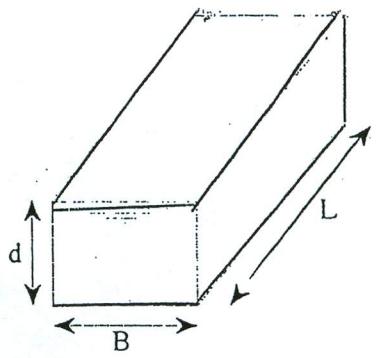
Primary Sedimentation Tank

Purpose

- Removal of 40 → 60% of suspended solids.
- Removal of 25 → 35% of organic matter.

Design Criteria:

- Retention time (R.T) = (2 → 4) hr.
- Q_{design} (Q_{des}) $= Q_{max}$
  $= 1.5\ Q_{avg.}$
- Volume (capacity) $= Q_{des.} \times R.T$
  $= n \times B \times L \times d.$
- n (number of tanks) ≥ 2
- d (depth of water) = (2 → 6) m.
- B (width) = (2 → 3) d.
- L (length) = (3 → 5) B ⊁ 50 m.



- Surface loading rate (S.L.R) or Over flow rate (O.F.R). $m^3/m^2/d.$

$$S.L.R = \frac{Q}{S.A} = \frac{Q}{n\,B\,L}$$

$(30 \rightarrow 45\ m^3/m^2/d)$

* في حالة حوض الترسيب المستطيل

- Hydraulic load on outlet weir $m^3/m/d.$

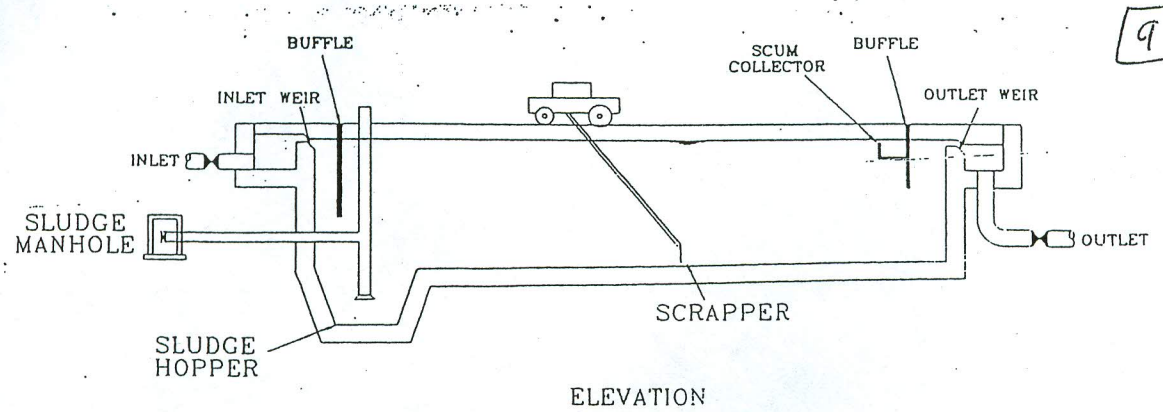
$$\text{Hyd. load} = \frac{Q}{n \times L_w}$$

حيث L_w: طول هدار الخروج

$(150 \rightarrow 600\ m^3/m/d)$

- Horizontal velocity (V_{Hz}) m/min

$$V_{Hz} = \frac{Q}{n\,B\,d} \quad \not< 0.3\ m/min.$$



ELEVATION

Example:

Design primary sedimentation tank for W.W.T.P. of hourly flow 3000 m^3.

Compute the S.S. and the BOD at the effluent of the tank, If the influent:

- S.S (suspended solids) = 400 ppm
- BOD = 300 ppm

Solution:

$Q_{des} = 3000\ m^3/hr.$

Assume R.T= 3 hrs.

$\therefore$ Capacity $= Q_{des} \times R.T$

$= 3000\ m^3/hr \times 3\ hrs.$

$= 9000\ m^3$

assume S.L.R $= 35\ m^3/m^2/d$

$$\therefore S.A = \frac{Q}{S.L.R} = \frac{3000\ m^3/hr \times 24}{35\ m^3/m^2/d} = 2057\ m^2$$

$$Depth = \frac{Capacity}{Area} = \frac{9000}{2057} = 4.37\ m$$

$B = (2 \rightarrow 3)\ d = (2 \rightarrow 3)\ 4.37 \simeq 12\ m.$

$L = (3 \rightarrow 5)\ B = (3 \rightarrow 5)\ 10 \simeq 50\ m.$

To get (n):

$$n = \frac{S.A_{total}}{S.A_{onetank}} = \frac{2057}{12 \times 48} = 3.6 \simeq 4$$

$$L_{act} = \frac{S.A_{total}}{n \times B} = \frac{2057}{4 \times 12} = 42.85 \simeq 42.90 \text{ m.}$$

Checks:

- $S.L.R = \frac{Q}{S.A} = \frac{Q}{n\,B\,L} = \frac{3000 \times 24}{4 \times 12 \times 42.9} = 34.9 \text{ m}^3/\text{m}^2/\text{d}$

  $(30 \rightarrow 45) \text{ m}^3/\text{m}^2/\text{d}$ safe

- $V_{Hz} = \frac{Q}{n\,B\,d} = \frac{3000 \ / \ 60}{4 \times 12 \times 4.37} = 0.24 \text{ m/min.}$

  $\nvdash$ 0.3 m/min. safe

- $\text{Hydraulic load} = \frac{Q}{n \times B}$

  $= \frac{3000}{4 \times 12} \times 24$

  $= 1500 \text{ m}^3/\text{m}`/\text{d}$

  $(300 \rightarrow 600) \text{ m}^3/\text{m}`/\text{d}$ Unsafe

ملحوظة: لا نقوم بإعادة التصميم ولكن نقوم بحساب طول جديد لهدار الخروج.

