Use of direct rain as an investigation process and design of basins using ARR2016 methods

Prof Peter Coombes[1]
[1]*Urban Water Cycle Solutions, Carrington, Australia*

Overview
Urban stormwater catchments can be subject to complex hydrological and hydraulic responses that are driven by unresolved sub-catchment influences, flow pathways and local depression storages. The East Mayfield urban catchment in Newcastle Australia displayed difficult to define hydrology processes with significant flooding outcomes. Direct rain (rain on grid) processes in combination with Australian Rainfall and Runoff (ARR2016) inputs were used as an investigation method to define catchment storages and surface runoff processes including cross catchment flows. This process permitted a realistic understanding of the urban hydrology and establishment of a realistic coupled 1D/2D model of the East Mayfield.

The Regional Flood Frequency Estimation (RFFE) model provided by the revised ARR2016 utilises local information within a regional framework to estimate rural peak flows. Given that many urban stormwater management strategies require a no worsening of stormwater peak flows, the RFFE permits evidence based estimates of stormwater runoff targets for design of urban stormwater infrastructure. This investigation utilised rainfall ensembles to design a detention basin to meet the no worsening targets defined by the RFFE and to account for climate change impacts using new methods provided by ARR2016.

This paper provides an overview of the processes to define complex urban hydrology, establish evidence based targets for urban catchments and design of detention basins using ARR2016 resources.

Objectives
Demonstrate the use ARR methods to derive predevelopment runoff conditions as a target for design of a detention basin to mitigate urban runoff and incorporate climate change. This also highlights the selection process for urban and rural losses, use of rainfall ensembles and the required order of actions in the design process. Present a unique case study where direct rain (rain on grid) methods are used in combination with new ARR resources as a method of investigation to resolve urban hydrology processes in complex catchments.

Results
The RFFE model provided by ARR2016 permitted the development of no worsening targets for the design of stormwater infrastructure. Use of ensembles of design rainfall allowed design of a detention basin that included evidence of the freeboard and overland flow requirements. The ARR2016 methods also facilitated testing of performance of the detention basin in response the climate change. A direct rain method was successfully used as an investigation process to define connectivity and area of stormwater sub-catchments, and to estimate local catchment losses.

Conclusions

This paper demonstrates the use of the ARR2016 methods and data to design a detention basin to meet a no worsening objective. In addition, a case study is used to demonstrated the value of direct rain methods as an investigation process to better define the characteristics of a complete urban catchment.