The Wastewater Planning Users Group
CIWEM's Urban Drainage Group

WaPUG

The Wastewater and Urban Drainage Conference

The challenge to manage surface water and flooding in the urban environment

Delegate Notes

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Welcome to the conference

This information gives the answers to some of the most frequently raised questions that arise at the conferences we organise.

Conference Outputs

- **The Power Point presentations** and delegate notes will be available shortly after the event on the CMS www.coastms.co.uk and CIWEM www.ciwem.org websites. We will notify you by email when these have been placed on the sites.

- **Memory stick** The full papers from the conference are included on the memory stick in your delegate packs, along with a number of other key documents; there is a contents page listing papers and contributions.

Questions – Bookings – Receipts – In house information If you have any questions during the event about bookings, finances, or logistics please see ***Christina Beech*** at the registration desk; she will be pleased to help.

Timing We will try to ensure that the conference runs on time to allow the allocated time for speakers and as importantly for discussion. A bell will be rung 5 minutes before the start of sessions.

Food There is always ample food at the events and you can come back for more. Once you have collected your food ***could you move away*** from the serving table. Catering staff are on hand if you need anything, including extra drinks.

Delegate list A list of the delegates to 1 November is at the end of the delegate notes.

Evaluation form There is a questionnaire and evaluation form in your delegate pack; your views will help us improve future events. Please leave these at the registration desk along with your badge when you leave.

NB Valuables **If you have anything you value keep it with you i.e. do not leave laptops unattended.**

Before you leave Check you haven't left anything in the conference hall.

Please also take any **leaflets or reports.**

N.B. Paper 1 – not sumitting abstract
Workshop 1 – not received in time for these notes

Introduction

The aim of this conference is to give delegates a flavour of the challenges faced by urban drainage practitioners in delivering significant capital and operational investment programmes over the next 5 years, for both water companies and Local Authorities. These challenges include:

- **Drive for efficiencies** – Water Companies are under higher pressures than ever before to deliver programme efficiencies across the board. All stakeholders will be required to maximise outputs, reduce costs and deliver increased value throughout the design and construction process. Modelling plays a key role in delivering this value in the planning and solution development process.
- **Innovation** – This will be an essential tool in delivering efficiencies through advances in technology, smarter processes and better use of modelling and data gathering techniques.
- **System optimisation and operation** – managing risk in the urban drainage system is not just constructing newer larger assets; smarter management of the system and better use of modelling and associated disciplines provides an opportunity to improve serviceability rather than more capital expenditure.
- **Accounting for Carbon** – Increasingly, schemes are being measured in terms of carbon cost, and the conference will look at how this is beginning to influence decisions for urban drainage practitioners.
- **Climate Change** – In order to plan for the future, we must accurately consider changes in rainfall patterns over time. Research is continuously moving forward in this field and modelling plays a key role in understanding the impacts on system performance and design.
- **Collaborative Working** – Larger number of stakeholders are involved in the management and design of urban drainage systems. Delivery of efficiencies, innovation and optimised solutions will only be achieved by all stakeholders working together. Surface Water Management Plans and AMP5 Design and Build arrangements lead the way in showing how this can be achieved.

The objectives of the meeting will be to explore the key challenges facing the water industry over the next 5 years, and explore how urban drainage practitioners will meet these, particularly in the context of modelling and system management. The conference will:

- Inform delegates of the key messages and challenges faced through case studies including integrated modelling, water quality modelling, surface water management plans and improved system operation.
- Describe the latest technical developments, areas of research and innovations in urban drainage studies, including data acquisition, modelling, sustainable design, optimisation and asset management techniques.
- Provide a forum for delegates and stakeholders to influence the development of future methods and procedures, and to understand how these challenges will be met.

Programme

Wednesday 10th November 2010

17.30 **Registration & Exhibition**

18.00 – 19.30 **WaPUG Research Group – Feedback from the July overland flow & flood risk workshops: Determine future steps Beaufort Room** **Graham Squibbs** United Utilities and **Jamie Margetts** Clear

20.00 **Pre-conference dinner – Hotel Restaurant**

Thursday 11th November 2010

08.00 Registration and refreshments with Exhibition in Queens Suite

09.15 **Welcome** Chairperson: **Gerard Morris** President of CIWEM & Environment Agency

9.15 ***Session 1 What Does the Future Hold? – The Next Five Years***

9.20-9.45 Paper 1 **Keynote Speaker - Innovation - The Way Forward Ian Noble** Operations Director Optimise

9.45 – 10.10 Paper 2 **Climate Change** **Brian Morrow** United Utilities plc

10.10 – 10.35 Paper 3 **Carbon** **Bob Stear** Severn Trent

10.35 – 11.00 Paper 4 **Urban Water Management in Australia** **Tony Weber** eWater CRC National Practice Leader – Water Quality for BMT WBM

11.00 -11.30 Refreshments and Exhibition in Queens Suite

11.30 – 12.45 ***Session 2 How to Implement the New Legislation*** Chairperson: **Fola Ogunyoye** Chair CIWEM Rivers and Coastal Group and Royal Haskoning

11.30 - 11.55 Paper 5 **SUDS & Roads** **Neil McLean** SEPA

11.55 - 12.20 Paper 6 **National Sustainable Drainage Standards** **Nick Orman** WRc

12.20 - 12.45 Paper 7 **Local Authority - Capacity building** **James Levesconte** Halcrow

12.45 - 14.15 Lunch in Hotel First course - Restaurant
Sweet course & refreshments in the Exhibition – Queens Suite

