Name :- Muhammad Hamza Rashid

ID # :- 7805

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Submitted To :- Dr. MAQ Jehangir Durrani

IQRA NATIONAL UNIVERSITY

DEPARTMENT OF CIVIL ENGINEERING

(QUESTION - 01)
(PART-A)

A :- Explain anti water-logging measures.

Ans :- **WATER LOGGING :-**

The Soil whose surface Layers are Saturated with water is called water-logged soil. The phenomena of rising water table is known as water-logging.

ANTI WATER-LOGGING MEASURES :-

For Controlling the water-logging, following measures are adopted.

i) EFFICIENT SURFACE DRAINAGE :-

Efficient Surface Drainage allows a quick flow of rain water in short period that helps in reducing the water logging. Its Initial Construction cost is high.

ii) RESTRICTION OF IRRIGATION :-

In one particular Season, only a small portion of land Should recieve canal water.

Remaining areas should irrigated in next season by rotation.

iii) LINING OF WATER COURSES :-

Lining of Canals and water Courses reduces the Seepage of water.

iv) REMOVING OBSTRUCTION IN NATURAL DRAINAGE :-

Water (Drainage) Should Cross with roads, railways, Canals

to make it more efficient and it (water) should not allowed to stay in one area.

Also by bush and jungle cutting, Natural flow is provided.

v) OPTIMUM USE OF WATER:-

Certain amount of water gives the best result. Less or more water reduces the yield. Cultivators should be educated so that not to use more water.

vi) Changes in Crop pattern.

vii) Prevention of Seepage from water reservoirs

viii) Adoption of Sprinkler method for Irrigation

(PART-B)

b:- Differentiate b/w Saline and Alkine Soils.

Ans:-

SALINE	ALKALINE SOILS
1- Saline Soils are the Soils that contain high contents of Soluble Salts.	1- Alkaline Soils are the Soils that contain excessive absorbed Sodium.
2- Saline soils have a PH less than 8.5.	2- Alkaline soils have a PH greater than 8.5
3- Saline Soils have an exchangeable Sodium % less than 15.	3- Alkaline Soils have an exchangeable Sodium Percentage higher than 15.
4- The Salinity of the Saline Soils increased due to mineral weathering, excessive irrigation, use of fertilizers and animal wastes etc.	4- The availability of plant nutrients in alkaline soils are low. Some plants like geraniums and maidenhair fern thrive in this soil.

5- Saline soils have electrical conductivity of 4 or more mmhos/cm.	5- Alkaline soils usually have electrical conductivity of less than 4 mmhos/cm.
6- Saline soils are white or light gray in color.	6- Alkaline soils are Black color soil.

(PART-C)

C:- How do you reclaim salt affected lands?

Ans. Salt affected lands can be reclaimed by adopting the following procedures :-

1- AVOIDING OF EFFORESCENCE :-

i) Efforescence can be avoided by maintaining the water table sufficiently below the roots.

ii) Hence all the measures which were suggested for preventing water logging hold good for preventing salinity of lands.

iii) To the lower water table in saline soils, an efficient drainage (surface and sub-surface) must be provided.

2- LEACHING :-

In this process

i) Land is flooded with water

ii) Alkaline salts will be dissolved in water

iii) Percolation to the ground water

iv) Drainage by sub-surface drains.

=> High salt resistant crops like rice are grown on leached land for 1 or 2 seasons.

=> Then ordinary crops like wheat or cotton are grown.

Then the land is said to be have reclaimed.

3- SURFACE DRAINAGE:-

It includes removal of excess of water using open ditches, field drains, land grading etc. Open drain removes excess of irrigation and storm water.

4- LAND GRADING:-

It is a continous land slope towards field drains. It is necessary for surface irrigation.

5- SURFACE INLET:-

A surface inlet is a structure constructed to carry the pit water into the sub surface drain.

The surface water from pot hole depressions, road ditches may be removed by inlet surface inlet.

(QUESTION- 02)
(PART- A)

a) Explain the procedure of designing of an irrigation canal by Kennedy's theory.

Ans:- RG Kennedy investigated canals systems for twenty years and come up with Kennedy's theory.

Kennedy studied straight reaches of upper Bari Doab canal which are stable for 30 years.

=> $V_o = CD^n$

where,

=> V_o is Critical velocity (non-silting or non-scouring)

=> C is Constant dependents upon quantity of silt.

