Establishing the Scope for an Integrated Drainage Study

Tuesday 28th February 2012

Iain McLachlan – Clear Environmental Ltd

Definition of an Integrated Study

- Integrated Urban Drainage is an approach to planning or managing an urban drainage system which leads to an understanding of how different physical components interact and how different organisations must work together for it to operate effectively. (WaPUG IUD Guide)
- In the last ten years the Integrated Catchment Assessment has become more widespread

Up to Now

- But on some level, right from the beginning, catchment modelling studies have always used an integrated approach
- From basic methods such as using level files to represent the impact of rivers/tides
- Through more involved processes such as groundwater infiltration calibration
- To more complex recent aspects such as overland flow assessment

Up to Now

- We've always considered the effects from all sources in a catchment. We just haven't specifically demonstrated every aspect from the one tool
- A lot of progress is due to advances in IT. Bigger and more complex multiple layered models now practical
- However, it is also due to an increasing acceptance that every action has a consequence
- Watercourses and waterbodies do not have a limitless capacity to accept discharges, just as sewers do not have an unlimited capacity to take surface flows from every increasingly paved over surfaces.

- This is an extreme example but demonstrates what has occurred across Scotland and the UK during several housing booms
- The trunk drainage network will have remained essentially the same
- In many cases urban watercourses have become paved over and hidden from view

- So why are we carrying out some Integrated Catchment Studies now?
- Flooding has always been a hot topic through the ages

- But in recent years, flooding has had an increasingly high profile in the media.

But people are always going to like living near water

Just not that near

One Solution……

Legislation

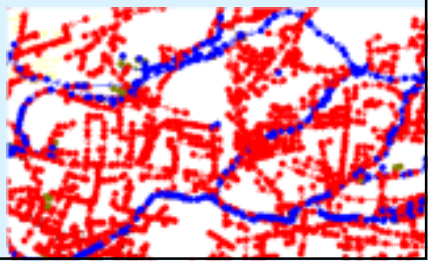
- The Flood Risk Management (Scotland) Act 2009
- Requires the creation of Flood Risk Management Plans (FRMPs) at national and local level
- To do this, need to gather data and information to understanding flooding and develop interventions
- All Responsible Authorities are required to work collaboratively to produce the plans

- Hence the need for an Integrated Study

- When carrying out these studies, the first task is to pull all the available data together:

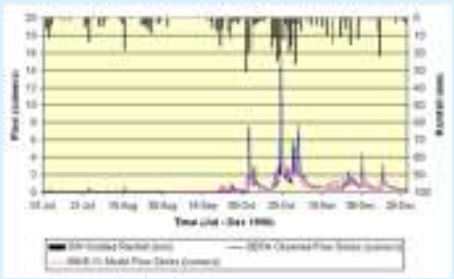
Scottish Water

- Sewer Models
- Associated DAS Reports: MBV, Needs, Audits, Optioneering
- Historical Flooding data
- CCTV Data
- GIS Extract
- Asset Performance Data
- LiDAR Data



Local Authorities

- Historical Flooding data
- Watercourse Models
- Associated Watercourse Model Reports
- Historical Flooding data
- Flood Prevention Scheme Details
- Local Plan and New Development Information
- GIS Extract including culvert data
- Asset Performance Data



SEPA

- Historical Flooding data including Coastal Data
- National Flood Risk Assessment Data
- Pluvial Flooding Extent Maps
- River Gauge Data
- Waterbody quality Information including bathing water details

Others

Can be catchment specific but

- Police and Fire Brigade hold information when they have been called out to flooding incidents
- Many watercourses have local steering or action groups who maintain websites highlighting problems
- DEFRA
- Met Office
- Scottish Government
- Port Authorities – Tidal Data

The next task is to identify the issues are areas of interest in the catchment – To create a study envelope:

Review the available information to:

- Place the different sources of flooding to identify hotspots
- Identify the interactions (IDs) between sewer & watercourses
- Identify any known water quality issues in the catchment
- Identify other hydraulically important areas in the catchment
- Indentify areas where the model requires updating
- Most importantly, discussions with the stakeholders to ensure local knowledge is captured and included

Coastal Flooding?

