WASTEWATER RESEARCH & INDUSTRY SUPPORT FORUM
WORKSHOP ON TERRAIN MODELLING FOR FLOOD ROUTING

Background

It is believed that the traditional approach to the design of urban drainage creates a number of difficulties, which are insoluble when things go wrong. Urban development is now denser, there are a growing proportion of paved surfaces and there is a perception that storms are more intense as a result of global warming. The design of new sewerage systems on green field or re-development sites is based on a limit of liability for the provider. A similar approach is applied to land drainage in urban areas. Therefore it may be assumed that any liability above these limits is met by the owners of properties (usually through insurance).

The reality is that wherever flooding occurs, the brickbats fly and property owners will tend not to accept the principle of there being a limit of liability when drainage infrastructure is overwhelmed.

There is an argument that public bodies and Water Companies should look carefully at any new infrastructure adopted and at any improvements to existing infrastructure, to determine that overloading by extreme events does not make properties more vulnerable to flooding or likely to suffer a greater degree of damage.

Provision for overland flow modelling in existing software is acknowledged but generally, the industry lacks the appropriate tools to carry out a proper analysis of flood routing and too little attention is paid to this topic in planning the urban environment.

Objectives:

1. To identify and quantify the potential benefits to sewerage planning and design offered by terrain modelling;
2. To identify the gaps in science, resources and application which limit the use and availability of terrain modelling;
3. To identify and prioritise both the science driven and application driven research required to overcome the deficiencies identified in 2 and to enable realisation of the benefits in 1.

Arrangements

The meeting was arranged as a workshop with free participation by all the delegates. The first half-hour was ‘scene setting’ by invited speakers who were:

- Dr David Balmforth, Montgomery Watson – The development work by Dr C Maksimovic at Imperial College.
- Richard Allitt, Richard Allitt Associates – An Example of Overland Flow causing Urban Flooding.
- John Mattinson, Haswell Consulting – Video of and Extreme Event in a City Centre.

The workshop began at 5.30 pm and finished at 8.00 pm. There were 26 attendees and their names and affiliations are attached.

Discussion Points and Comments

1. Modelling would need to fully embrace the above/below ground interface.
2. Antecedent conditions are very important because depression and detention storage is filled prior to the onset of overland flow.
3. Gully inlets have finite capacity which is exceeded by intense rainfall. We can therefore have overland flow whilst below-ground drainage systems have spare capacity.
4. Whatever level at which design criteria are set, there will always be a threshold of responsibility.

5. There are indications that rainfall intensities may be increasing as a result of Global Warming.
6. The spatial limits of intense storms will need to be represented. The coverage of thunderstorms may not be sufficiently understood.
7. The lawyers in Canada now have it established that, up to the limit of a 100 year return period storm, surface run-off should not cross property boundaries.
8. Information on local topography, in sufficient detail to model overland flow effectively, may be very expensive to provide.
9. There is considerable confusion about responsibilities for urban run-off which mitigates against investigating complete solutions.
10. Currently, only a 'below ground' solution to urban flooding is offered, but modelling will need to get much more sophisticated to handle the 'flow past the patio door'. This is a move from 2D to 3D design.
11. We have not done enough with extreme events to fully understand the mechanisms which arise. It is difficult to identify the cause of flooding in many extreme cases and we cannot accurately estimate what may happen when events rarer than the design threshold occur.
12. We rarely identify 'at risk properties' before a flooding event occurs. This is particularly significant for new building development and for re-development with increased density.
13. Micro flood routing is being done in isolated instances and there has been some success with modelling surfaces as open channels.
14. The macro modelling by Imperial College addresses many of the fundamental issues. This will need to be adapted for urban sub-catchments.
15. The algorithms are likely to be easier than gathering the data required for effective modelling.

Identified Needs

1. To complete the link between cause and effect and ensure that explicit rather than implicit solutions are examined.
2. To meet the demand for increased flooding protection for properties.
3. Provide more robust solutions for existing problems.
4. Pre-identify properties at risk of flooding.
5. Demonstrate and quantify the interaction of urban run-off processes.

Summary

1. Current Position

    - Considerable knowledge about terrain modelling exists at the macro level for whole catchments
    - Applications at the micro level exist but tend to be ad hoc
    - Perceptions of global warming are causing questions to be asked about flood protection for properties and the adequacy of current design practice
    - There is a threat of legal action against parties who do not control surface run-off

2. Main Issues to be Addressed

    - Capturing 3D terrain micro data
    - Antecedent conditions
    - Depression/detention storage

- Above/below ground interface
- Design standards and criteria

3. Perceived Benefits

   - Lower cost solutions to drainage problems
   - Increased flood protection for property
   - Evaluation of preventive action at site layout stage
   - Reducing damage and impact in extreme events
   - Avoiding legal actions

4. Action

   The agreed action was that, through the WASTEWATER RESEARCH & INDUSTRY SUPPORT FORUM, WaPUG should exert influence to undertake a scoping study to focus development in appropriate areas. A plan will be formulated in February 2000 and progress reported regularly at WaPUG meetings.

Further information can be obtained from Andy Eadon on aeadon@haswell.com

List of Attendees

Gerard Morris	EA	Chairman
Andy Eadon	WaPUG	Host/Rapporteur
David Balmforth #	Montgomery Watson	Consultant/Researcher
John Mattinson #	Haswell Consulting	(Case Study Video)
Richard Allitt #	Richard Allitt Associates	Consultant
Phil Gelder	Severn Trent	
Richard Long	W S Atkins	
David Fortune	Wallingford Software	
Mike Reeves	Wallingford Software	
Simon Matthews	DHI	
Brian Reed	Ciria	
Bill Burton	Consultancy	
Stan Bradshaw	Redrow Homes/HBF	
Bob Andoh	Hydoresearch	
David Wotherspoon	North of Scotland Water	
Ian Clifforde	Binnie Black & Veatch	
Jan Valk	VAV Sweden	
Vicki Harley	Hartfair Ltd	
Heather Davis	Thames Water	
Andy Browning	Thames Water	
Martin Osborne	BGP Reid Crowther	
Gary Edwards	Entec UK Ltd	
Philip Deakin	Entec UK Ltd	
Bob Crabtree	WRc Swindon	
Richard Kellagher	H R Wallingford	
John MacKenzie	Operational Solutions	

Invited speakers