ASSUMPTIONS OF KENNEDY :-

1- Vertical Component of eddies support the silt particles

2- The silting power of a channel depends upon its velocity, which controls the eddies.

3- The silt transportation power depends upon its depth.

4- The silt transporting power of a channel is independent of bed width.

CANAL DESIGNING BY KENNEDY'S THEORY :-

STEP #1 :-

Assume the trial value of D and put in equation ① and determine

$$V_o = 0.546 m D^{0.64}$$

STEP #2 :-

From equation ⒷB,

$$Q = AV$$

$$A = BD + D^2/2 \quad \text{—— Ⓐ}$$

$$P = B + D5^{1/2} \quad \text{—— Ⓑ}$$

=> For assumed D, determine B.

=> Also find $R = A/P$

STEP # 3:-

Now Substitute the value of R in equation (2) (Kutters and chazys Equation) to obtain V which will be actual velocity for assumed dimensions.

STEP # 4:-

If the velocity worked out from equation (2) agrees with that of obtained equation (3) (Kennedy's Equation), Then the assumed depth is correct. Otherwise repeat the Procedure with changed value of D

(PART - B)

Design an irrigation channel by Kennedy's theory to carry a discharge of 30 m^3/sec with Cvr(m) of 1 and N as 0.0225 and bed slope of 1 in 5000. Assume the depth (D) as 2.3m.

GIVEN DATA:-

Discharge (Q) = 30 m^3/sec

Cvr(m) = 1

N = 0.0225

Bed slope = 1 in 5000

Depth (D) = 2.3m

SOLUTION:-

Finding velocity,

By formula,

$V_K = 0.546 m D^{0.64}$

$= 0.546(1)(2.3)^{0.64}$ $\Rightarrow$ $V_K = 0.930$ m

=> Now Calculating Area of Canal,

By formula,

$Q = AV \Rightarrow A = Q/V$

$A = 30/0.930$

Area = 32.25 m²

=> Now we have to Calculate B, By using formula

$A = BD + \frac{D^2}{2} \Rightarrow BD + 0.5D^2$

=> By putting values,

$A = BD + 0.5D^2$

$32.25 = B(2.3) + 0.5(2.3)^2$

$32.25 - 2.645 = 2.3(B)$

$29.605 = 2.3(B)$

=> **B = 12.87 m**

=> Now we have to Calculate wetted perimeter,

So By formula,

$P = B + \sqrt{5}D$

$= 12.87 + \sqrt{5}(2.3) \Rightarrow$ **P = 18.01 m**

=> Now we have to Calculate Hydraulic Radius,

$R = A/P$

$= 32.25/18.01 \Rightarrow$ **R = 1.79 m**

=> Now Calculating mean velocity from chezy equation,

$V_c = C(RS)^{1/2}$

where

$$C = \frac{\frac{1}{n} + \left(23 + \frac{0.00155}{S}\right)}{1 + \left(23 + \frac{0.00155}{S}\right)\frac{n}{\sqrt{R}}} \Rightarrow \frac{\frac{1}{0.0225} + \left(23 + \frac{0.00155}{(1/5000)}\right)}{1 + \left(23 + \frac{0.00155}{(1/5000)}\right) \times \left(\frac{0.0225}{\sqrt{1.79}}\right)}$$

$$C = \frac{75.19}{1.517} = 49.56$$

$$\Rightarrow \quad V_c = 49.56\left(1.79\left(\frac{1}{5000}\right)\right)^{1/2}$$

$$V_c = 0.93$$

$$\Rightarrow \quad \boxed{V_c = 0.93\text{m}}$$

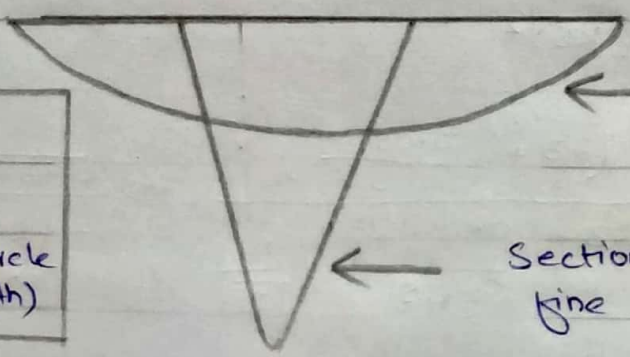
(QUESTION-03)
(PART-A)

Differentiate b/w initial regime and Final regime in accordance to Laceys theory.

