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SECTION A

1

Q.1

a. Culverts:-

An opening through an embankment for the Conveyance of water by mean of pipe or an enclosed channel.

OR

It is a transverse and totally enclosed drain under a road or railway.

OR.

Culvert is a tunnel carrying a stream under a road or railway. A culvert may act as bridge for traffic to pass on it. They are typically found in a natural flow of water and serves the purpose of a bridge or a current flow controller.

b. Cause way:-

Cause way is define is a road that is raised as to be above water marshland etc is called Causeway.

Q1 Part : B

Ans 5

Cross Drainage works:-

• In an Irrigation project, when the network of main canals, branch canals, distributaries, etc. are provided, then those canals may have to cross the natural drainages like rivers, stream, nallahs, etc. at different points within the command area of the project. The crossing of the cannals with such obstacle cannot be avoided. So, suitable structures must be constructed at the crossing point for the easy flow of water of the cannal and drainage in the respective directions. These structure are known as cross-drainage works.

Necessity of Cross Drainage works.

• The water-shed canals do not cross natural drainages But in actual orientation of the canal network, this ideal condition may not be available and the obstacles like natural drainages works must be provided for running the irrigation system.

• At the crossing point, the water of the cannal and the drainage get intermixed. So. for the smooth running of the cannal with its design discharge the cross drainage works are required.

The site condition of the crossing point may be such that without any suitable structure. The water of the cannal and drainage can not be diverted to their natural directions. So the cross drainge works must be provided to maintain their natural direction of flow.

TYPES OF Cross Drainage Works

- Type I (Irrigation Cannal passes over the drainge)
  - (a) Aqueduct
  - (b) Siphon Aqueduct.

- Type II (Drainage passes over the irrigation Canal)
  - (a) Super passage
  - (b) Siphon Super passage

- Type III (Drainage and Canal intersection each other of the Same level)
  - (a) Level Crossing
  - (b) Inlet and outlet.

* Aqueduct :-

→ The hydraulic structure in which the irrigation cannal is taken over the drainage (such as river, stream etc..) is know as aqueduct. This structure is suitable when bed level of canal

Siphon Aqueduct :-

- In a hydrulic structure where the canal is taken over the draimge, but the drainage water cannot pass clearly below the cannal. It flows under siphonic action. So. it is known as siphon aqueduct.

* Type II

* Super passage :-

The hydraulic structure in which the drainage is taken over the irrigation canal is known as Super passage. The Structure is suitable when the bed level of drainage is above the full supply level of the canal.

Siphon Super passage :-

↳ The hydraulic structure in which the drainage is taken over the irrigation canal, but the canal water passes below the drainage under siphonic action is know as siphon super passage.

* Type III

* Level Crossings :-

→ when the bed level of canal and the stream are approximately the same and quality of water in canal and stream is not much different, the cross drainage work constructed is called level crossing where water of canal and stream is allowed to mix. with the help of regulators both in canal and stream. water is disposed through canal and stream is required quantity. Level crossing consits of following components (i) Crest wall (ii) stream regulator (iii) canal regulater.

* Inlet and Outlet :-

→ when irrigation canal meets a small stream or drain at same level, drain is allowed to enter the canal as in inlet. At some distance from this inlet point, a part of water is allowed to drain as outlet which eventually meets the orginal stream. stone pitching is required at the inlet and outlet. The bed and banks between inlet and outlet are also protected by stone pitching this type of CDW is called inlet and outlet.

Q2

Part = a

Ans 5. - **Weir :-**

An impervious barrier which is constructed across a river to raise the water level on the up stream side is known as weir. Here the water level is raised up to the required height and the surplus water is allowed to flow over the weir. Generally it is constructed across a inundation river.

Barrage :-

When adjustable gates are installed over a weir to maintain the water surface at different levels at different times then it is known as barrage. The water level is adjusted by operating the adjustable gates or shutters. The gates are placed at different tiers and these are operated by cables from the cabin. The gates are supported on the piers at both ends. The distance b/w pier to pier is know as (Fig 1.5).

Q2 Part b :-

Ans: **Reynold's Number :-**

Reynold's number is the ratio of inertial forces to viscous forces. The Reynolds number is a dimensionless number used to categorize the fluid systems important in controlling the velocities or flow pattern of a fluid.

Mathematically :

$$N_{Re} = \frac{\rho v d}{\mu}$$

Laminar :- The flow in a pipe is laminar if the reynolds number is less than 2100.

Turbulant :- If the reynolds Number is greater than 4000 than it is Turbulant.

Neither laminar nor turbulant flow :- when the Reynolds number is between 2000 and 2800, the flow is neither Laminar nor turbulant.