14.15 - 15.30 ***Session 3 Case Studies*** Chairperson: **James Hale** Clear

14.15 - 14.40 Paper 8 **A Summary of Challenges and Solutions for Delivering 33 SWMPs** **Michael Arthur** Capita Symonds

14.40 - 15.05 Paper 9 **Using ICM Modelling to Fully Understand the Problem** **Bob Fleming** MWH

15.05 – 15.30 Paper 10 **SWMP – More than just modelling** **Martin Osborne** Mouchel

15.30 – 16.00 Afternoon Refreshments and Exhibition in Queens Suite

16.00 – 17.00 **Workshop 1 – Lidar** Leader: **Alastair Moseley** WSP Environmental
Workshop 2 – Flow Survey Leader: **Phil Dyke** MWH/Optimise
Workshop 3 – Climate change – impacts on rainfall and urban flooding Leader: **Murray Dale** Halcrow

17.00 – 18.30 **Exhibition**

19.30 **Conference Dinner** followed by the WaPUG Event in the Royal Suite

Friday 12th November 2010

09.00 - 10.15 ***Session 4 Integrated Solutions*** Chairperson: **Adam Davies** Hyder Consulting Ltd

9.00 - 9.25 Paper 11 **Application of Integrated WQ Modelling for Efficient Management of WQ in River Irk with Cost Effective Investment Gemma Manache** MWH/United Utilities

9.25 - 9.50 Paper 12 **WFD Taking the Next Step Forward in Joined Up Thinking** **Ed Bramley** Yorkshire Water

9.50 -10.15 Paper 13 **Flood Hazard Quality Assessment for the central business district of Auckland** **Andy Gibson** AECOM

10.15 - 11.00 Refreshments and Exhibition Queens Suite

11.00- 12.15 ***Session 5 Operational Issues*** Chairperson: **Neil Scarlett** IETG

11.00 - 11.25 Paper 14 **Best Management Practice for Blockage Reduction** **Jonathan Cutting** Mouchel **Nathan Muggeridge** Mouchel / Asset Solutions Consulting Ltd

11.25 - 11.50 Paper 15 **Live Data for Live Models to Aid Ops Decisions Ian Small** Mott MacDonald

11.50 - 12.15 Paper 16 **Just In Time Operational Management** **Chris Digman** MWH

12.15 – 13.00 **WaPUG Forum**

13.00 Lunch in Hotel Restaurant

WaPUG Research Group – Feedback from the July overland flow & flood risk workshops: Determine future steps

Graham Squibbs & Jamie Margotts
Email: graham.squibbs@uuplc.co.uk jamie.margetts@clearltd.com

In July 2010, WaPUG held two workshops each attended by over 20 delegates to understand the gaps and needs in the available technology and practice guidance for overland flow modelling and urban flood risk analysis and mapping. These two workshops were highly successful, with current state of play being examined, and then a number of proposals identified to improve the available technology, practitioner guidance, training and experience, and interactions with legislation and other stakeholders.

The aim of this workshop is to go through the solutions that were proposed and identify where these can be taken up by WaPUG to improve the available industry knowledge. The solutions will be prioritized and a delivery framework developed to plan how WaPUG can achieve some of the targets and goals. Some solutions need to be progressed by other parties, so the workshop will also identify these and develop the best course of action to disseminate the ideas to the wider industry.

Paper 2: Climate Change

Brian Morrow
Climate Change Adaptation Manager, United Utilities, Thirlmere House, Lingley Mere Business Park, Warrington, WA5 3LP
Tel No: 01925 537177 Email: brian.morrow@uuplc.co.uk

Climate Change and how we as an industry are proposing to adapt to its impacts are currently towards (if not at) the top of peoples in trays.

The presentation will set out the high level impacts that are predicted for the North West of England, the approach that United Utilities are taking to prepare our adaptation report for Defra and other areas of climate change related work.

Predicted impacts for the North West
The impacts have all been derived from the UKCP09 data produced by UKCIP.
Data was collated for 4 main areas of potential impact :

- Increase in temperature
- Decrease in precipitation
- Increase in precipitation
- Sea level rise
-

The 'High Emissions' scenario was used on the basis that all evidence to date is that we are currently on or above the projected path, together with the fact that there is no global agreement to control the release of greenhouse gasses.

Adaptation report
Under the Climate Change Act 2008 UU are required to produce a report on the Adaptation work. The report must be with Defra by end Jan 2011 and cover the following 7 areas :

1. Functions impacted by CC
2. Approach
3. Summary of risks
4. Proposed actions
5. Uncertainties & assumptions
6. Barriers and interdependencies
7. Monitoring & evaluation of adaptation programme

We see this report as the first in the PR14 process and hence it is going through a formal approval and sign off process.

The first draft has been prepared and reviewed and the programme is to get it in the post before Christmas.

Other areas of work
We are also looking at the impacts of climate change in several other areas of work:

- Ofwat - through their 'sustainable Drainage' project
- UKWIR – looking to develop a R&D project to agree a consistent approach on what we do with the numbers ie how do we actually adapt.
- Surface water management – developing methods to retrofit SUDS to free up capacity in the sewer network
- Resilience and/or resistance – understanding how work in this area benefits adaptation.

Paper 3: Rising to the carbon challenge

Bob Stear
Severn Trent Water Ltd
Email: Bob.Stear@severntrent.co.uk

Carbon reduction presents a significant challenge to the water industry. If we are to play are part in contributing to an 80% reduction in emissions by 2050 we need to act now.

