FRMRC flood risk management research consortium

Some new approaches for the planning and response to flooding

Dr Christophe Viavattene
Professor Hazel Faulkner
Professor Bryan Ellis

fhrc Flood Hazard Research Centre
Middlesex University

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Challenges for urban water management

- Ethical context : sustainable development;
- Legislative context: the *Water Framework Directive;*
- UK Summer floods of 2007 has led to a focus on urban surface water management and the *Flood and Water Mgt Act* - surface plans needed for LAs;
- LAs required to have long-term water management & flood risk reduction strategies, including SUDS suggested as appropriate way forward); stakeholder involvement (*Pitt Report*)

What can science offer?

- Forecasts & nowcasts;
- Hazard inundation mapping/modelling;
- SUDS; design effectiveness and location;
- Assets: location design and fragility.

What can social science offer?

- Improved communication models/tools;
- Improved professional interface;
- Improved psychosocial models of response; behaviour/vulnerability assessments;
- Health impact assessments.

Challenges for urban water science

- Obligations to inform on/communicate about the state of the Art tools:
  - Urban storm water models (of 'the hazard') require good representation of the physical phenomena but as they are currently developed are technical and not very user-friendly;
  - SUDS – a wide range of structures, impacts on water quality & quantity knows, and costs and benefits generally established;
  - Stakeholder engagement- improved communication.
- Drive for transparency & joint ownership of the uncertainties (CC, urban futures, financial crisis…);

Middlesex University's Flood Hazard Research Centre's research has aimed to

"…trial improved methodologies for urban flood risk assessment and response"

Novelty of the approach:

- ✓ To retain some of the subtlety of the available scientific models of the 'hazard';
- ✓ To incorporate social vulnerability into risk assessments;
- ✓ To revisit and tailor tools to maximise match with professional needs, using stakeholder-held knowledges wherever possible.

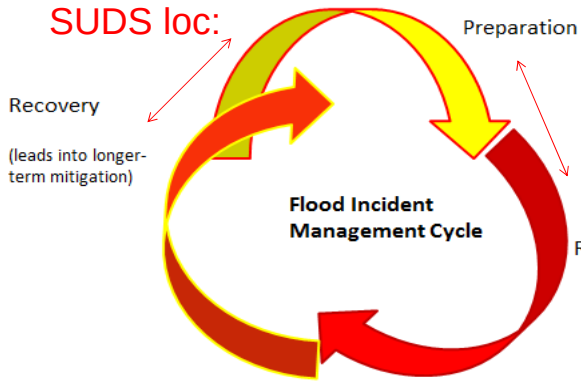
Three tools developed for trial:

1. SUDSLOC: a method of identifying the sites where the retrofitting of sustainable drainage surfaces can be introduced, and assessing their hydrological functionality;
2. WLCC_UI tool: to assess the feasibility of undertaking Whole Life Cycle Costing of Non- structural measures in urban flood risk assessments;
3. a GIS-based flood risk mapping tool: coupling vulnerability metrics with local-scale inundation models for use by emergency response professionals *(next presentation)* .

Where may these tools play a role in the Flood Incident Management (FIM) cycle?

WLCC_UI

SUDS loc:



GIS tool for emergency responders

SUDSLOC is a GIS Support System for Sustainable Urban Drainage implementation at a local scale

Dr Christophe Viavattene & Professor Bryan Ellis

SUDSLOC emerged from research in a FP6 project called SWITCH (Sustainable Water for Tomorrows Cities and Homes). It ran between 2006 and 2011, and had 33 partners. The theme ranged around the idea of a shift in urban water management frameworks. Researchers explored efficiency in water supply, waste water, urban water planning governance and institutions. The cities involved in the 'learning alliances included Accra, Birmingham. Alexandria, Beijing, Lodz, Tel Aviv and Zaragoza.