Ans:- According to Lacey, channel with no silting or Scouring may actually be not in regime.
He differentiated b/w Initial regime and final regime but this theory is applicable to final regime.

INITIAL REGIME	FINAL REGIME
When only bed slope of channel changes but the Cross section remains same then also No silting or Scouring take place. This is said to be have Initial Regime.	If all the parameters (Perimeter, depth and slope) have equally free to vary and adjust according to discharge and silt grades then the channel is said to be have Final regime.

In the final regime, the Cross section assumes Semi-ellipse shape.



Coarser the silt, flatter the ellipse

Finer the silt the Section is Semi-circle (greater the depth)

(PART-B)

Design a regime channel by Laceys theory for discharge 30 m^3/sec and mean diameter of silt particle is 0.56mm.

GIVEN DATA:-

Discharge (Q) = 30 m^3/sec

Mean dia of Silt particle (M) = 0.56mm

Solution:-

First we have to calculate velocity, (mean)

$$V_m = \left[\frac{Qf^2}{140}\right]^{1/6}$$

$$= \left[\frac{30(1.32)^2}{140}\right]^{1/6}$$

$$V_m = 0.85 \text{ m/sec}$$

$\because$ f = Lacey's Silt factor

$f = 1.76 M^{0.5}$

$= 1.76(0.56)^{0.5}$

$f = 1.32$

$\Rightarrow$ Now we will Hydraulic mean depth

$$R = \frac{5}{2}\left(\frac{v^2}{f}\right)$$

$$= \frac{5}{2}\left(\frac{(0.85)^2}{1.32}\right) \Rightarrow R = 1.36$$

$\Rightarrow$ Now finding the value of "P"

By formula,

$$P = 4.75\sqrt{Q}$$

First we have to find Area =

By discharge formula,

$$Q = AV$$

$$\Rightarrow A = Q/V$$

$$= \frac{30}{0.85} \Rightarrow \boxed{A = 35.29\ m^2}$$

Now,

$$P = 4.75\sqrt{Q}$$

$$= 4.75 \times \sqrt{30} \Rightarrow \boxed{P = 26.01}$$

Finally, we have to calculate "S"
By using formula,

$$S = \frac{f^{5/3}}{3340\ Q^{1/6}}$$

$$= \frac{(1.32)^{5/3}}{3340 \times (30)^{1/6}}$$

$$\Rightarrow \boxed{S = 0.000269}$$

DIMENSIONS CALCULATIONS:-

By formula

$$\Rightarrow A = BD + \frac{D^2}{2}$$

$$35.29 = BD + \frac{D^2}{2} \quad \text{---(1)}$$

$$\Rightarrow P = B + D\sqrt{5}$$

$$26.01 = B + 2.236D$$

$$B = 26.01 - 2.236D \quad \text{---(2)}$$

Put eq (2) in eq (1),

$$35.29 = (26.01 - 2.236D)D + \frac{D^2}{2}$$

$$35.29 = 26.01D - 2.236D^2 + \frac{D^2}{2}$$

$$35.29 = 26.01D - 2.236D^2 + 0.5D^2$$

$$35.29 = 26.01D - 1.736D^2$$

$$\Rightarrow \underset{a}{-1.736D^2} + \underset{b}{26.01D} - \underset{c}{35.29} = 0$$

By Quadratic Equation :-

$$D = \frac{-(26.01) + \sqrt{(26.01)^2 - 4(-1.736)(-35.29)}}{2(-1.736)}$$

$D = 1.51\,m$ → Put in eq (2),

$$\Rightarrow B = 26.01 - 2.236(1.51)$$

$$\Rightarrow B = 22.63\,m$$

(QUESTION-04)
(PART-A)