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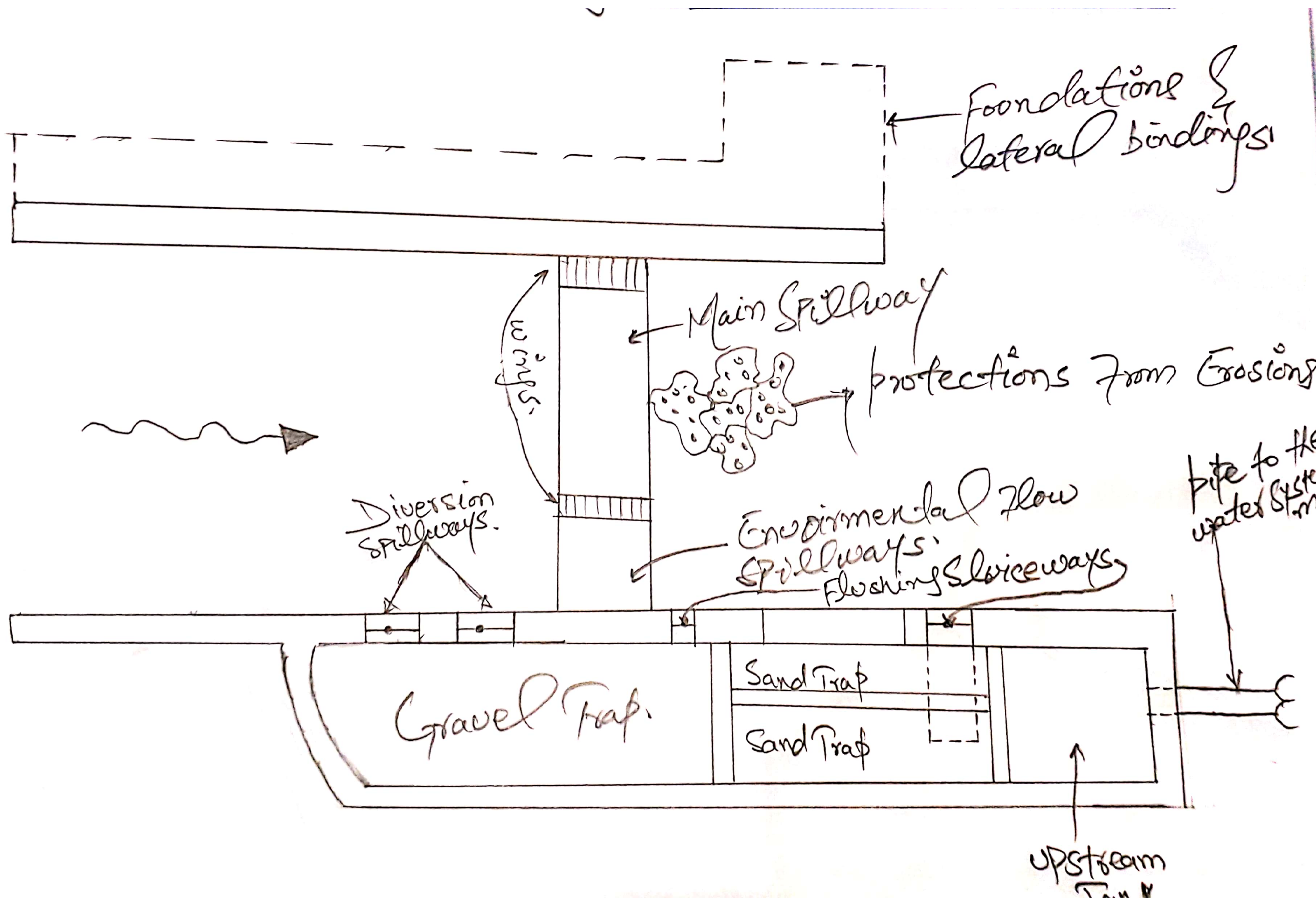
Lower Critical velocity :- The velocity at which flow changes from laminar to transition is called Lower Critical velocity.

Higher Critical velocity :- The velocity at which flow changes from transition to turbulent is called Higher Critical velocity.


Foundations & lateral bindings.
Main Spillway
protections from Erosions
Wings.
Diversion spillways.
Environmental flow spillways.
Flushing Sluiceways.
Pipe to the water system
Gravel Trap.
Sand Trap
Sand Trap
Upstream

Q3

PART B

Scour depth under the bridge:-

1.) the contracted width (i.e the bridge length, L) is less than regime width, W (equation (9.9)), the normal scour depth, D_N under the bridge is given by

$$D_N = R_s (W/L)^{0.61}$$

where R_s is the regime scour depth (equation (9.10))

The maximum scour depth in a single-span bridge (no piers) with a straight approach (case 1) is about 25% more than the normal scour given by equation (10.18), whereas in the case of a multispan structure with a curved approach reach (case 2) it is 100% more than the normal scour. if the constriction is predominant, the maximum scour depth is the maximum of case 1 or case 2, or the value given by

$$D_{max} = R_s (W/L)^{1.56}.$$

Q4

Given data :-

Inside dimension = 15 ft × 15 ft

Live load = 1.5 K/ft^2 = 1500 lb/ft^2

Dead load = 300 lb/ft^2

Unit weight of soil = 100 lb/ft^3

Angle of repose = 30°

Use Concrete of 1:2:4 ratio

fy = 60 ksi

Thickness = 0.92 m = 3 ft

Required data :-

Design a box calvert = ?