Severn Trent Water has begun this journey by focusing on operational carbon emissions, particularly energy usage to deliver a reduction in Green House Gases (GHGs) in line with the Carbon Reduction Commitment. At the same time we are seeking to better understand the impact of the green house gases realised by our sewage and sludge treatment processes so we can design, build and operate assets to minimise emissions.

In addition to energy or GHG reduction initiatives we have started to raise the profile and understanding of carbon and it's impacts within the company and our supply chain; In order to meet our reduction targets, carbon must a consideration in everything we do as a business. Severn Trent is forecasting a small reduction in GHG emissions by the end of AMP5, however our Quality Programme represents a significant increase in emissions.

In order to minimise the impact of this challenge, we have embarked on a collaborative project with the EA "Balancing Carbon and Ecology". Both organisations have signed up to the vision: " By working together we will meet the requirements of the Water Framework Directive at least carbon footprint and at least cost to customers". This new approach is promoting more flexible ways of setting, meeting and enforcing permits. It has led to an increased understanding of the challenges and limitations faced by both organisations and is providing a platform to challenge and influence national policy and regulation. A national, joined up approach by the water industry is essential to enable us to deliver the scale of carbon reduction we have set out to achieve.

The presentation will finally set out a set of provocative questions intended to be referenced in subsequent presentations throughout the Conference.

Paper 4: Urban Water Management in Australia – Lessons in Facilitating Uptake

Tony Weber
International Technical and Business Development Manager – eWater Innovation
National Practice Leader – Water Quality, BMT WBM
Visiting Fellow, Australian National University Fenner School
Brisbane, Queensland, Australia
Tel No: +61 407 316 215 Email: Tony.Weber@bmtwbm.com.au

The management of water in Australia has been of prime importance given the climatic extremes regularly experienced across the country. The history of urban water management has moved from ensuring reliable supplies of potable water, through management of flooding, management of the impacts of urban water on the environment, and now, to integrated urban water management, where all aspects of the water cycle are considered and managed. The challenge in this new paradigm is how to facilitate uptake of integrated water management by identifying which solutions are effective, and can be readily assessed by regulatory authorities to ensure legislative compliance. In Australia, this role has been largely undertaken through the use of a software tool.

The Model for Urban Stormwater Improvement Conceptualisation or MUSIC, developed in partnership by research agencies, academia, government bodies and industry representatives, has become a significant vehicle to facilitate the adoption of Sustainable Urban Drainage solutions (SUDs) to manage the urban water cycle. Primarily this has focused on the use of SUDS for the management of urban runoff, but has moved more recently into all aspects of the water cycle. One of the key drivers for facilitating uptake in improved urban water management was the setting of appropriate targets and the use of MUSIC to assess compliance with those targets. This paper explores the background of the MUSIC model, how it has been used by regulatory agencies and how it may be suitable for application to urban water management in the UK.

Paper 5: SUDS and Roads

Neil McLean
Scottish Environment Protection Agency, Erskine Court, Castle Business Park, Stirling, FK9 4TR
Tel No: 01786 455979 Email: neil.McLean@SEPA.org.UK

Since the introduction of SUDS (Sustainable Urban Drainage Systems) to the UK in 1996 significant progress has been made to formalise the use of sustainable drainage in new developments. This will continue in England through the Flood and Water Act and the use of SUDS standards.

There has however been reticence from parts of the roads sector in fully endorsing the use of SUDS for road drainage. As a means to overcome this, the Sustainable Urban Drainage Scottish Working Party (SUDSWP), a multi-stakeholder body including Scottish Water and SEPA, ran a conference with Transport Scotland aimed at encouraging the use of SUDS in particular by local authorities.

As a result of this conference a dedicated sustainable road drainage guide has been produced. "*SUDS for Roads*"* is now available on line and hard copies will be released to all local authorities in Scotland.

To extend this there needs to be agreement between drainage authorities and road authorities to share drainage arrangements. This is of concern in these financially challenging times and the desire for innovative, pragmatic and easy to deliver and maintain solutions has become ever more necessary.

By the sharing of multi-use facilities it becomes possible that such systems can be delivered, probably at a lower capital cost if designed properly. Perhaps more importantly with accurate construction detail and through careful planning and with good foresight we can achieve low maintenance facilities that meet climate change concerns, deliver water quality solutions, provide amenity and also serve as the drainage function for each development.

* "*SUDS for Roads*" is available from the "quicklink" on the SEPA home page www.SEPA.org.uk
or from the SCOTS website at
http://scots.sharepoint.apptix.net/roads/General%20Publications/Forms/AllItems.aspx?RootFolder=%2froads%2fGeneral%20Publications%2fSuDS%20for%20Roads&View=%7b53441DF3%2d0B24%2d4FD6%2d9FC3%2d0E7170AA6B11%7d

Paper 6: National Standards for Sustainable Drainage

Nick Orman
Principal Consultant, WRc Email: nick.orman@btinternet.com

Paul Shaffer
Associate, CIRIA Email: paul.shaffer@ciria.org

Bridget Woods-Ballard
Principal Engineer, HR Wallingford Email: b.woods-ballard@hrwallingford.co.uk

The Flood and Water Management Act 2010 introduces new arrangements for the approval and adoption of surface water drainage systems in England and Wales.
Schedule 3 of the Act 2010 requires surface water drainage for all new developments and re-developments to be approved by the SuDS Approving Body (SAB), which will be at unitary and county council level, before building can commence. The proposed drainage system will have to meet **new** National Standards for design, construction, operation and maintenance of SuDS in England and Wales before approval can be given. The Act amends the automatic right to connect surface water to the public sewer to make it conditional on approval of the proposed drainage plans.