- This is again catchment specific but effects from Coastal Flooding are normally not dynamically represented in an integrated model.
- Impacts from tidal ingress can be represented by level files

Tidal Considerations

Depending on the sensitivity of these impacts to the coastal influence, one or more of the following may need to be considered:

- Joint Probability to consider the likelihood of heavy rain coinciding with high tides
- Timing of tidal cycle
- Surge
- Waves
- Climate Change

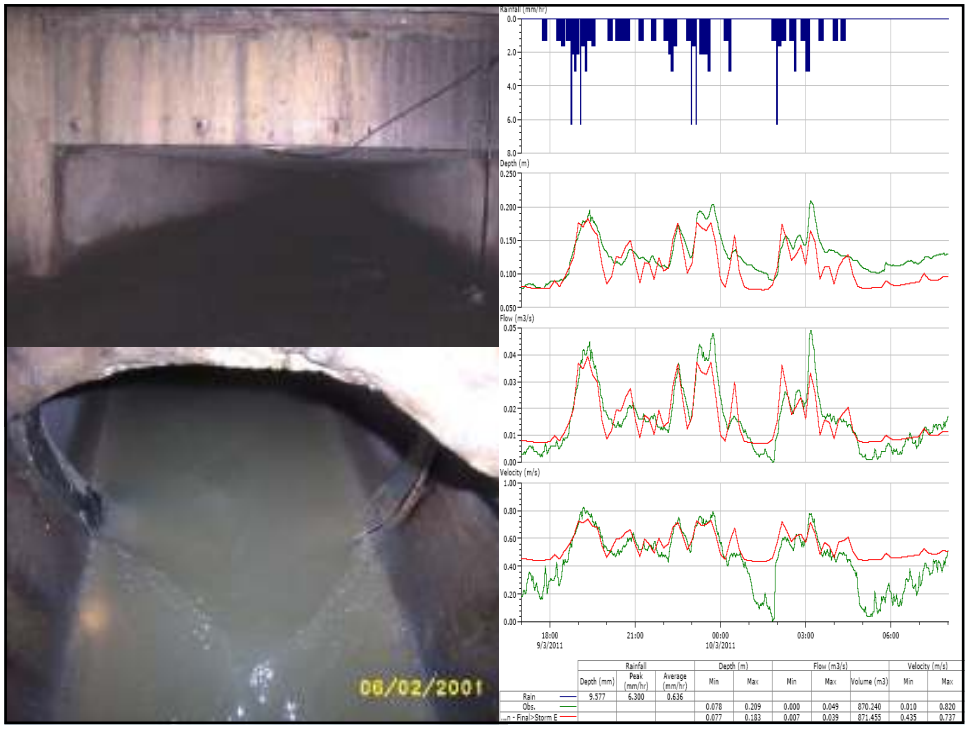
- Following the Model Review – A Data Collection Plan can be created:

Includes all data for all aspects of the catchment and as such should be discussed and agreed with all stakeholders

- As much use as possible should be made from available data
- Scope includes Flow Surveys, Manhole Surveys, CSO & Asset Survey, Culvert Surveys, River Cross Sections; Outfall Surveys, Pumping Station surveys and performance tests.
- Topographical Surveys may be required to ground truth LiDAR data

- VERIFICATION OF THE INTEGRATED MODEL:

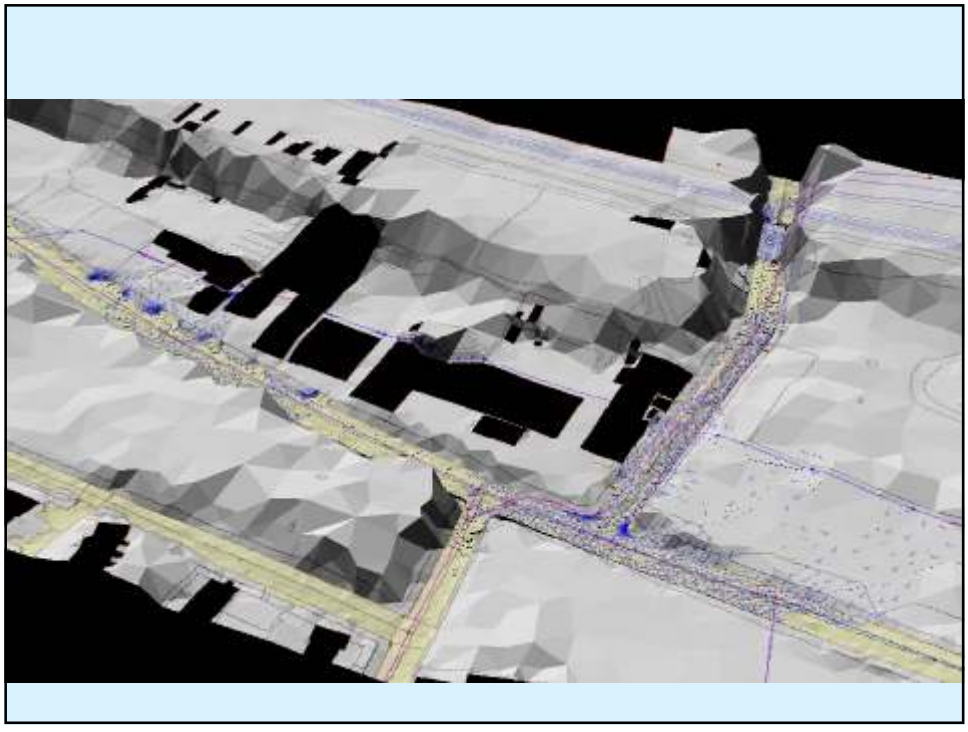
- Sewer Verification – Standard Approach based on WaPUG
- Watercourse Calibration – Where possible, monitors placed in culverted sections. Failing that, calibrated against SEPA Gauged data, or from FEH inflow parameters
- 2D/Overland Flow Representation – Initial areas selected for scoping, however these will be refined or added to during the study
- Historical Flooding Verification – Comparison with all available sources of reported flooding



