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Comparing the In-ground Stilling Basin Performances: Movable Condition VS Clear Water

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The purpose of stilling basins below the Flood Mitigation Dams (FMDs) is not only to dissipate the excess energy of the outflow, but also to let the sediment and fish pass through unobstructed. This paper, firstly, demonstrates an eco-friendly concept for stilling basin downstream of FMDs, called In-ground Stilling Basin (ISB). Secondly, it attempts to identify the following objectives: i) the bed topography deformation and sediment flushing efficiency from ISB; and ii) the interaction between sediment deposition and flow field characteristics by comparing the clear water and movable conditions.

To achieve the purpose of this study, experimental investigations are carried out considering various influential parameters such as: ISB length (*L*= 75, 100 and 125 cm), ISB depth (*s*= 5, 10 and 15 cm), end-sill height (h_e= 0, 4, 8 and 12 cm), end-sill width (*be*= 20, 30, 40 and 50 cm), sediment grain size (d_{50}= 1, 5 and 10 mm) and a range of Froude number at the bottom outlet (Fr_1) from 2.5 to 6.

Fig. 1 illustrates the bed topography deformation along the centreline of ISB in equilibrium condition. The test configuration related to this figure is provided in Table 1. It is found that considering two free spaces of 5 cm at the lateral side of end-sill drastically increases the maximum scouring depth within ISB (Fig. 1 and 2). However, it is realized that having lateral free spaces showed an almost equal function for velocity reduction within ISB compared with a conventional end-sill. Comparing the clear water condition with the movable condition revealed that the sediment deposition within ISB increases the stability and symmetry of the hydraulic jump below FMD. Moreover, a taller end-sill without free spaces decreases the performance of ISB regarding to the velocity reduction along the centerline. This is because of the sedimentation effect within ISB resulting in reduction of the sequent depth of the jump just behind the end-sill.

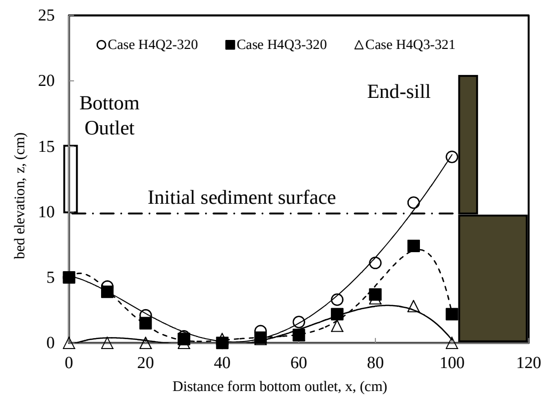


Fig. 1: The bed topography within ISB in equilibrium condition.

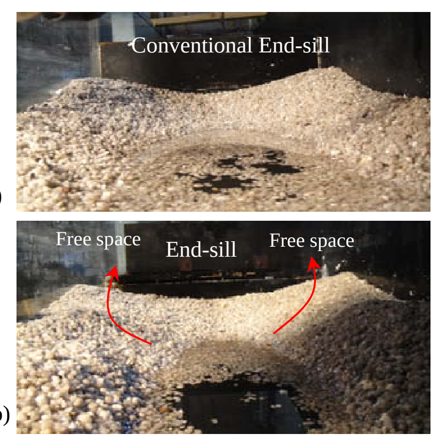
a) b)


Fig. 2: The photography of bed changes in equilibrium condition: a) Case H4Q3-320, b) Case H4Q3-321.

Table 1: The test configuration showed in Fig. 1

Case	*Q* (l/s)	Fr_1	*L* (cm)	*s* (cm)	h_e (cm)	b_e (cm)	d_{50} (mm)
H4Q2-30	10	2.8	100	10	12	50	5
H4Q3-30	15	4.3	100	10	12	50	5
H4Q3-31	15	4.3	100	10	12	40	5