The act also provides for the SAB to be responsible for adopting and maintaining SuDS that serve more than one property, in accordance with the SuDS National Standards.

Secondary legislation, currently in development, will set out detail of how the process will work, e.g. appeals and enforcement.

This presentation will describe the legislative framework its effect and its relationship to other parts of the FWMA. It will also provide a likely outline of the principles and structure of the proposed SuDS National Standards and the role of its guidance.

Paper 7: Local Authority Capacity Building

James LeVesconte
Halcrow Group Ltd, Building 304 Bridgewater Place, Birchwood Business Park, Warrington, Cheshire, WA3 6XG
Tel No: 01925 867 500 Email: levescontej@halcrow.com

Following the implementation of the Flood Risk Regulations (2009) and the Floods and Water Management Act (2010), the Association of Greater Manchester Authorities (AGMA) employed a joint Halcrow-IBM team to investigate the existing flood risk management capacity and capability within the ten Greater Manchester authorities. The aim of the study was to identify the existing flood risk management capacity and capability and to identify the most effective operational model for delivering the new responsibilities resulting from the new legislation.

The study identified that there are a number of issues surrounding flood risk management capacity and capability within Greater Manchester, notably:

- There is significant variation in capacity, capability and organisational set-up between the ten Greater Manchester authorities.
- There is an ageing population working in flood risk management in Greater Manchester authorities.
- There is a lack of specific flood risk management experience and expertise across Greater Manchester authorities.
- There is a lack of flood risk management capacity across AGMA authorities with the equivalent of less than 1.5 Full Time Equivalents (FTE) per authority working in flood risk management.
- The size and number of dedicated Drainage teams has dropped significantly since United Utilities took over the sewerage undertaker role. There is a large variation in the team size and drainage capability between the authorities, with some authorities having no drainage capability.

Following a multi-criteria appraisal, the study concluded that some form of collaborative working between the Greater Manchester authorities would be the most effective operational delivery model in light of the new legislation. This would either be from pooling all Greater Manchester drainage resources in to one team, or by operating in 'clusters' with three or four authorities working collaboratively to deliver the new responsibilities. This decision on which model to implement has been referred to senior management within AGMA.

Paper 8: Drain London: A Summary of Challenges and Solutions for Delivering 33 Surface Water Management Plans

Michael Arthur
BEng, MIPENZ, CPEng, Senior Consultant, Capita Symonds Ltd, Level 7, 52 Grosvenor Gardens, Belgravia, London, SW1W 0AU
Tel No: 020 7808 4583 Email: michael.arthur@capita.co.uk

Matthew Graham
MSc, MCIWEM, CEnv, CPESC, Principal Consultant, Scott Wilson UK/URS, 6-8 Greencoat Place, London, SW1P 1PL
Tel No: 01256 310 818 Email: matthew.graham@scottwilson.com

An initial high level assessment of surface water flood risk across greater London indicated that approximate 680,000 properties may be at risk of surface water flooding. The main objective of Drain London is to better manage and reduce surface water flood risk in London. The project will develop individual strategic level Surface Water Management Plans (SWMPs) and Preliminary Flood Risk Assessments (PFRAs) for each of the 33 London Boroughs.

This paper aims to describe the methods and solutions developed to overcome the technical and political challenges encountered during the project to date within context of the SWMP process:

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

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

Paper 9: Using ICM modelling to fully understand the problem (a case study)

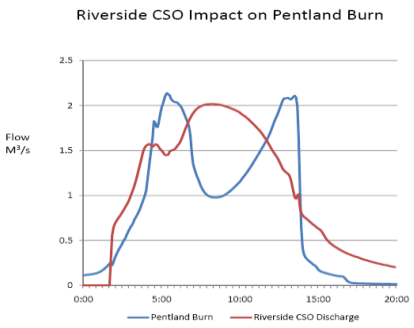
Robert Fleming Technical Manager
MWH, Eastfield House, Eastfield Road, Edinburgh, EH28 8LS
Tel No: 0131 335 4200 Email: Robert.A.Fleming@mwhglobal.com

Margaret C B Williams Project Engineer
MWH, Eastfield House, Eastfield Road, Edinburgh, EH28 8LS
Telephone: 0131 335 4200
Email: Margaret.Williams@mwhglobal.com

Summary

The Glasgow Strategic Study involves the development of catchment plans which will take a holistic approach to the understanding of the drainage and watercourse systems within the Metropolitan Glasgow Area. MWH have been carrying out the model maintenance of the Glasgow Shieldhall (475k population) catchment to incorporate rivers, surface water systems and ancillary improvements to undertake these studies.

One particular area within the Shieldhall catchment which has suffered from historic flooding problems in the past. The flood events have no clearly defined flood mechanism and cover several locations. To complicate matters, the area in question is beside a small watercourse which receives a significant CSO discharge, with identified water quality issues, these links between sewer and watercourse systems will benefit from Integrated Catchment Modelling approach to understand the flood mechanism.



Outline strategic options have been identified from basic hydraulic network modelling, following determination of catchment needs during the Scottish Water SR10 UID programme. Using an integrated modelling approach, we now have an enhanced understanding of the flood mechanism and can now appreciate how this will impact on the proposed options.