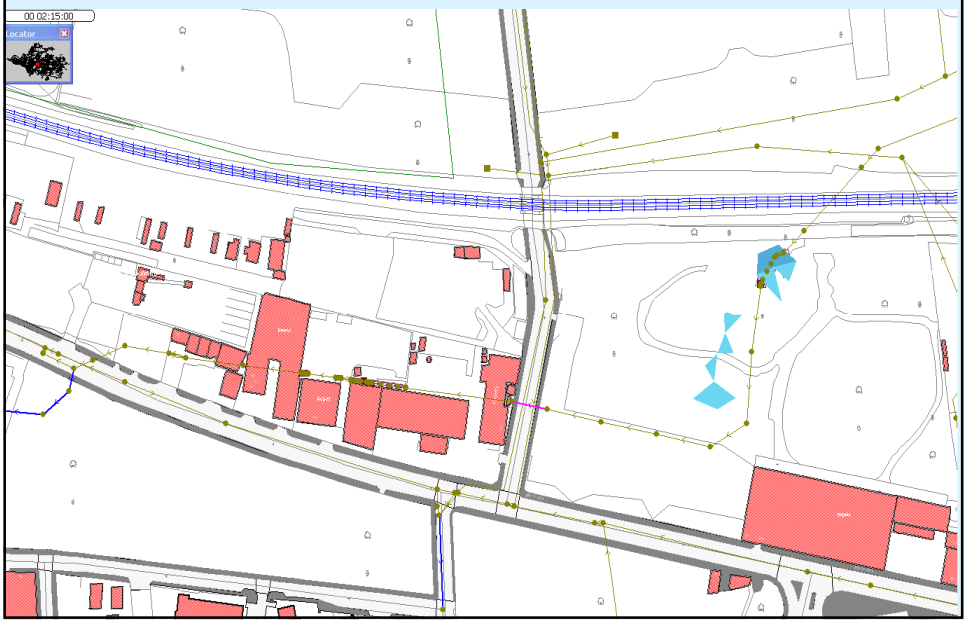
2D Representation

- Not practical to carry out to a very detailed level across the whole study area
- Areas selected where it is felt advantageous to understand the flow routing and any integration of surface flows and below ground flooding

In the following example, Flooding occurs from a sewer and a culverted watercourse and is then channelled by the urban topography and flows to a different location of the catchment which has no modelled flooding



Visual Example



Catchment Needs Identification

- Although the purpose is to identify flooding needs, other problems should not be ignored as they may link to flooding
- Water Quality should be assessed in case future WQ requirements are incompatible with flooding schemes
- Operational Issues should also be assessed for the same reason

Climate Change & Future Proofing Needs

- Design Rainfall can be uplifted to allow for effects from Climate Change. Based on UKCP09 (United Kingdom Climate Projections (2009) provides climate information for the UK up to the end of this century
- Populations used in the models can be increased to allow for future growth
- Impermeable Creep within the model can be allowed for

Optioneering Processes

- 4 Basic Groups of Options will be Created
- Discrete Options to resolve flooding from the sewer system
- Discrete Options which resolve pluvial or fluvial flooding from watercourses and coastal flooding
- Combined Options which resolve flooding resulting from multiple sources
- Strategic Options which resolve issues at a catchment level

Optioneering Processes

- Options can be further broken down

- Storage Options – Avoiding pumped return where possible
- Transfer Options –Passing flows to less stressed parts of the same network or in the case of the sewer system, to the watercourse network if allowable
- Upstream Flow Reduction

Optioneering Processes

- Increase in pipe/culvert capacity
- Retrofit SUDS
- Surface Water Management & Separation
- Watercourse Attenuation and Flood Management
- Coastal Protection
- Ground Level Raising
- Operational Improvements – Silt, Pumps
- Infiltration Assessment and Reduction

Outputs

- What will we have at the end of the study:
- A usable audited integrated model
- A defined set of Catchment Needs
- A selection of costed options for the above Needs
- A greater understanding on how the catchment operates during pluvial and fluvial events.
- The tools to do something about it