Experiment No. 6

“To understand the scour in open channel flow”

Apparatus Name: Advanced Hydrological Apparatus

HYDROGEOLOGY LAB

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING

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Procedure:

Connect the flexible piping from the river inlet tank to the quick release connector on the flow meter.

Set the slope of the sand tank to approximately 2%. Smooth and lightly tamp down the sand level with the top of the sand tank. Use the scoop to cut an initial straight channel into the sediment bed from the river inlet tank to the deep cut-out. The channel should be approximately 4 cm wide and 2 cm deep.

Switch on the pump and set an inlet flow rate of 2 l/min. Allow the channel to develop for 30 minutes. Sediment yield and channel discharge may be recorded if desired, but this is not essential. Accessories may be placed in the channel in order to simulate bridge piers, groynes, vanes and so on. These items should be partially sunk into the streambed to prevent movement during the run. A variety of shapes have been provided so that the effects of streamlined, flat-ended and cylindrical shapes may be investigated. Other items may be used to simulate additional flow obstructions, such as a pebble to represent a boulder. Any such items must be heavy enough to remain motionless in the flow.

Place the chosen object into the main channel approximately one third of the way down the sand tank from the river inlet. Any changes in channel shape and the development of any scour holes and sediment depositions should be observed and recorded. Flow turbulence and eddies may be located by observing the reflection of light off the water surface.

Increase the valley slope in increments of 0.3-0.5%, observing the development if the scour hole and the channel along the length of the sand tank. The channel should be left for at least 15 mins after each change in slope. Scour hole geometry, channel width and depth, discharge, sediment yield and valley slope may be recorded if desired. The experiment may be varied by altering the position of the obstruction within the width of the channel, and by using multiple obstructions.

One method of making diagrams of the channel requires two rulers or measuring sticks, both of which must be rigid and one of which must be at least 1 meter in length. This long ruler should be laid across the top of the tank from one side to the other, parallel to the end, and then moved along the tank in steps of 10 cm. At each position, the second ruler is then used to measure the distance from the top line of the tank to the sand surface, in steps across the entire width of the tank. Reference points should be recorded for notable features such as the positions of the channel sides and any flow turbulence and eddies. More detailed sketches should be made of scour whole geometry.

Observations and Calculations:

Valley Slope %	River Discharge l/min	Sediment Yield g/min

Assignment:

a) Draw the diagrams of the channel planform, flow obstructions, flow turbulence and scour features should be made for each set of conditions.

b) Describe the way in which the shape of an obstruction influences the amount of scouring of the riverbed and sides.

c) If multiple obstructions were investigated, comment on the effect of spacing, both across the channel and down its length.

d) Can any conclusions be drawn from the experimental model on the best positioning of bridge piers across a river to minimize scour, and on the best cross-section for the base of such piers?

e) What other factors may need to be considered when designing an artificial river structure such as a bridge or groyne?