

Abstract

The first dual (Sewage-runoff) drainage system in the Indian subcontinent was laid out in Kolkata (erstwhile Calcutta) in the latter half of the nineteenth century during the heydays of British colonial rule. However, with the passage of time, although the over ground feature of the city has transferred drastically, the shape and sizes of the conduits forming the network have remained nearly the same with the result that there have been instance of frequent flooding of the streets due to surcharging (that is, overflowing) of the sewers. The flows of the sewers are directed to different pumping stations from where these are lifted to drainage canals, the combined discharge of which is disposed of to a tidal creek, some distance away from the city. This thesis attempts to model the flows in three of these urban sewer networks by comparing the computed outflows simulated using a public domain software “SWMM” with the observations of the pumping station discharges. An attempt is also made to simulate the surface inundations caused from sewer overflows by linking the code “LISFLOOD-FP” (developed and shared by Professor Paul Bates, University of Bristol, UK) and compare them with the street flooding reports of Kolkata Police. The calibrated SWMM model is also run to check the extent of outflows to reach the pumping stations under various rainfall intensities. A second part of the thesis explores the hydraulics of the open channels that drain a peri-urban neighborhood of Kolkata and tries to evaluate the effects of land-use change on the variation of the peak quantity of runoff from the catchment. The effect of rainfall of different intensities and varying time-distributions are investigated. The difference in the discharge from this un-sewered catchment and the previously mentioned sewered catchments of Kolkata are examined and recommendations for improvement of the drainage of these regions suggested.

Keywords: Sewer, Un-sewered, Peri-urban, conduits, SWMM, LISFLOOD-FP