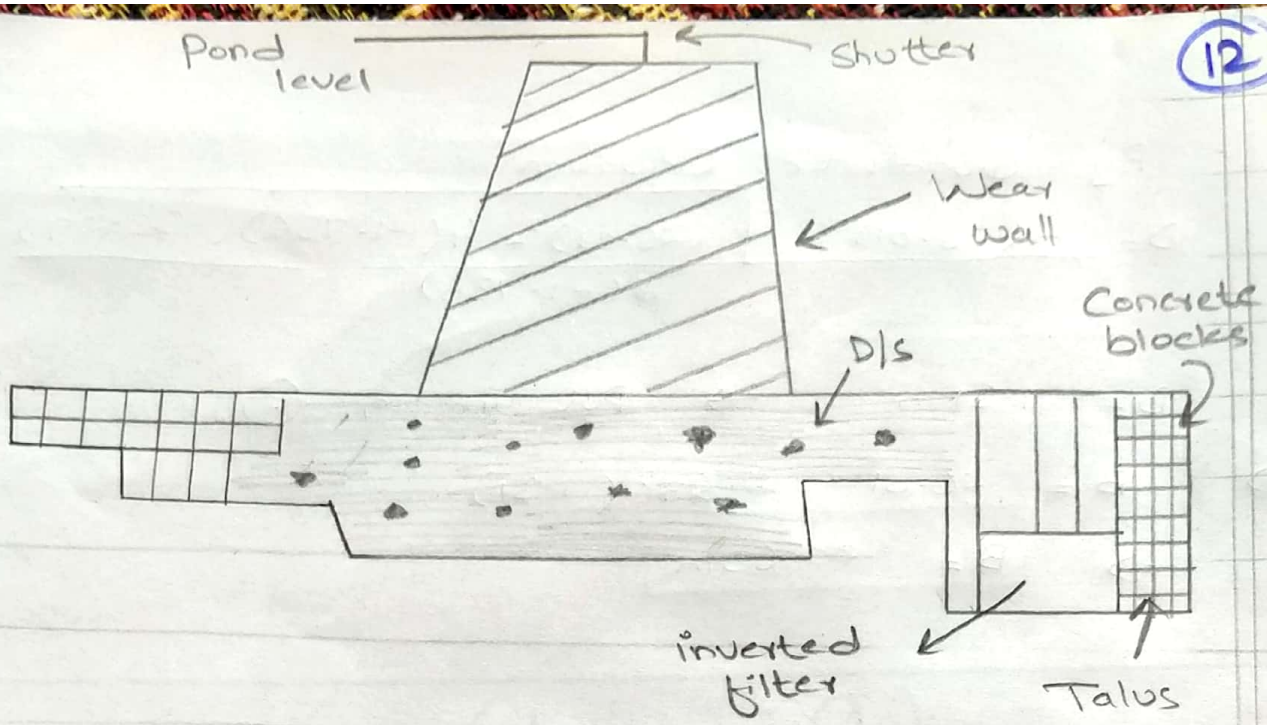
Explain the components of headworks with neat diagrams.

COMPONENTS OF HEADWORKS:-

Following are the Components of Headworks.

