# Hydraulic Similitude Studies in the Design of Sand Dams



by

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# ABSTRACT

A sand dam essentially is a weir wall that holds a reservoir full of sediment within which water is stored. The dam is constructed by erecting a weir wall across a river channel so that as water flows during subsequent storms, the sediment carried along is left trapped behind this weir. With this sediment too, water is retained within the pores left by individual aggregate packing. A substantial amount of the water stored can be drained out for use. The amount that is retained depends upon characteristics of the aggregates composing the reservoir. The use of sand dams has been proposed as a viable option to water supply in areas with seasonal watercourses and plentiful sediment flowing within the channels. Problems associated with reduced yields of water from them have been blamed on the use of high step height increments for weirs to trap sediment at every stage apart from other natural factors.

The effect of the step height increment consequent to the water yield of these sand dams has been investigated on a laboratory scale model to shed more light on this technique to determine other ways of trapping sediment with high water storage and yielding properties. This was achieved by use of experimental units with different step height increments, flow conditions, slopes and weir types (solid and mesh or perforated types) that were varied along as the experiments were conducted. Experiments were conducted to simulate actual conditions in an existing prototype, Nasukuta sand dam, which is situated in semi-arid lands of West Pokot district. A geometrically distorted existing laboratory flume model was used for the experiments. The trends of sand storage properties resulting from different step height increments, degree of slope, flow rate and type of weir structure used for the construction of a dam were investigated by comparison of performance of the resulting sand reservoirs.

The principal findings were that the water yield was not so much affected by the step height increment used as by the weir type, slope of the channel and the sediment-laden discharge. The step height increments used should be of moderate size. Step heights of between 185 and 350 *mm* were found to be desirable. The solid weir offered the best trap with typical specific yields above 30 % especially at higher step height increments while the mesh barrier could only afford slightly above 20 % on average. For lower slopes of channel the sediment properties deteriorated. The

recommended slope for a sand dam should be at least 0.9 %. Higher runoff discharges during the formation give more desirable properties for the sand deposit. The flows should typically be above 65 *l/s* per *m* width of channel. These conclusions were drawn from statistical significance tests where analysis of variance of the mean observations of the response variables was used to give an estimate of the underlying variation between experimental units, which provided a basis of inferences about the effects of the applied treatments and additionally from property trends of the sediment trapped.