

Opinion Piece - moving hydraulic modelling to a professional level

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Where have we come from?

Hydraulic modelling as a tool in the kit bag of engineers has changed dramatically in the past 20 years. The table below shows the advancements in the discipline. For instance, 20 years ago engineers wrote their own coding in FORTRAN to calculate flows and water levels and then produce the results using dot matrix printers only they could decipher. Today the coding is written in a black-box environment with graphics and tables in multiple colours at every location within the model boundary.

Early 1990's	Today
Personal software	Proprietary software
Specialist	Generalist
Specific projects	Used in most water-related projects
12 modellers nationwide	Over 300 modellers
Calculation driven	Black-box GIS driven
2-3 specialist firms	Most firms have hydraulic modellers

Table 1: Changes in Hydraulic Modelling in 20 years

Today most civil engineering firms employ full-time hydraulic modellers and there are many more self-employed modellers who support smaller firms. In 2000 the modelling SIG held its first stand-alone conference in Rotorua. It attracted about 200 delegates. Half of the delegates were not full-time modellers but asset managers who used the services of modellers to solve their problems.

Given this number I would estimate that there are perhaps 150 engineers and scientists who would be regarded as full-time modellers and perhaps a further 350 who do modelling part time as part of their general engineering job. This is a large pool of talent highly diversified in age, company size and experience. As a measure of how things have moved on, when I arrived in New Zealand in 1990 with a PhD in computational hydraulics I probably had just 3 organisations I could work for. Now the options for a young engineer are wide and varied.

In short the industry has come a long way and it has been an exciting journey.

So where are we now?

The Resource Management Act has made a difference in the growth of hydraulic modelling. The simple questions by a consenting authority like Please establish the impact of your infill on the 100-year floodplain? Or What extra discharge will you subdivision have on downstream watercourse and how will you mitigate it? are typical. Auckland Regional Council in using the Integrated Catchment Management Plan approach has allowed stormwater, wastewater, water supply and groundwater specialists to work together.

The consequence of the increased use of hydraulic models means a greater cost to councils and private companies and the importance of hydraulic models overtaking the previous traditional manual methods. Hydraulic models are increasingly relied upon to make major infrastructure and environmental management decisions. As a rough estimate, based on the number of practising modellers, the annual cost of modelling in New Zealand is about \$60million leading to perhaps a further \$2billion of infrastructure construction.

In a short time there is now a major responsibility attached to hydraulic models and their interpretation.

So what are the issues?

I have a long list issues that need to be addressed, I am myself on a continual learning curve, but I outline those of greatest concern;

1. Style over substance
2. Graduates being thrown into the deep-end
3. Poor reporting
4. Lack of long-term quality control

How can I justify these comments? Easy, I listen to the end users, the clients. Firstly style over substance means that many users do not understand what is in the little black-box but the pictures look pretty. The advance in data rich GIS tools has provided modellers with megabytes of information that is easily manipulated. Graphics of floodplains, pipe hydraulics, and pollution plumes in an array of colours and moving in time look very impressive. But how do we know if they are right? How do we judge the answers being spooled out onto reams of paper?

A recent Danish Hydraulic Institute User Group day highlighted this for me. This is not a criticism of DHI. Some invited presenters showed a general lack of understanding of what hydraulic behaviour of the

system they were trying to portray – but the graphics looked great!! These were presentations by the younger graduates. I feel for them because I think they are thrown in at the deep-end and expected to learn the menus and understand the system quickly.

Poor reporting is probably a curse for most engineering and scientific disciplines. Say too much and it's too technical or say too little and you neglect key points. Many times the audience is unknown to the modeller and the outputs are thus confusing to everyone. Do pipe flows for each flood event need to be printed? Where is the rainfall distribution? How many houses drain to each node? The narrative excludes the problems encountered so others following behind do not know what to expect or why the model is unstable.

Finally, it seems there is a general lack of long term quality control. I recently did a random survey of 21 council modellers and asset managers asked them whether they had a formal archiving system for hydraulic models constructed in-house or externally by consultants. 85% said that they did not. The investment in constructing and utilising models is huge and should be protected for the future. It is an asset with the same intrinsic value as any pump station, culvert crossing or LID structure.

So how do we solve these issues?

Training, training and meaningful formal training. There are a number of learning opportunities provided for modellers but it is fragmented and voluntary. The opportunities include software vendor training, conferences, workshops, evening get-togethers and SIG training days. These are useful in many ways for networking and software familiarity but they have no structure that can help modellers understand all aspects of modelling from the start of a project to its written conclusion. When a client commissions a project which requires a modelling component the only thing they know about the modeller is how many years experience they have and what software they can use. Sometimes clients do not even know what modellers are working on their projects.

A way forward

What we need is some kind of an accreditation system with formal training. NZWETA provide numerous practical courses and some have certificate and diploma qualifications. IPENZ also provide access to various courses. Most of these courses are for operators but why can't the desk-bound consultant go through the same rigour? A course with meaning will increase the professional perception and mana of hydraulic modellers and provide confidence to their clients in that they have undergone some formal process and training.

The accreditation process could have the following framework:

1. Two-day theory
2. Two-day practical training using a particular software package
3. Two-day practical training using another software package
4. Attendance at a workshop or conference with a review report
5. Submission of a report done on the job
6. Examination

There are many experienced modellers that could be used as mentors in the process. For example Dr Alistair Barnett would have a lot to offer young engineers.

Many modellers probably spend 10–15 days a year attending various events so this would not impose additional down-time paid for by their employers. Accreditation would need to be maintained by some sort of attendance or report submission. Many engineers who make hydraulic modelling their career choice would be able to distinguish themselves and provide clients with a value-add component to their work.

The hydraulic modelling industry is now mature enough to take this next step. We need to help our young up-and-coming engineers. We just need a structure and mechanism to make it happen. ■



Dr Steven Joynes has 25 year hydraulic modelling experience and is the former chair of the modelling SIG. If you have any comments or want to move things forward then feel free to contact him at hms@wave.co.nz.