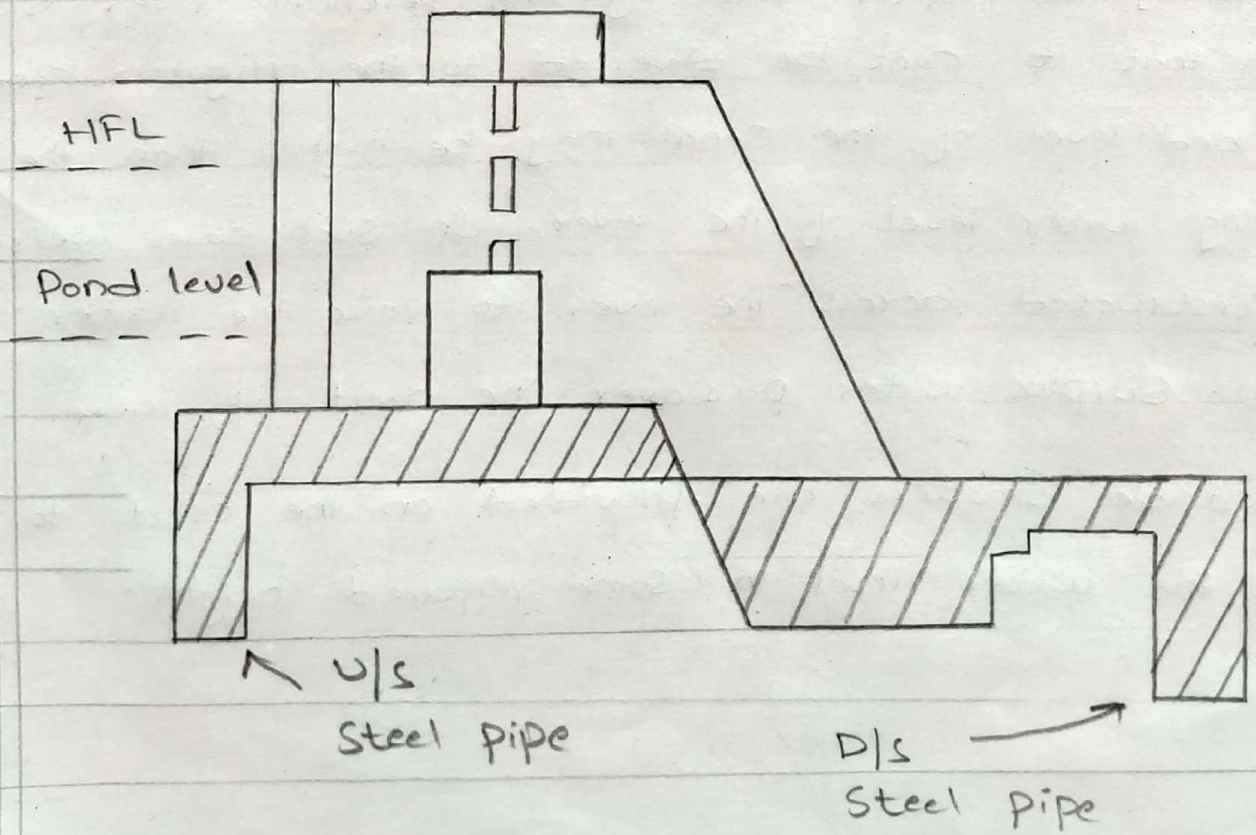
1- WEIR:-

Normally the water level of any perennial river is such that it can't be diverted to the irrigation canal. The bed level of the canal may be higher than the existing water level of the river. In such cases, weir is constructed across the river to raise the water level. Surplus water pass over the crest of weir. Adjustable shutters are provided on the crest to raise the water level to some required height.



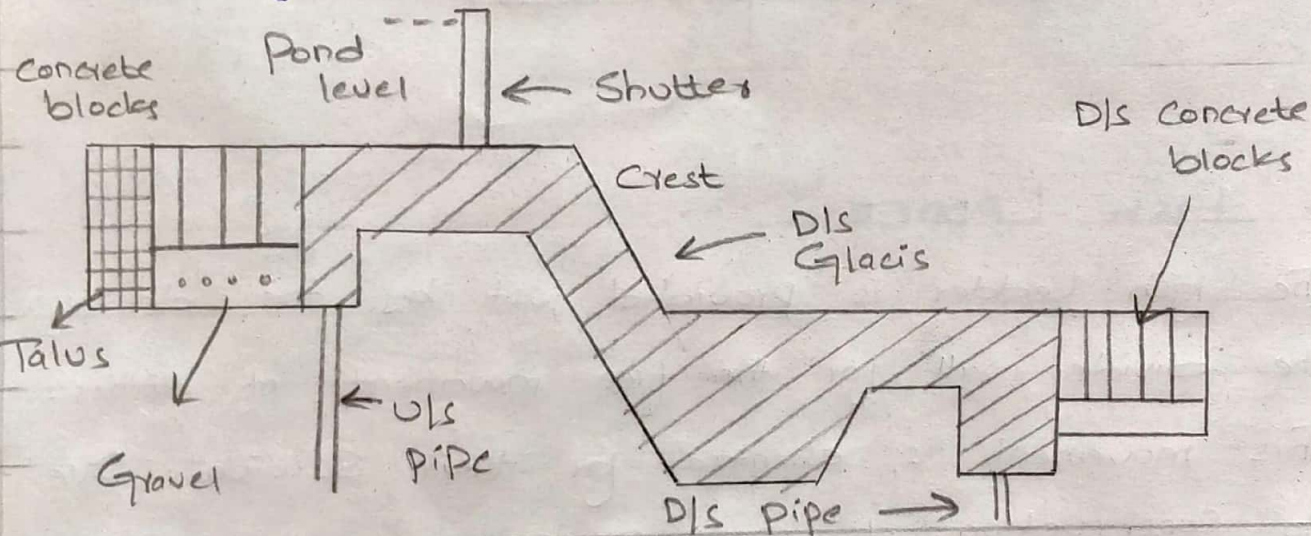
3) BARRAGE :-

When the water level on the upstream side of weir is required to be raised to different values at different time, barrage is constructed. Barrage is an arrangement of adjustable gates or shutters at different tires over the weir.