This paper will aim to demonstrate the benefits of ICM modelling and the impact it has on the proposed optioneering decisions over previous outline 1D hydraulically modelled solutions.

Paper 10: Surface water management plans – more than just modelling

Martin Osborne
Technical Director, Mouchel
Tel No: 07736 362 944 Email: Martin.Osborne@mouchel.com

Surface Water Management Plans are one of the main tools for local authorities to deliver their new responsibilities for dealing with local flood risk.

SWMPs look at all sources of flooding except for flooding from main rivers. This includes overland exceedence flows, watercourses, flooding from sewers and groundwater flooding. The scope for flooding from sewers includes flooding due to blockage and collapse except for dry weather flooding.

SWMPs do require modelling to help to define flood risk but they also need to be linked to real data of past flooding to confirm the risk. In recent studies we have developed a useful way of integrating knowledge of risk from different sources.

Successful SWMPs require all stakeholders (including water companies) to work together to define risk and to implement solutions.

There are several challenges to integrating practice for SWMPs with water company practice for assessing flood risk. This relates particularly to the framework for flood damage cost and the risk from sewer blockage. and collaboration is difficult until there is an integrated approach.

Water companies and local authorities both have issues around making detailed flood risk information available to customers and residents. Some local authorities are prepared to be much more open than water companies have considered.

Water companies will need to build the results of SWMPs into their business plans for the next periodic review to show that they are responsive to local needs and local strategies.

Workshop 2: Flow Survey – Where do we go from here?

Phil Dyke
Wastewater Networks Technical Manager, Optimise (MWH UK Limited)
Pegasus House, 1 Cranbrook Way, Solihull Business Park, Solihull, B90 4GT
Tel No: 0121 746 5715 (direct) 07500 056639 (mobile)
Email: phil.dyke@uk.mwhglobal.com

Flow surveys have been an important part of model verification for over 30 years in one form or another and whilst the technology behind modelling and flow survey equipment has advanced significantly the specification, procedures and general approach has remained pretty much unchanged since the release of the WRc Guide to Short Term Flow Surveys in 1987.

With advances in technology and in particular the advent of reliable GPRS it is becoming clear that the way in which companies use flow and depth monitors is going through a significant change and there is a growing belief that there are alternative and more cost effective ways of collecting flow data which would improve the efficiency of the service, remove dead time from the program and enhance the quality of the data.

The aim of the workshop will be to discuss the current position and try to agree what if anything needs to change to make the most of the new technology available.

Workshop 3: Climate Change

Murray Dale
Associate Director / Hydrometeorologist, Halcrow Group Limited, Ash House, Falcon Road, Exeter, EX2 7LB
Tel No: 01392 354367 Mobile: 07894 491215 Email: dalem@halcrow.com

Notes for the Climate change impacts on rainfall workshop as follows:

This workshop will aim to address certain challenges we face in this area, and will discuss:

1. practices being adopted by different WaSCs when considering climate change on drainage performance
2. uplifts to design rainfall events for flood studies
3. changes to continuous simulation rainfall time series to represent climate change
4. use of climate analogues (using rainfall data from other parts of the world to represent future rainfall climate)
5. use of UKCP09 information in drainage modelling

Murray will make a short presentation to highlight these issues, invite other topics, and then facilitate a discussion on these items

www.halcrow.com
http://www.halcrow.com/flood-forecasting

Paper 11: Application of integrated water quality modelling for efficient management of water quality in the River Irk with cost-effective investment

Dr Gemma Manache
Technical Manager, MWH, North West Business Unit, No 2 Clearwater, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington, WA5 3UZ, UK
Tel No: +44 1925 464880 Email: gemma.manache@mwhglobal.com

Graham Squibbs
Modelling Technical Expert, United Utilities Engineering, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington, WA5 3LP, UK
Tel No: +44 1925 463064 Email: graham.squibbs@uuplc.co.uk

Abstract
To meet water quality standards in urban rivers, significant investments in urban drainage systems are required. For future investments in sewerage infrastructure to be cost-effective, an integrated approach at river basin scale should be adopted in evaluating future water quality management issues, policies, and operational improvements. This paper illustrates the benefit of adopting such an approach through the application of integrated catchment modelling (ICM) to the Irk catchment. Hydrologic, hydraulic, and water quality modelling was applied to assess the impact of catchment runoff, combined sewer overflows (CSOs), surface water outfalls (SWOs), and final effluent from the wastewater treatment works on the River Irk. The compliance of the River Irk was assessed against UPM standards based on the use of a river water-quality model which was developed and calibrated in the framework of the ICM approach. In order to enhance the water quality of the river Irk, solutions for the critical CSOs discharging at the river system were identified. Compared to previous solutions identified using a mass balance approach and simplified river model, the application of the ICM approach resulted in a significant decrease in the total storage volume required to achieve compliance with the standard and better identification of the locations where solutions should be implemented. Overall, the results obtained demonstrate that the application of the ICM approach allows significant savings in terms of the wastewater structures needed to protect the legitimate uses of the receiving waters.