Assume Max. Hydraulic load = 600 $\text{m}^3/\text{m}`/\text{d}$.

$$\text{Hyd. load} = \frac{Q}{n \text{ (weir length)}}$$

$$\therefore \text{New weir length} = \frac{Q}{\text{hyd. load} \times n}$$

$$= \frac{3000 \times 24}{600 \times 4}$$

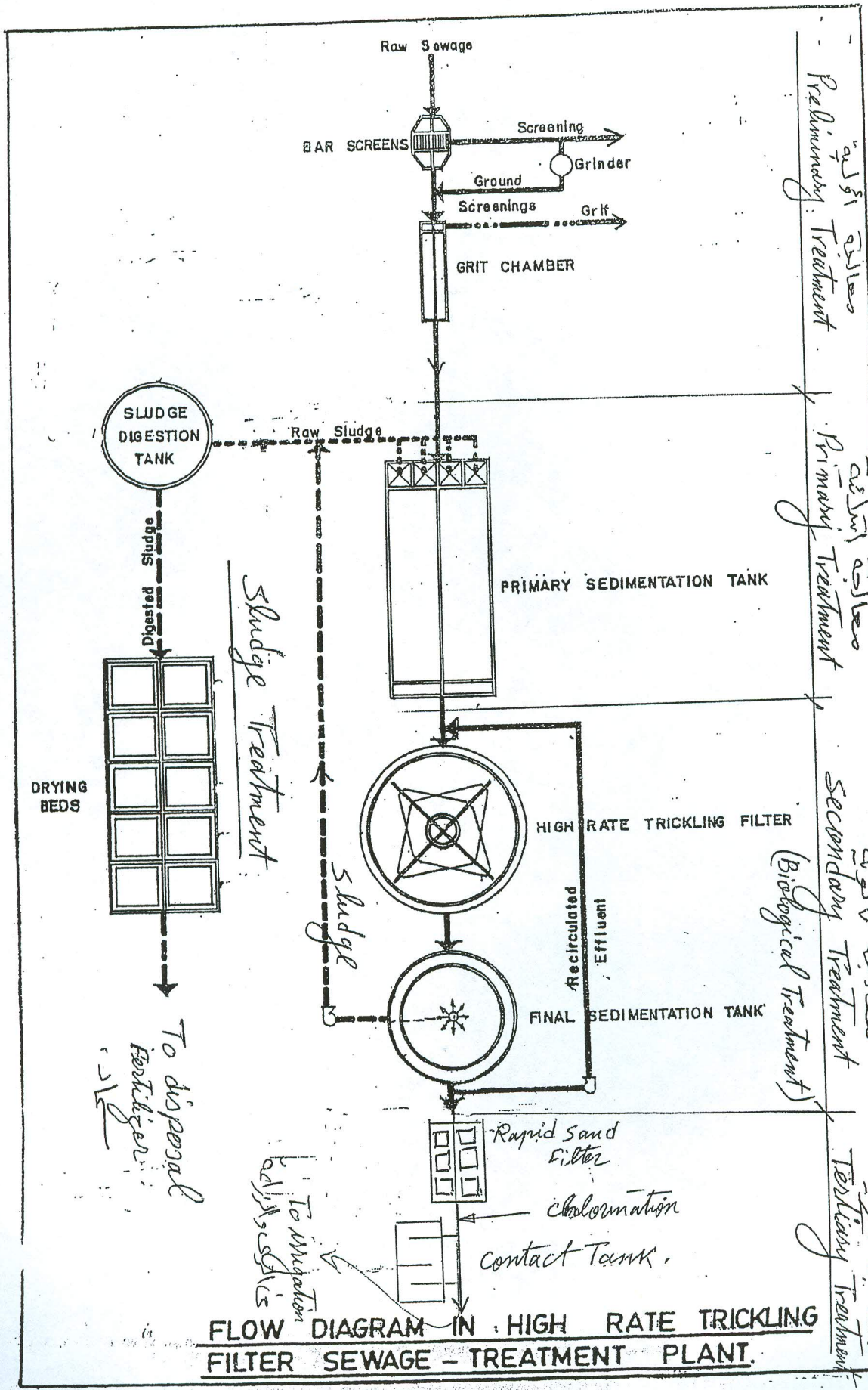
$$= 30 \text{ m.}$$

نى أننا ... اج أن تهدر المياه المنقاة على طول 30 م في كل حوض ويتم ذلك عن طريق إضافة هدارات جديدة.

Assume primary sedimentation tank removes (40 → 60%) 60% of suspended solids & (25 → 35%) 30% of organic matter.

$\therefore$ S.S. of the **effluent** $= 400 \times (1 - 0.60) = 160$ ppm

BOD of the **effluent** $= 300 \times (1 - 0.30) = 210$ ppm



FLOW DIAGRAM IN HIGH RATE TRICKLING FILTER SEWAGE – TREATMENT PLANT.