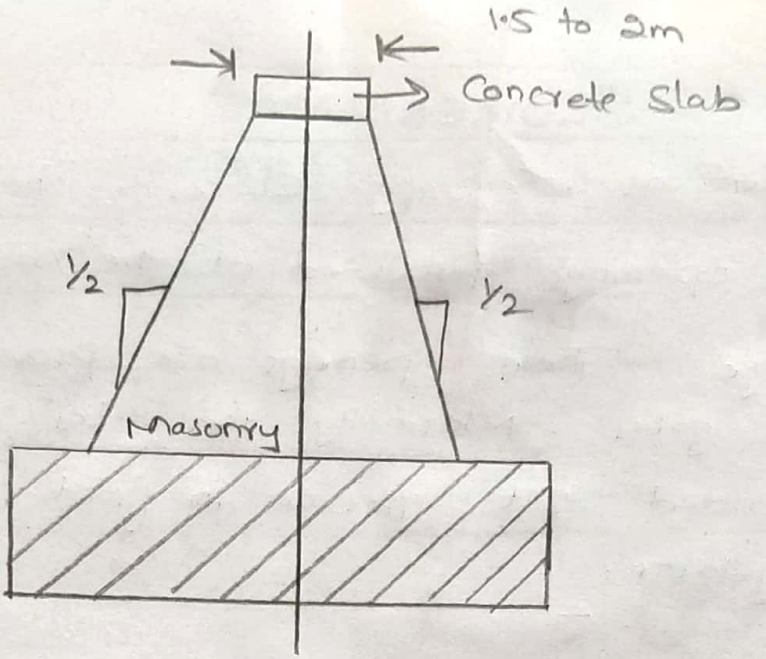
3- UNDER - SLUICES:-

Also known as Scouring Sluices. The under sluices are the openings provided at the base of the weir or barrage. These openings are provided with adjustable gates. Normally the gates are kept closed. The suspended silt goes on in front of the canal head regulator.



