The effectiveness of groundwater recharges well to mitigate flood

Abstract:

Management of urban storm-water is characterized by the use of hydraulic structures like culvert, manmade channels, water ways, detention basins, infiltration trench, spillway, dams and other drainage structures to either convey or store the storm-water downstream. But in some cases these structures may not be effective to either convey or store the excess runoff because of some inherent factors like topography, soil type, and other factors could include high rain intensity over a long duration and poor drainage design. In the case of Batu Pahat, Johor, Malaysia, some of the contributing factors include; flatness of the catchment area and low infiltration rate of the top layer soil (clayey). The method of injecting some of the storm-water into the ground (aquifer) through a recharge well (perforated pipe), so as to reduce the peak flow rate reaching these structures was adopted to mitigate flood. This method was evaluated by means of carrying out experiment on a physical model and on an actual site. The determination of the effectiveness of this method was carried out by simulating storm-water accumulation in a reduced scaled physical model. This small scaled model had a rainfall simulator fitted with a sand tank, the sand tank contained soil materials of different grain size and different coefficient of permeability. The model is 100 ± 60 ± 40 cm in dimension and a perforated pipe of 3.5 cm is fixed in the model to simulate recharge well. By varying the rainfall intensity and rainfall duration on the model a relationship was established between the rainfall characteristics and movement of stormwater into the ground by using the recharge well to mitigate flood. The results obtained from the physical model are then compared with results obtained from an actual site where an actual recharge well is present. On the physical model the reduction in rainwater when the recharge well is present is about 6.07% of the total rainwater on average and on the prototype is 2.8, 7.2 and 3.5% of the total rainwater that fell on a catchment of 100,000 m2 for three different rain events. Apart from the high water table noticed at the actual site, other data obtained from the actual site indicated that the recharge well system will be successful when it is adopted to mitigate flood in a site similar in physical and soil properties to the physical model.