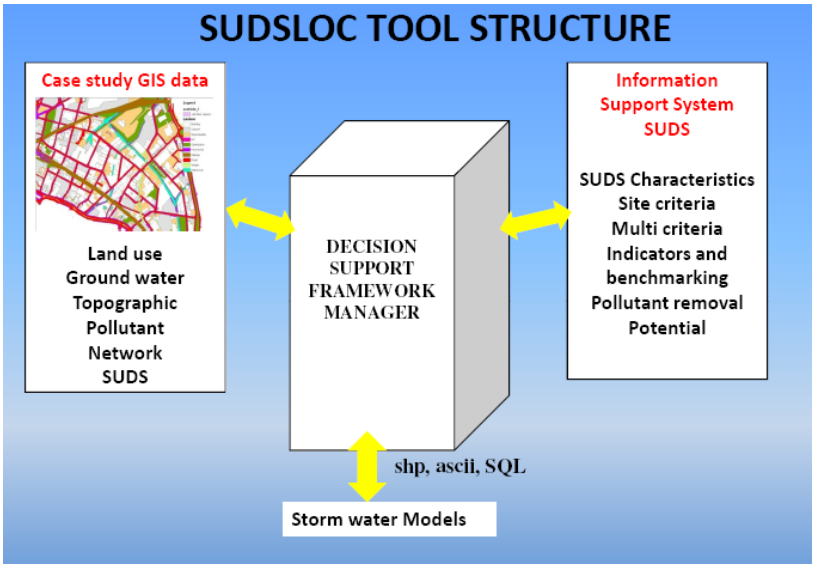
SUDSLOC was a joint Middlesex collaboration between the Flood Hazard Research Centre and the Urban Pollution Research Centre. The idea was to use GIS tools to identify sites where that stormwater management could potentially be retrofitted into urban environments to reduce water contamination and flood risk.

http://www.swittchurbanwater.eu

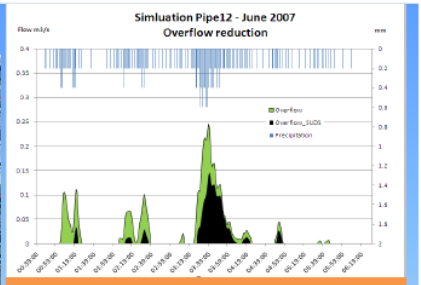
AIMS

SUDSLOC aims :

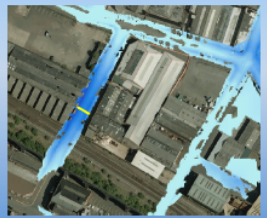
- To integrate qualitative and quantitative data from a variety of sources to enable the investigation of the potential benefits of SUDS;
- To incorporate a user-friendly tool to ensure simplicity and ease of communication;
- To make it useable for stakeholders in planning and management positions who have relatively few skills in GIS (once the spatial data are ready to use);
- To 'bolt on' to local storm modelling (the hazard')

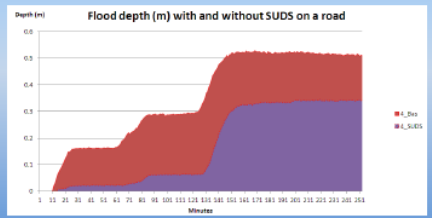


Effective prediction



In total decrease from 1240 to 838 m³ (pipe12)





Summary of SUDSLOC benefits

- It offers an accurate robust methodology for identifying and quantifying local hotspots and "critical drainage areas" for surface water associated with extreme storm events;
- Provides a methodological basis for preparation of emergency flood planning (e.g. safe access/escape routes, evacuation etc.);
- Is a basis for selecting and locating appropriate SUDS drainage controls for the mitigation of extreme event surface flooding as well as pollution impacts;
- Provides a flexible communication tool for stakeholder and public consultation.

WLCC_UI is an uncertainty index to measure the feasibility of a whole life cycle costing[1] approach in flood risk management

Dr Christophe Viavattene & Professor Hazel Faulkner

WLCC_UI tool was developed under the auspices of FRMRC2, which is an interdisciplinary research consortium made up of partners from universities, government bodies and practitioners supported by:

- Engineering and Physical Sciences Research Council
- Department of Environment, Food and Rural Affairs/Environment Agency Joint Research Programme
- United Kingdom Water Industry Research
- Office of Public Works Dublin
- Northern Ireland Rivers Agency

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[1] WLCC is defined as :"…the systematic consideration of all relevant costs and revenues associated with the acquisition and ownerships of an asset".

