

# IRRIGATION OUTLETS

## Definition:-

It is a hydraulic structure, which conveys irrigation water from a state-owned distributary to private-owned watercourse.

### State-owned distributary:

A water channel which owned, and operate and maintained at the cost of government.(Canal – Branch Canal –Distributary – Minor – Subminor)

### Private-owned watercourse:

A water channel, which is maintained at the cost of farmers.

## The following characteristics are assumed for the performance of an outlet

### i) Flexibility

It is the rate of change of outlet discharge to the rate of change of discharge of parent channel.

### ii) Sensitivity:-

It is defined as the ratio of the rate of change of discharge of an outlet to rate of change in the level of distributary water surface i.e normal depth of channel.

### iii) Efficiency

This is defined as the ratio of the head recovered to the head put in.

## iv) NOTATIONS & DEFINITIONS

<b>A.O.S.M</b>	Adjustable Orifice Semi Modular
<b>A.P.M</b>	Adjustable Proportionate Modular
<b>Bt</b>	The width of the throat of a view flume etc
<b>F.S.D</b>	Full Supply Depth
<b>F.S.L</b>	Full Supply level
<b>Hm</b>	Minimum working head

## V). Module

A device for ensuring a constant discharge of water passing from one channel into an other irrespective of water level in each , within specified limits.

## **Types of Outlets**

### **Non-Modular:**

It is an outlet in which discharge of outlet depends in water level of watercourse and the parent channel. This means that a cultivator can be drawn more discharge of water illegally by lowering the water level in watercourse ( pipe or banal type and secretly outlet).

### **Semi Modular:**

It is an outlet in which the discharge of outlet depends upon the water level in the distributray only and is independent of the water level watercourse (open flume and A.O.S.M).

### **Modular:**

It is rigid module in which discharge is independent of the level in the distributary as well as watercourse.

## **Types of Outlet used in Punjab**

- i) Open Flume
- ii) Pipe Outlet
- iii) Adjustable Orifice Semi Modular
- iv) Pipe – Cum – OF/AOSM

## **1. OPEN FLUME OUTLET**

### **Formula**

$$Q = KBt G^{3/2}$$

Where

Q = Discharge in lps

Bt = Throat width in meter

G = Head ( Depth of water above Crest in m)

= F.S.L of canal – Crest level

Max F.S.L of watercourse = F.S.L of canal - Hm

Hm = 0.2 G

“Hm” is minimum modular head required for satisfactory performance of outlet.

Values of K & Bt in MKS system are given below.

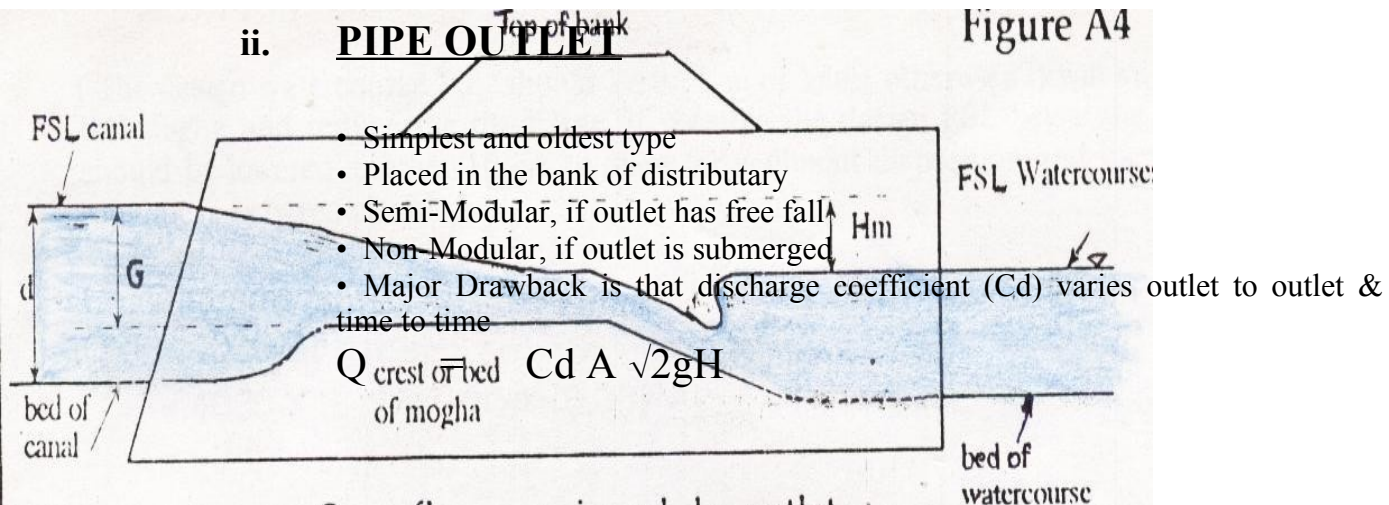
<b>K</b>	<b>Bt (m)</b>
1600	0.06 – 0.09
1630	0.09 m – 0.12
1650	greater than 0.12

## **OPEN FLUME OUTLET**

ii.

