Designing for Exceedance Update – The CIRIA Project

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Summary

Media coverage of flooding has become far more frequent and intense over recent years. It is inevitable that during periods of extreme rainfall, the existing minor system (below ground drainage) does not have the capacity to convey extreme flows. The minor system can be exceeded when:

- The rate of surface runoff exceeds the drainage system inlet capacity
- The minor system becomes overloaded
- The minor system fails (e.g. because of a collapse or blockage)
- The outfall becomes restricted due to high water levels in the receiving water

If the minor system fails, overland flow and flooding is likely to occur. Flooding is indiscriminate and can cause harm or distress to people and significant damage to property. The stress caused by the clean up operation, loss of possessions, loss of business, restoration and living in temporary accommodation can be considerable. This is often exacerbated if flooding occurs from a combined sewerage system and or it occurs regularly.

It is not economic or sustainable to build the minor system to have sufficient capacity to cope with extreme events (e.g. 100 year return period event/annual probability of 0.01). Therefore better use of the major system which includes above ground pathways such as roads and grass lined channels, could enable exceedance flows to be controlled and actively managed. This is likely to become more important, as current climate change predictions indicate that we are more likely to experience intense and severe rainfall events more frequently. As a result, this may increase the frequency of flooding unless major system flows are managed. Hence the current approach to managing urban flood risk is likely to be unsustainable in the future.

To tackle this challenge, CIRIA with MWH, HR Wallingford and Imperial College have developed guidance on how flows that exceed the capacity of the minor system might be managed. This is accomplished by improving the interface between minor and major systems, and the built environment. In particular it focuses on above ground flowpaths, the diverse stakeholder challenges that occur and the active management of the risks.

The guidance has been written to enable systems to safely and sustainably accommodate periods where the design capacity of drainage systems are exceeded due to increased flows, and is relevant to both piped systems and SUDS. It identifies when the major system comes into operation and gives guidance as to how practitioners and engineers may determine the

flows and volumes conveyed on the surface by the major system, in specific circumstances. The interaction between the minor and major system is described and a methodology to model it is presented. The modelling of the two systems is briefly described and this forms part of the 'Exceedance Flood Risk Assessment' (EFRA).

The EFRA is used to identify the severity of flooding and where it occurs. The risk is determined by combining the probability and consequence of the flooding. Probability is related to its return period. Consequence is related to the damage that may be caused to property as well as health and safety implications. A three level approach has been taken that enables users to select an assessment level most appropriate to the catchment being considered. For simple catchments, the EFRA is relatively straightforward and requires a minimum amount of data collection, whereas in large and complex catchments the EFRA is a substantial piece of work. The EFRA process identifies locations or areas at risk for existing and new designs. The process feeds back into the above ground surface conveyance and surface storage design.

The guidance promotes the use of above ground conveyance before utilising above ground storage. Only when conveyance is not possible, should storage options be considered, e.g. when the downstream system does not have the capacity to accommodate the conveyed flows. Advice is given on the design of conveyance pathways which includes using minor roads. Storage options are presented which would not normally be considered to store the temporary exceedance flows, and include car parks, playing fields, minor roads, parkland and numerous others.

The guidance will enable engineers, planners and designers to appreciate the risks involved with exceedance flows. It will enable these practitioners to:

- Address the key issues with regard to designing urban drainage systems that can cope with periods of exceedance
- Provide guidance on risk assessment procedures to determine the likelihood and impacts of drainage exceedance
- Provide guidance on planning and design considerations to reduce the impacts of exceedance in drainage systems
- Provide best practice guidance for the design of urban drainage systems that can sustainably accommodate periods of exceedance.

The guidance is due to be published this autumn.