CONTEXT: the economic appraisal of UFRM

- Flood defences and engineering strategies have dominated UFRM in the past. The traditional approach costings is to use a CBS; in this approach costing uncertainties constrained;
- Whole Life Cycle Costing (WLCC) is recommended for economic appraisals of both hard and soft structural responses (DEFRA,HM Treasury);
- but in Autumn 2000 UK policy changed to Integrated Urban Flood Risk Management (IUFRM -a risk-based approach)…… *leading to…*

- a wider range of options to cost…
  hard & soft structural and non-structural elements
  PLUS recovery, flood warnings, flood fighting, emergency services, floodgates, sandbags, demountables…
- the development begs the question: "can WLC be undertaken for all IUFR cost elements?"
  Is the economic appraisal of a "low capital cost, high-level of services" provision limited, difficult, even impossible because of the increased cost uncertainties ?
  - Are we wasting time & money on the least-best option? Should we cost alternative projects ahead of delivery?
  - What shall we do about insufficient data on elemental costs – about the gaps in data and knowledge which need to be filled to achieve a successful appraisal?

AIM

- review the feasibility of calculating the 'true overall cost' of different (structural and non-structural) response strategies and interventions in UFR assessments;
- propose a methodology for approaching the costing of all response strategies in one tool (WLCC_UI)

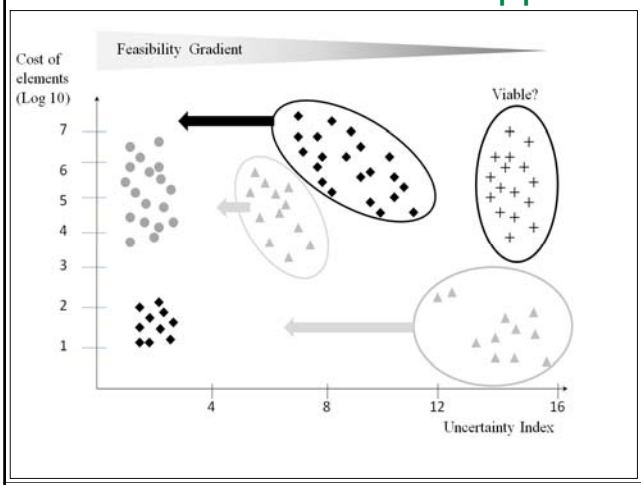
- The method allows flood risk managers to assess if there is enough knowledge and data to support a robust, effective economic appraisal for an integrated UFRM project.
- The tool identifies those project elements for which more accurate costings will be important
- Then assesses the confidence with which these elements can be effectively costed against the elemental cost itself;

- What do we agree is the 'project' and its boundaries?
- What are elements to be costed, over what time period/life cycle?
- devise a way to 'map' the degree of uncertainty of making these estimations of an element (a 2-D uncertainty index) against the element's cost range;
- Undertake this for all elements;
- This then targets areas where costings are worth undertaking.

A CBS approach is used

- Locate all elements for the uncertainty analysis in a hierarchical methodology based on a Cost Breaking Down Structure (CBS)
- Identify elemental costs range (log scale)
- Calculate a 2-dimensional Uncertainty index
  - Level of uncertainty (domain behaviour and availability)
  - Nature of the cost dimension (complexity of its behaviour)

The concept fully developed into a decision-support tool



For each considered element, an uncertainty index is calculated, based on (a) confidence level in available knowledge of the costs; and (b) and behaviour of the costs through time; and mapped against element costs on a $\log_{10}$ scale .

Summary

- Both tools offer the potential for planning and improving an area's response to flooding, and make it cost-effective -useful in project mapping;
- The SUDSLOC tool is available now – the WLCC_UI tool remains conceptual – trial on existing project are still required.

THANK YOU FOR YOUR ATTENTION !

Where to find more information:
http://www.floodrisk.org.uk/
[c.viavattene@mdx.ac.uk]

ref: Viavattene C. and Faulkner H. (2009). An uncertainty index to measure the feasibility of whole life cycle costing approach in flood risk management. Cost Action C22 **Road Map Towards a Flood Resilient Urban Environment** Paris 26/27.11.2009