb tender loins, pulled brisket in blue cheese sauce, grill chicken breast, red wine chorizo, tequila and garlic marinated chicken bites.
- **Garden Platter** - Mediterranean vegetables salad with fresh greens.
- **Charcuterie Platter** - Selection of high-quality artisan cheeses and European cured meats, served with nuts, olives, crackers, fresh fruits, chutney and marmalade.
- **Moroccan Meatball Platter** - Moroccan spiced infused lamb cooked in rich tomato gravy, with parmesan cheese.
- **Grilled Platters with Vegetables with Cajun chicken**
- **Crispy Chicken Wings with spicy aioli**
- **Mozzarella Stuffed Arancini Balls** - Stuffed risotto balls with chunky salsa with citrus aioli
- **Stuffed Mushrooms** - Mozzarella, parsley and crumb stuffed mushrooms with Cajun spice and parmesan



Drinks

Tap Beers

- NW11 Gold Lager
 - Glass \$11.50
 - Vase \$21
 - Jug \$39
- Common People Pilsner
 - Glass \$12
 - Vase \$22
 - Jug \$41
- McLeod's Paradise Pale Ale
 - Glass \$13
 - Vase \$24
 - Jug \$44

***Yes, we did say vases – probably the only place you can tell your partner you only had one when you really had two.
We'll let you work that out.***

Wine

The Conservatory is the first bar in New Zealand to bring on board the wines by the glass dispensers, so our customers can taste wine in its optimal state and by the glass, rather than having to buy a bottle.

Pinot Gris

- The Ned – Marlborough
 - Bottle \$52
 - Glass \$11.50

Chardonnay - Napier

- Tony Bish Flat & Sassy
 - Bottle \$56
 - Glass \$12

Sauvignon Blanc

- Oyster Bay – Wairau Valley
 - Bottle \$51
 - Glass \$11
 -

Rose

- The Ned – Marlborough
 - Bottle \$52
 - Glass \$11.50

Pinot Noir

- Russian Jack – Martinborough
 - Bottle \$57
 - Glass \$12



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WIPA

Water Industry Professionals Association

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Modelling Group
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We are Passionate about Water Industry Professionals

The Water Industry Professional Association (WIPA) provides a continuing professional development and registration programme for water industry professionals.

It's about ensuring a high level of competency within the industry is maintained.

How do I enrol into WIPA?

If you want to enrol into the WIPA programme, please complete the enrolment form

If you have any questions, please contact on info@wipa.co.nz

Programme Costs

There is a one-off fee for approved applicants to enrol into the WIPA programme. Once you have enrolled you will be required to pay an annual administration fee to ensure your enrolment stays current.

Enrolment fee: \$150 + gst

Annual Administration fee: \$100 + gst

Course attendance incurs a separate fee at the applicants own/employers' cost. More information on course fees can be found on the website, www.wipa.co.nz

Gaining CPD Credits

Water industry employees who are enrolled in the WIPA CPD programme can earn CPD credits by attending training courses that are listed on the WIPA website, and below. To become a Registered Water Industry Professional, applicants must gain 30 WIPA CPD credits within a two-year period. You can gain these credits through:

- Approved WIPA courses
- Presenting a paper at a conference (3 credits for a 30-minute presentation)



Below is the current listing of courses provided to the WIPA programme. Check the website regularly for additional courses as they become available.

Drinking Water

- Backflow Prevention
- Chlorination Basics
- Corrosion protection of steel assets in water/wastewater treatment plants
- Critical Control Points for water supplies
- Flexitec PVC Pipe Design & Installation
- Introduction to Water Safety Planning
- Polytec Injection Extrusion Welding
- Polytec PE Pipe Design and Installation
- Polytec PE Pipe Buttwelding
- Polytec PE Pipe and Fittings Electrofusion
- Polytec PE Pipe Welding
- Polytec PE Pipe and Fittings Welding QA Inspection
- Polyethylene Pipe Welding
- Principles and Trends in Water Treatment
- The 6 Principles of Drinking Water Safety in Practice
- Water Sampling Potable Water

Wastewater

- Corrosion protection of steel assets in water/wastewater treatment plants
- Flexitec PVC Pipe Design & Installation
- Polytec Injection Extrusion Welding
- Polytec PE Pipe Design and Installation
- Polytec PE Pipe Buttwelding
- Polytec PE Pipe and Fittings Electrofusion
- Polytec PE Pipe and Fittings Welding QA Inspection
- Polyethylene Pipe Welding
- Prevention of concrete corrosion in water/wastewater treatment plants and chemical bunds
- Principles and Trends in Wastewater Treatment
- Water Sampling Environmental and Wastewater



Modelling Group

WATER NEW ZEALAND



Stormwater

- Flexitec PVC Pipe Design & Installation
- Polytec Injection Extrusion Welding
- Polytec PE Pipe Design and Installation
- Polytec PE Pipe Buttwelding
- Polytec PE Pipe and Fittings Electrofusion
- Polytec PE Pipe and Fittings Welding QA Inspection
- Polyethylene Pipe Welding

Essential Skills

Watch this space as we add courses as they become available.

The WIPA is a joint venture between the Water Industry Operations Group and Water New Zealand



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Contact Information

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Modelling Group
WATER NEW ZEALAND



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Questionnaire and Feedback

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Water New Zealand Modelling SIG Communications Questionnaire

The Committee is on a mission to improve communications with the wider modelling group and we therefore we need your feedback on communications and of course the 2020 Symposium.

So, if you could take a couple of minutes to complete the survey below, we would appreciate it very much.

Modelling Communication please circle response

1. Are you a current Water New Zealand Member?

Yes

☐

No

☐

Don't Know

☐

Want to join

☐

Forms at registration desk

2. Which industry do you working in?

Central Govt

☐

Local Govt

☐

Regional Govt

☐

Contractor

☐

Consultant

☐

Supplier

☐

Retired

☐

Other

3. What region are you from?

Northland

☐

Auckland

☐

Waikato

☐

Bay of Plenty

☐

Taranaki

☐

East Coast

☐

Hawkes Bay

☐

Manawatu/Whanganui

☐

Wellington

☐

Nelson/Marlborough

☐

West Coast

☐

Canterbury

☐

Otago

☐



4. How do you describe your modelling knowledge?

Beginner ☐ Intermediate ☐ Experienced ☐

5. Which water do you model?

All 3 Waters ☐ Water Supply ☐ Wastewater ☐
Stormwater ☐

6. Are you interested in more communication from the Modelling Group Committee?

Yes ☐ No ☐

7. Which communication preference do you have?

Email ☐ LinkedIn ☐ Newsletter ☐
Water New Zealand website ☐ Other

8. How often do you visit the Water New Zealand website for news and events?

9. Would you be interested to submit content to an email / newsletter / LinkedIn etc?

Yes ☐ No ☐

10. What other communication methods would you like us to utilise?



MODELLING SYMPOSIUM

1. How did you hear about the yearly Modelling Symposium?

Word of Mouth

☐

Attended previously

☐

2. How do you hear about providing abstracts for the Symposium?

3. Would you like to submit an abstract for 2021?

Yes

☐

No

☐

4. If you have attended previous symposiums, could please indicate your satisfaction with

Range of topics

Ok

☐

Good

☐

Fabulous

☐

Length of
symposium (2
days)

Ok

☐

Good

☐

Fabulous

☐

Quality of
Presentations

Ok

☐

Good

☐

Fabulous

☐



5. Three things we could improve on

6. Three take a ways from the symposium

