Certificate Course on Participatory Irrigation Management (CCPIM)

Module 11- Water measurement, Water Accounting, Water Audit, and estimation of water losses.

Topic 11.3- Measuring outlet discharges

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Measuring outlet discharges

Topics of module 11

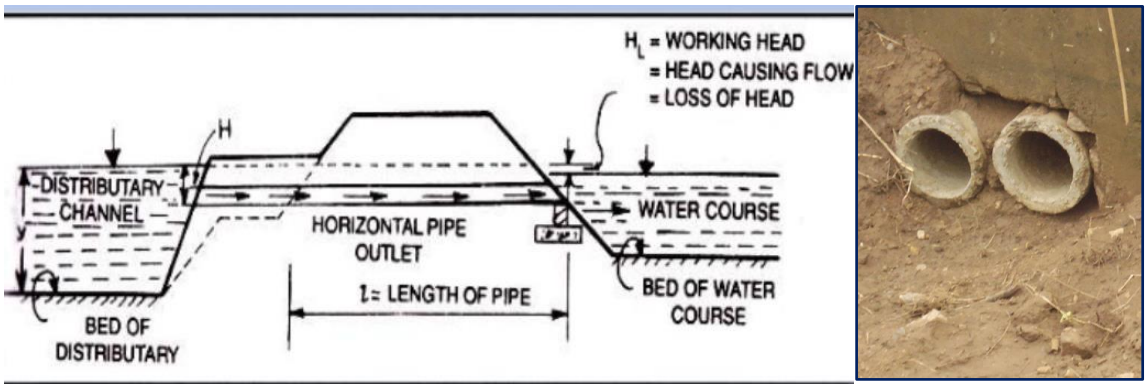
Introduction:

One of the main objectives of establishing Water Users' Associations is that the sharing of water between the canal sub-systems and the farmers should be equitable. For equitable distribution of water, the flow or discharge measurements are necessary.

Discharge measurement of an outlet:

What is an outlet: Outlets are the openings constructed in the banks of distributaries and minors. Field channel takes off from this point and gets irrigation water through outlet. It is also called turnout or sluice in some parts of India. The field channels below the outlets are maintained by the cultivators. An outlet works like a tap or spout to transfer the water from the distributary and minors to the watercourse/ field channels. Generally, it is a pipe made of cast iron, cement concrete or PVC which is laid across a canal bank on a cement concrete foundation and fixed by walls at both ends.

Picture-8: The longitudinal section and photograph of an outlet fixed at the Canal Bank



The outlets are of two types:

I. *Submerged Outlets*: One whose pout or outer end remains submerged in the flow and
II. *Freefall Outlets*: Which discharges freely in the atmosphere over the watercourse.

The discharge passing through an outlet depends upon the head of water over the outlet which should be first measured.

Measurement of head in submerged outlet:

Measure the water depth in a running watercourse. Then block the watercourse down steam of measuring point and remeasure the water depth. The increase in water depth can be taken as 'water head'.

Measurement of head in a free fall outlet:

The depth of water surface over centre of pipe will be the 'head'

Calculation of Discharge of an outlet:

The discharge (Q) in cusec =A*C*√2gh Where h is the head (in feet) and g is gravitational constant (value 32.2 ft/sec2)

A is the area of internal cross-section of pipe (in square feet)

C is an empirical coefficient whose value may be taken as 0.68 in submerged condition and 0.63 in freefall condition

Exercise on outlet discharge measurement

Experiment details: The water from a 6-inch diameter pipe-outlet is freely falling into a water course. The head of canal water over the outlet is measured as 9 inches. What is the discharge of the outlet?

A ready reckoner table for cross-section areas is given below:

Table1: Cross-section area of pipes of different diameter

Diameter of pipe (inch)	Internal cross section of pipe (square feet)
4	0.0870
5	0.1400
6	0.1964

Solution:

The discharge (Q) in cusec =A*C*√2gh

Where h is the head (in feet) and g is gravitational constant (value 32.2 ft/sec2)

A is the area of internal cross-section of pipe (in square feet)

C is an empirical coefficient whose value may be taken as 0.68 in submerged condition and 0.63 in freefall condition

Here the value of 'h' is 9 inch or (9/12) =0.75 feet

The value of 'A' from the above table is 0.1964 square feet. (In absence of table, the area can be calculated as $A = \pi r^2$ where r is the radius of pipe)

Q=0.1964*0.63*$\sqrt{(2 * 32.2 * 0.75)}$=0.86 cusec

Discharge of outlet is 0.86 cusec

Do it yourself

In the above exercise, if the outlet pipe is submerged in the water flowing in to the water course, what will be the discharge of the Outlet.