## PIPE OUTLET

Figure A4



### Free Flow Condition,

$$Q = C_d A \sqrt{2gH}$$

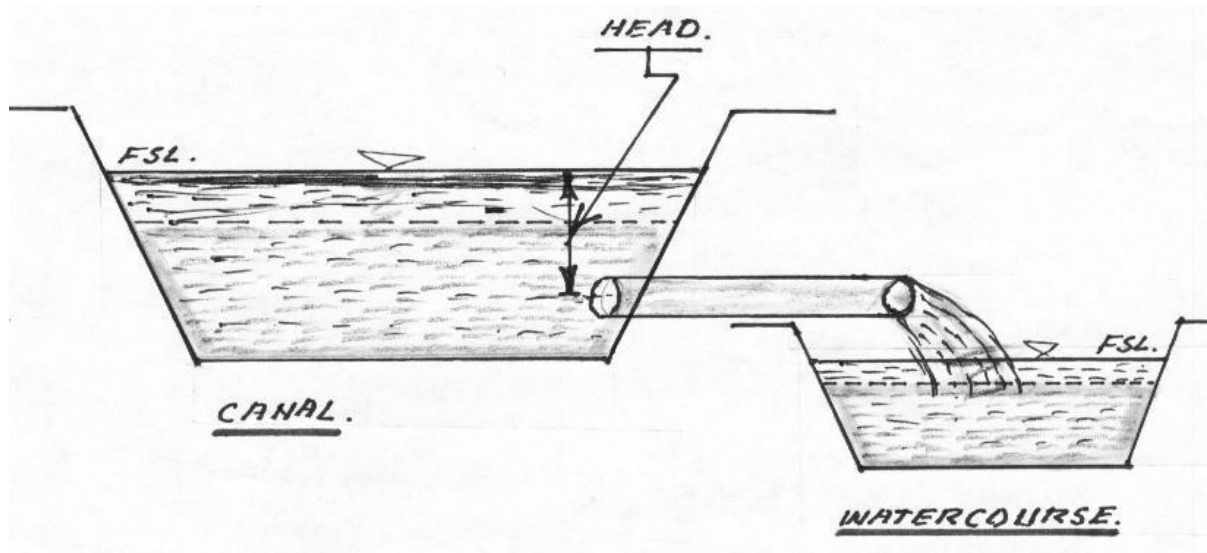
$Q$  = Discharge in cubic meter per second  
 $H$  = FSL of Canal – Center of pipe  
 $A$  = Area of pipe ( $m^2$ ),  $g = 9.80 \text{ m/sec/sec}$   
 $C_d = 0.63$

### Submerge Flow Condition

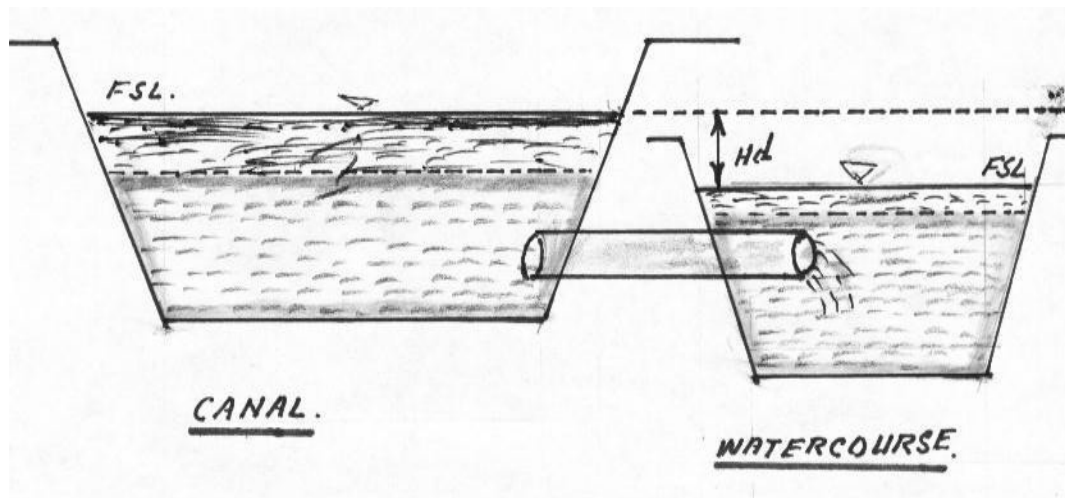
$$Q = C_d A \sqrt{2gH_d}$$

$Q$  = Discharge in cubic meter per second  
 $H_d$  = FSL of Canal – FSL of Watercourse  
 $A$  = Area of pipe ( $m^2$ )  
 $C_d = 0.74$