Key publications
Manache, G. and Melching, C.S., Effect of the wastewater treatment levels on the sensitivity of a water-quality model to uncertain model-input parameters. Proceedings CD-ROM, Hydro Predict 2008. Bruthans, J., Kovar, K., and Hrkal, Z., eds., Prague, Czeck Republic, September 15-18, 2008.
Manache, G. and Melching, C. S., Identification of reliable regression- and correlation based sensitivity measures for importance ranking of water-quality model parameters. Journal of Environmental Modelling and Software 23(5), 549-562, 2008.
Manache, G. and Melching, C.S., Sensitivity of Latin Hypercube Sampling to sample size and distributional assumptions. , Proceedings CD-ROM, 32nd Congress of the International Association of Hydraulic Engineering and Research, Venice, Italy, July 1-6, 2007.
Manache, G., Melching, C. S., and Lanyon R., Calibration of a continuous simulation faecal coliform model based on historical data analysis., Journal of Environmental Engineering, ASCE, 133 (7), July 1, 2007.
Manache, G. and Melching, C.S., Simulation of faecal coliform concentrations in the Chicago Waterway System under unsteady flow conditions., Technical Report 16, Institute for Urban Environmental Risk Management, Marquette University, Milwaukee, Wis., Research and Development Department, Metropolitan Water Reclamation District of Greater Chicago, Chicago, 2005.
Manache, G. and Melching, C. S. , Sensitivity analysis of a water-quality model using Latin Hypercube Sampling., Journal of Water Resources Planning and Management, ASCE, 130 (3), 232-242. 2004.
Manache, G., Melching, C. S. and Bauwens, W., Reliability analysis of a water quality model considering uncertainty in the model parameters. Monitoring and modelling catchment water quantity and quality. Verhoest, N., Hudson, J. and Hoeben, R., eds, Proceedings of the 8th International Conference of European Network of Experimental and Representative Basins (ERB)., Ghent, Belgium, September 2000, IHP-IV Technical documents in Hydrology No 66, 53-60, UNESCO, Paris, 2003.

Paper 12: Water Framework Directive – Taking the next step forward in joined up thinking

Ed Bramley
Environmental Regulation Manager, Yorkshire Water, Western House, Halifax Road,
Bradford, West Yorkshire, BD6 2LZ
Tel No: 01274 804 095 Email: ed.bramley@yorkshirewater.co.uk

The river Don is the main river in South Yorkshire, rising in the Pennines, and flows eastwards for 70 miles, through the major conurbation of Sheffield. In the late 1980's, the Don was one of the most polluted rivers in Europe, whether this was from discharges from sewage treatment works and the sewerage system, the many steel foundries in the area, or the coal mining and processing industries.

Over the last 25 years, the Don has been transformed into a largely clean river that supports a thriving fish population. There are even occasional sightings of salmon in the lower reaches of the river. And yet the river remains fragile. In July 2006, following a summer thunderstorm after a hot dry spell, there was a major fish kill on the river. Questions were asked in Parliament as a result. The Environment Agency is still recording episodes of poor water quality downstream of the main Sheffield sewage works.

To understand why there is still occasional poor water quality in the river Don, including the root causes of the fish kill, and what might be done to prevent a repetition, Yorkshire Water is carrying out a comprehensive study of the river Don. This will include significant fieldwork, allied to comprehensive modelling of the sewerage network, sewage treatment works, and the river system in an integrated and detailed manner. At the same time, it is important to engage with key external stakeholders on the study; not just the Environment Agency, but other key bodies as well, such as the Don Catchment Rivers Trust. And if that were not enough, everything has to be completed before the end of 2012.

This paper details the background to this innovative study, and the progress that has been achieved to date.

Paper 13: Rapid Flood Assessment vs Detailed Modelling

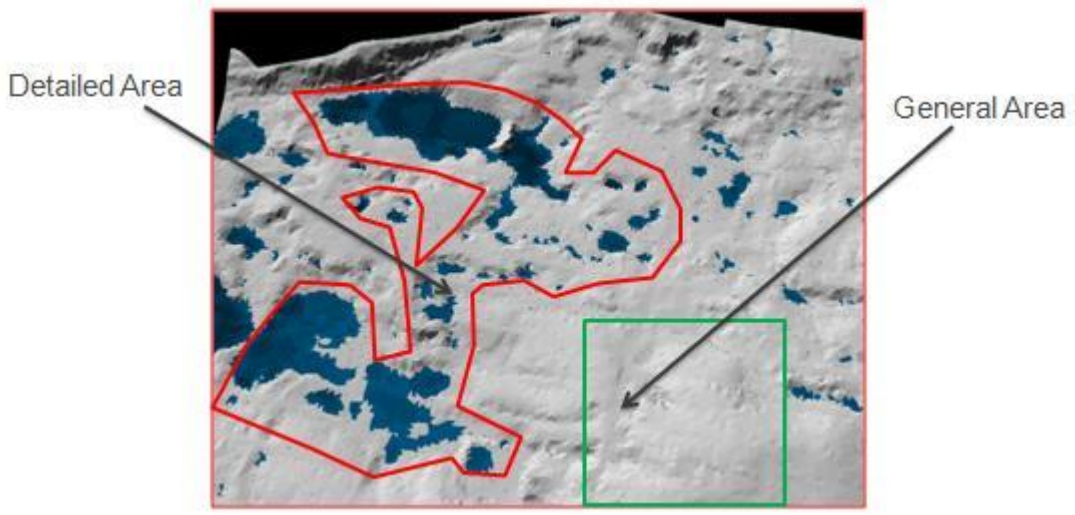
Andy Gibson
Sector Leader, Wastewater Network Planning, AECOM NZ, Level 6, 76 Cashel Street, Christchurch, 8011
PO Box 710 Christchurch 8140
Tel No: +64 3 977 6551 Email: Andy.Gibson@aecom.com

Storm water flood hazard assessment in urban areas comprising the identification of overland flood paths and flood levels forms an important part of territorial local authority responsibility in New Zealand.

