RESILIENCE MODELLING OF A LANDLOCKED CATCHMENT

Scott Wilkinson, CPEng, CMENZ,

GHD Limited

ABSTRACT

Urban development has often occurred in swampy landlocked catchment areas with no natural outlet for stormwater runoff. In order to maximize development potential, such areas have often been drained via a reticulation network that discharges stormwater runoff to adjoining catchment areas serviced with natural stormwater outlets. However, such areas remain vulnerable to a catastrophic failure within the drainage infrastructure. In many cases such infrastructure has been tunneled at depths which will make repairs difficult to be undertaken in a timely manner. Such a delay in repairs could result in the long-term attenuation of floodwaters with catastrophic impacts on affected land users.

To assess the impact of such infrastructure failure, long term modelling needs to be undertaken for the following purposes:

- to assess the full flooding impact if no remediation action is undertaken
- to determine the timeframe before critical infrastructure, such as occupied buildings / property access, arterial through roads and wastewater / water supply services are impacted
- to assess the minimum sizing of temporary works required to limit the extent of flooding to an acceptable level.

This paper outlines a case study of resilience modelling undertaken within an established urban area within New Zealand. Issues encountered during this modelling exercise included:

- Adoption of suitable rainfall / evaporation long term time series data
- Conversion of a standard UHM flood hazard model into a more suitable hydrological model which allows for the recovery of initial loss conditions in between consecutive storm events over a long-term rainfall model simulation
- Consideration of appropriate groundwater recharge rates that could typically be expected to occur
- Addressing modelled generated flows that typically occur within a hydraulic model for extended dry periods.

The flooding impacts for various rainfall scenarios were assessed including a typical historical rainfall period, a typical historical rainfall period preceded by a 100 year ARI storm event and a historical high intensity rainfall period. From this analysis a maximum permissible flood level was determined to protect critical infrastructure. A minimum flow discharge rate was then assessed to ensure this flood level could be maintained for most storm event eventualities. This flow rate was then used to design possible pumping / supplementary pipeline solutions to provide acceptable flood protection to the landlocked catchment.

KEYWORDS

Long term time series modelling, Groundwater recharge, Resilience design