Solution :- (1) :- load Calculation :-

Total load carry on top slab =

= self weight of slab + L.L + D.L

self weight of slab = 3 × 150

= 450 lb/ft^2

w = 450 + 1500 + 300 = 2250 lb/ft^2

2. Co-efficient of Earth pressure :-

$$Ka = \frac{1 - \sin \phi}{1 + \sin \phi}$$

$$Ka = \frac{1 - \sin(30)}{1 + \sin(30)}$$

$$Ka = 0.33$$

3) lateral Pressure due to (D.L + L.L)

= Total vertical load (L.L + D.L) × Ka

= (1500 + 300) × 0.33

= 594 lb/ft^2

4) lateral pressure due to soil :-

= Ka × γh

= 0.33 × 100 × 18

= 594 lb/ft^2

5) lateral pressure :-

(a) Top :

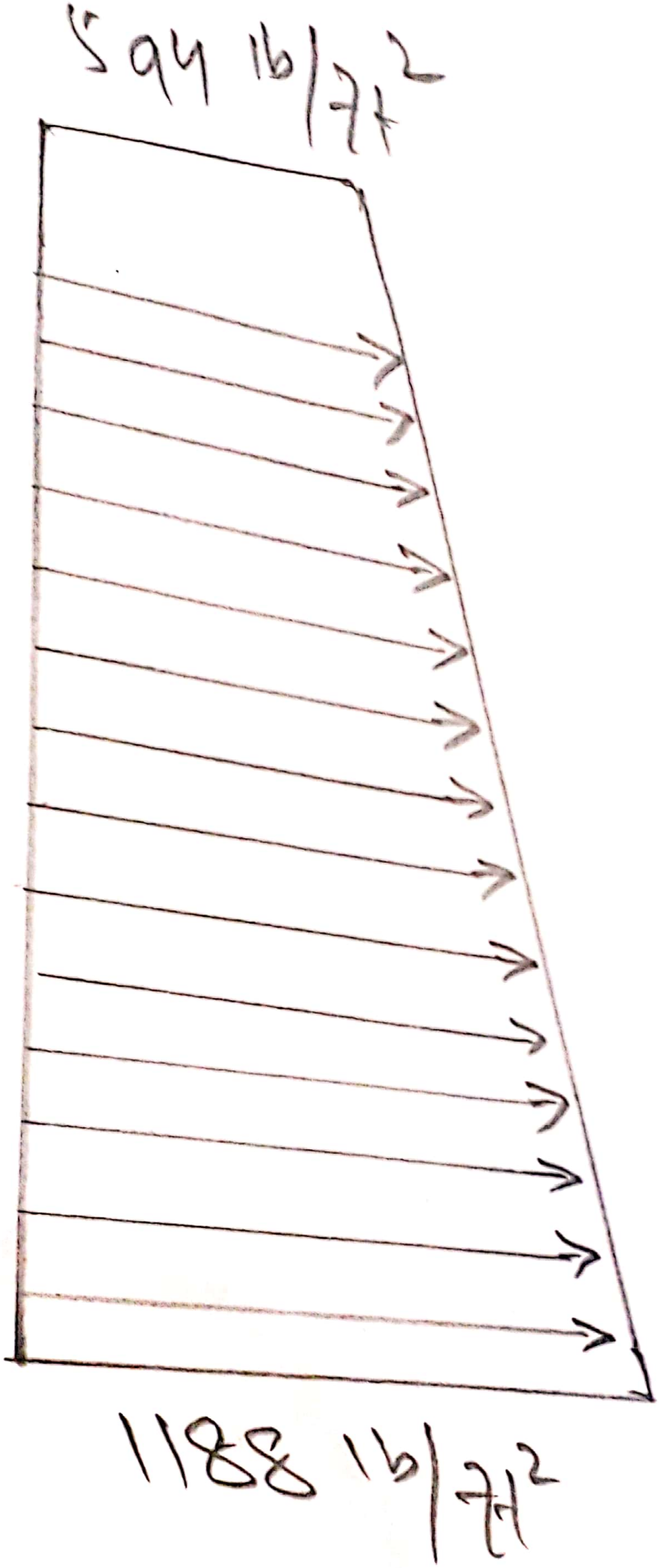
= lateral pressure due to (D.L + L.L)

= 594 lb/ft^2

(b) Bottom :- = lateral pressure due to (D.L + L.L) + lateral pressure due to soil

= 594 + 594

= 1188 lb/ft^2.


594 lb/ft²
1188 lb/ft²