In the past such data has been compiled on "best available" information such as field observations and resident reports. More recently 1D stormwater network models such as MIKE URBAN (formerly MOUSE) or 1D-2D (MIKE 11 / 21 and URBAN) and Infoworks which include representation of both the piped and above ground flow network (i.e primary channels and secondary overland flow paths) have provided a more robust basis for such assessments. This has been aided by the availability of high resolution and accurate land level data obtained from airborne laser surveys (LiDAR).

The Solution

AECOM have trialled a number of alternative approaches for assessing flood extents for low probability flows where the sub-surface drainage network is essentially ignored. These so called rapid flood hazard mapping (RFHM) assessments can provide a cost effective way in which to quickly and efficiently map the worst case flood extent with all pipe systems not functioning and identify the major overland flow paths by making direct use of the LiDAR data in a MIKE 21 2D hydrodynamic model.



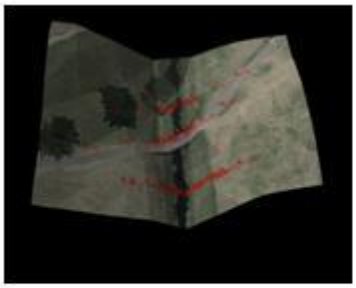
By introducing flows onto the LiDAR surface, the MIKE 21 model is able to simulate the accumulation and routing of the rainfall runoff, simultaneously generating flood extents, depths and velocities for the entire catchment.
Where building outlines are available in shapefile format the building footprint roughness can be increased thus ensuring flow around the building footprint (if appropriate).

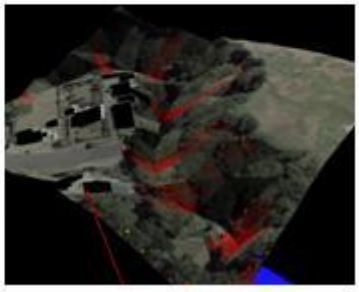
Two main approaches have been developed and applied in the Auckland region. The first approach, utilises the TP108 rainfall runoff model to generate a series of runoff hydrographs for the 100 year rainfall event for sub-catchments up to 10ha in area. Depending on the pipe system capacity (normally 10yr in Auckland) the runoff hydrograph is also developed and then subtracted from the 100yr event to understand the rainfall that may be routed as overland flow.

The generated adjusted hydrographs are introduced as "source points" on the MIKE 21 grid, which is then routed by the hydrodynamic model through the catchment. A very fine (3x3m) grid has been used so that fine features such as roads and rapid slope changes can be resolved in the model. Smaller catchment thresholds may also be applied. For example DHI have tested and compared a 10ha threshold to a 2ha threshold. The latter provides a greater coverage of the flood extent but does not significantly affect flood levels in the parts of the catchment common to both approaches.

An alternative method is to apply the net rainfall (100yr rainfall minus network capacity rainfall) directly to the model grid. In this method all routing is undertaken by the MIKE 21 model but the rainfall must first be processed to take into account the effects of local storage losses and surface imperviousness. This method has been successfully applied by DHI in Australia and AECOM in NZ.

Decisions need to be made on how to handle surface features such as cross drainage structures (bridge and culverts) and large buildings. Drainage structures may either be "cut out" of the model grid, which assumes minimal headlosses, or at the other extreme "blocked out", which assumes full blockage so that flows are forced over the road crest. Similarly buildings may be filtered from the model grid ("bare earth") or alternatively if building outlines are available as part of the LiDAR survey these may be extruded back into the model grid, which assumes complete loss of conveyance and storage due to the buildings. An example of this approach is shown in the figures below.





Conclusion

Both methods have been compared to more detailed flood mapping studies and despite the coarseness of the model assumptions, the results have compared very favourably. The 2D RFHM modelling has highlighted flood prone areas that were not previously identified in more detailed 1D modelling. The rainfall on grid approach has similarly been compared to detailed 1D-2D modelling in Australia and maximum water levels were within 200mm of the more detailed study.

The advantage of RFHM is the speed at which the assessments can be carried out, which typically is many times faster than traditional detailed model assessments, with consequent cost savings.

It is important to understand that the results do not necessarily provide a definitive flood hazard extent. It can be used successfully to prioritise areas for more detailed survey and for further more vigorous modelling without a detailed full catchment solution that can significantly slow down model simulation times.

Paper 14: Economic Level of Service for Sewer Blockages

Jonathan Cutting
Divisional Manager, Mouchel
Tel No: 07921 740507 Email: jonathan.cutting@mouchel.com

Nathan Muggeridge - Director
Director, Asset Solutions Consulting Limited
Tel No: 07739 655765 Email: nathan.muggeridge@asset-solutions-consulting.co.uk

Sewer blockages can potentially lead to a wide range of service failures such as internal property flooding, polluting discharge to a watercourse, unusable sanitation and odour. Ofwat June Return data shows that over 160,000 blockages are reported annually in England & Wales, some of which cause service failures. This equates to approximately 0.5 blockages per kilometre of sewer per year. This paper is a summary of the project commissioned by UKWIR in April 2009 titled 'Economic Level of Services for Sewer Blockages'. The outputs from the project included guidance on assessing the appropriate economic level of blockages and on approaches to blockage management to help achieve it at least cost. The guidance includes a strategy and planning tool to help with this assessment. The guidance considers both currently available techniques to manage sewer blockages and emerging techniques that are worthy of further investigation and development. The short-term or 'Quick fix' recommendation from the work included:

- Use of small vactors to completely remove blockages material from the system and not flush it down stream.
- Deploy low cost inspection devices to first ensure blockages are fully removed and secondly understand the root cause of the blockage.
- Incentivies blockage management teams (either in-house or contractors) on the level of service achieved and the elimination of repeat blockages rather than on productivity in removing blockages.
- Collect data on the cause, effect and actions taken to resolve a blockage event and subsequent analysis of this data to improve strategies.