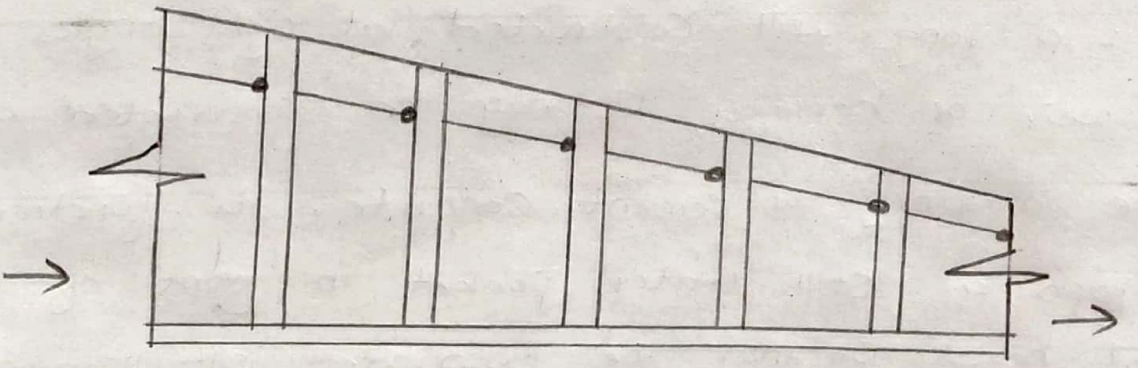
4- DIVIDE WALL:-

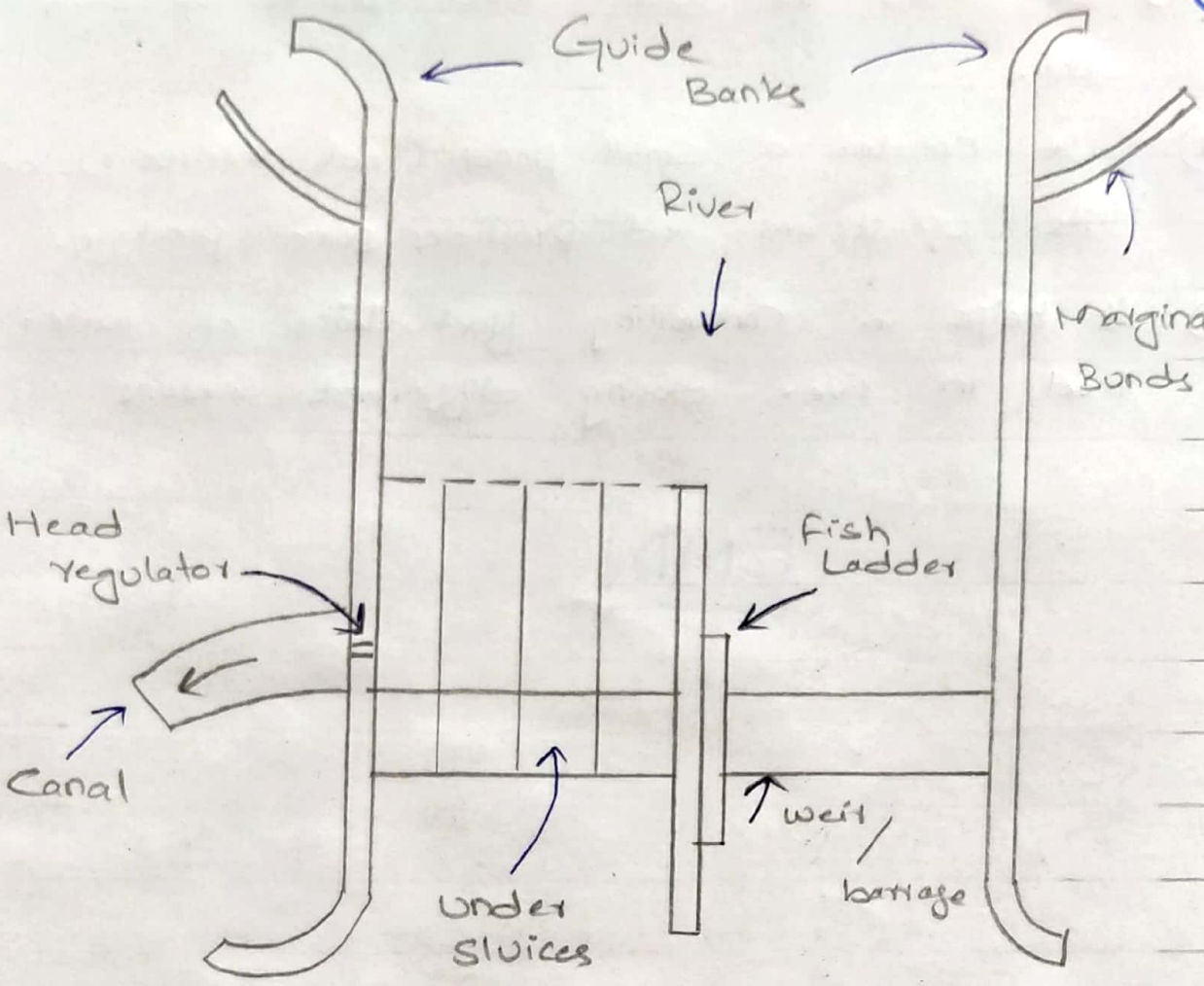
It is a long wall constructed at right angles in the weir or barrages, it may be constructed with stone masonry or cement concrete. Its function is to form a still water pocket in front of canal head so that the suspended silt can be settled down which can later be cleaned through the scouring slices from time to time.
It also controls the eddy currents or cross current in front of canal head.



5- FISH LADDER:-

The fish ladder is provided just by the side of the divide wall for the free movement of fishes. This movement is essential for their survival. Due to construction of weir or barrages, this movement gets obstructed and is detrimental to the fishes.





(PART-B)

What are the functions of head regulators?

Ans:- **HEAD REGULATOR:-**

Regulators constructed at the off taking points are called head regulators. When it is constructed at the main canal, it is called canal head regulator.

FUNCTIONS OF HEAD REGULATORS:-

Following are the functions performed by head regulators.

i) It regulates the water supply in canals.

ii) It controls the entry of silt into canals.

iii) It raises the water level on its up-stream side.

iv) It creates a small pond (not reservoir) on its up-stream and provides some pondage.

v) It helps in controlling fluctuations of water level in river during different seasons.

END!