## Pipe Outlet Free Condition



## Pipe Outlet Submerged Condition



## IRRIGATION OUTLETS CONTINUE

### iii. Adjustable Orifice Semi Modular

#### Formula

$$Q = 4030 B_t Y \sqrt{H_s}$$

where

$$Q = \text{lps}$$

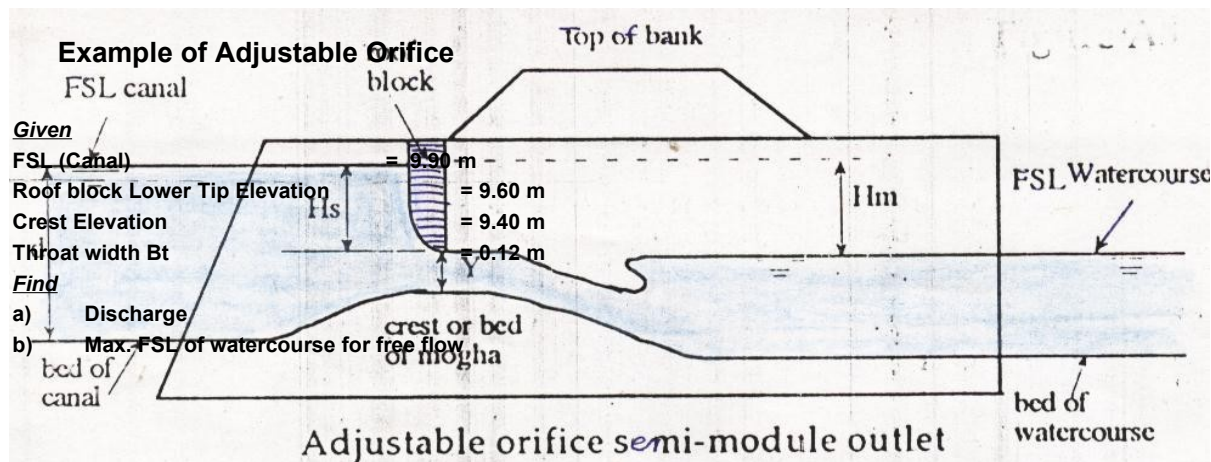
$$B_t = \text{Throat width (m)}$$

$$Y = \text{Distance between Lower Tip of Roof Block \& Crest}$$

$$H_s = \text{FSL of Canal} - \text{Lower tip of Roof Block}$$

$$\text{FSL of Watercourse} = \text{FSL of Canal} - H_m$$

$$H_m = 0.83 H_s - 0.5 B_t$$



$$a) Q = 4030 Bt Y \sqrt{H_s}$$

$$H_s = 9.90 - 9.60 = 0.30 \text{ m}$$

$$Y = 9.60 - 9.40 = 0.20 \text{ m}$$

**Solution**

$$Q =$$

$$4030 \times 0.12 \times 0.2 \sqrt{0.3} = 53 \text{ lps}$$

b). Max. FSL of Watercourse

$$= \text{FSL of Canal} - H_m$$

$$H_m = 0.83 \times 0.30 - 0.5 \times 0.12 = 0.189 \text{ m}$$

**Max-FSL of Watercourse**

$$= 9.90 - 0.189 = 9.711$$

m or lower for free flow

## Pipe-cum-AOSM

- Pipe from canal leads to a sump or cistern
- Sump is usually round in shape
- It can replace submerged Scratchley outlet
- On lined distributaries being installed
- Head will be measured in cistern
- Discharge will be equal to the semi-module fixed at its lower end

## Merits of Pipe-cum-Semi Module

- High degree of immunity
- Large range of modularity (good at even at low supply)
- Low head required
- Cheaper in heavy banks
- Easy inspection
- Easy and cheaper adjustment
- Adjustment possible even with running channel
- **Note:** Formulae is same as for OF or AOSM as the case may be

## DATA REQUIRED FOR DISCHARGE MEASUREMENT

### a). For Open Flume

- FSL of Canal
- Crest level of Mogha
- Bt

### b). AOSM use Level Set for measuring

- FSL of Canal
- Lower tip of Roof Block
- Crest level of Mogha
- Bt
- Y

### c). For Pipe & Scratchley use Level Set for measuring

- FSL of Canal
- FSL of watercourse
- Diameter of pipe