The project also recommended the Blockage Economic Level of Service (BELS) model should be used to determine economic maintenance policies as part of future strategy planning, to guide operational efficiency improvements and to provide a robust challenge to the Ofwat serviceability reference level for blockages. All promising new techniques to reduce blockages should be evaluated to determine whether they provide a cost beneficial solution.

Paper 15: Live Data for Live Models

Ian Small
Senior Modeller, Mott MacDonald, Demeter House, Station Road, Cambridge, CB1 2RS
Email: ian.small@mottmac.com

Hydraulic models are traditionally standalone tools used to solve a particular issue or provide a baseline to develop investment plans. They are expensive to construct but have great potential to be used more productively and efficiently.

As we collect more data on sewer systems, and frequently in real time there is an opportunity to use models to optimise the operation of networks. Coupled with increased computing power and the flexibility of 'cloud computing' what we can achieve is greatly enhanced.

We can potentially use these models and data to:

- identify some operational issues in real time – e.g. blockages and collapses
- in conjunction with rainfall predictions assess real time flood risk
- optimise the operation of the system to minimise spills, flooding etc.
- calibrate models in real time and against long term trends

To achieve these aims a group of market leading companies in their field have met to consider developing the concept of a software tool that can deliver the capabilities described above.

Mott MacDonald – initial idea and technical expertise
Nelen & Schuurmans – decision support system and software visualisation platform
Thames Water – pilot study data, a technical steer and expertise
EnginSoft – calibration, optimisation and other software support
OnSite – technical support on long term flow monitors and rainfall data

To prove the concept we have identified a pilot study to demonstrate the principles and linkages. The pilot is based on a large and complex London catchment that has had permanent monitoring installed for the last two years.

Paper 16: Just in time operational management

Chris Digman, Damian Ward, David Balmforth, Steve Kenney (MWH) and Neil Scarlett (IETG)

Contact: Dr Chris Digman, MWH
Tel No: 07766 732 314 Email: christopher.j.digman@mwhglobal.com

Water Companies have invested consistently in their sewer systems to reduce the number of properties that are at risk from sewer flooding. They have focussed their efforts on tackling a lack of hydraulic capacity with the result that thousands of householders and business no longer face the misery of internal flooding. Sadly there has not been the same success with sewer blockages and collapses.

Despite considerable investment in proactive work and operational response, flooding from these "other causes" continues to be a problem. Although some proactive measures such as manual inspection in 'hotspot' areas can help to identify potential system problems, sewer blockages and collapses tend mostly to be random. To address this random nature, the industry has to heavily rely on a reactive approach, responding to complaints from the public and then clearing and repairing the damage. However fast the companies respond, this is still a retrospective action, and it fails to tackle the problem at source. Such issues can potentially impact Service Incentive Mechanism scores.

Pollution as a result of sewage escape is also a serious problem, and in recent years there has been a focus on monitoring in the main sewer system, commonly at CSOs using devices such as 'Hawkeyes'. Analysis of such data undertaken by MWH and IETG has demonstrated that normal and abnormal trends can be recognised to identify when a problem may be present. This can lead to an intervention before the problem turns to an incident.

Knowing when problems are developing provides a significant opportunity to intervene before the problem becomes an incident and impacts a customer or the environment. MWH and IETG are taking this approach further upstream in the sewer system to help reduce the likelihood that a flooding other causes event occurs. This looks to identify where a problem is before it creates a flood, enabling the Water Company to respond.

Our paper will summarise the historical analysis work completed to date within the main sewer system. It will also outline the steps taken to prove the concept that it is possible to monitor and alert in more upstream areas where and when 'other causes failures' occur. This will include the work undertaken in the field and the data analysis to provide the evidence base.

WaPUG CONFERENCE FEEDBACK QUESTIONNAIRE

Thank you for attending the WaPUG Autumn Meeting. The Committee would appreciate your comments on how you think the conference went. Could you spend a few minutes completing this questionnaire, as it will assist us meeting your needs next year

	Poor		Average		Excellent
1. Was the match between conference content about what you expected from the advance publicity?	1	2	3	4	5
2. How did you rate the speakers?	1	2	3	4	5
3. Technically, were the presentations…	1	2	3	4	5
4. Was the organisation…	1	2	3	4	5
5. Was the venue…	1	2	3	4	5
6. Was the accommodation…	1	2	3	4	5
7. Was the catering…	1	2	3	4	5
8. Your overall Value assessment of the conference	1	2	3	4	5

9. How did you hear about the conference? (please tick) Via WaPUG [ ]
Via CMS/CIWEM Emails [ ] Other [ ] Please describe_____

10. What were the good things you liked about the event?

- _____
- _____
- _____

11. What didn't you like and what would you do to improve the event?

- _____
- _____
- _____

12. What topics would you like to see covered next year?

- _____
- _____
- _____

Thank you for completing the questionnaire.
Please return your completed form to the conference reception desk