Fig. 4 shows the horizontal velocity profiles for a submerged narrow-crested flow at five sections: $x$=-0.1m, 0m, 0.04m, 0.076m, and 0.24m. The submerge ratio of the downstream tailwater head above weir and upstream water head over weir is 0.89. The maximum velocity for each section varies from 0.4m/s to 0.7m/s. Relatively low velocity is observed at $x$=-0.1m. The velocity profile at the section x=0m shows the non-uniform pattern, and somewhat disturbed. This indicates the flow recirculation zone may develop at the entrance edge of weir. The developing recirculation zone is likely to affect the velocity distribution over the crest. At $x$= 0.04m, $x$=0.0.76m, and $x$=0.24m, the flow velocity profiles have the similar trend with velocity increasing toward the water surface. Velocities at the downstream are shown higher value than at the upstream. Due to the no-slip condition, the fluid velocity is zero at the bottom of channel and the weir crest. The flows shown in five sections are considered non-uniform, an increase in the horizontal velocity is observed along the flow direction.

The pressure distribution of simulated submerged flow over narrow-crested weir at the five section locations are shown in Fig.5. At the sections $x$=-0.1m, $x$=0.04m, $x$=0.076m, and $x$=0.24m, the pressure distribution all behaves similar to hydrostatic pressure under submerged flow condition. At $x$=0m, small difference in pressure distribution from hydrostatic pattern over the crest is believed to be caused by the recirculation zone at the entrance edge of weir crest.
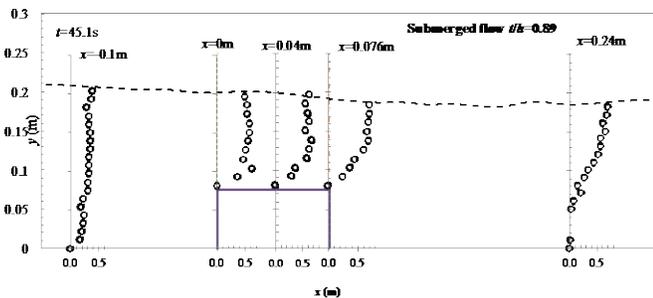


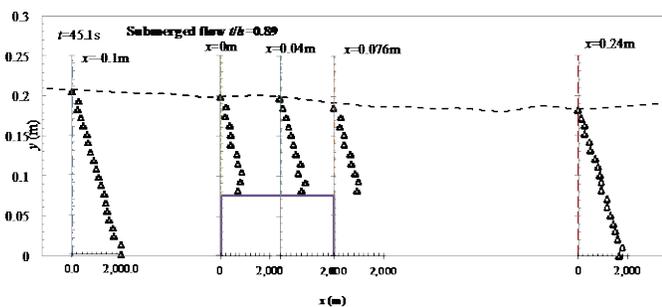Fig. 4 Horizontal velocity profiles at different sections.



Fig. 5 Pressure profiles at different sections.

## SUMMARY

The numerical study of open-boundary free-surface flow over weir of finite crest length with squared-edge is explored by using the MPS method. In the study, MPS method has addressed its capability of successfully modeling the narrow-crested weir flow. For water surface, the simulation results from the MPS method are shown in a good agreement. Horizontal velocity and pressure profiles are plotted to show the distribution pattern at different locations along the flow direction. Despite of some patterns of horizontal velocity and pressure distribution varied from theoretical distribution, the simulation results from the MPS method are considered reasonable.

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