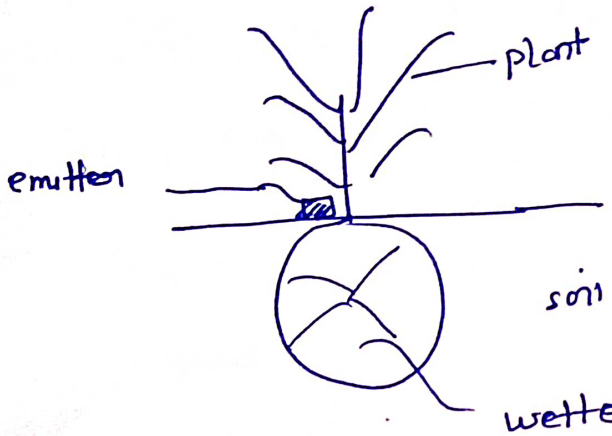
Drip Irrigation

→ An efficient irrigation system in which the water is applied directly to root of plants.



Name → Drip / Trickle irrigation / micro irrigation.

Advantages → High crop yield ↑ (20-50%) more
→ suitable for fruit crops
→ quality of crops yield ↑
→ Minimum crop loss
→ high saving of irrigation water (less evaporation)
20-50% more as compared to others.
→ fertilizers and chemicals (effluent system)
→ low energy Requirements.
→ low labour cost.
→ control disease of crops.
→ Can be used in slopply land
→ " " in problematic soils

Disadvantages

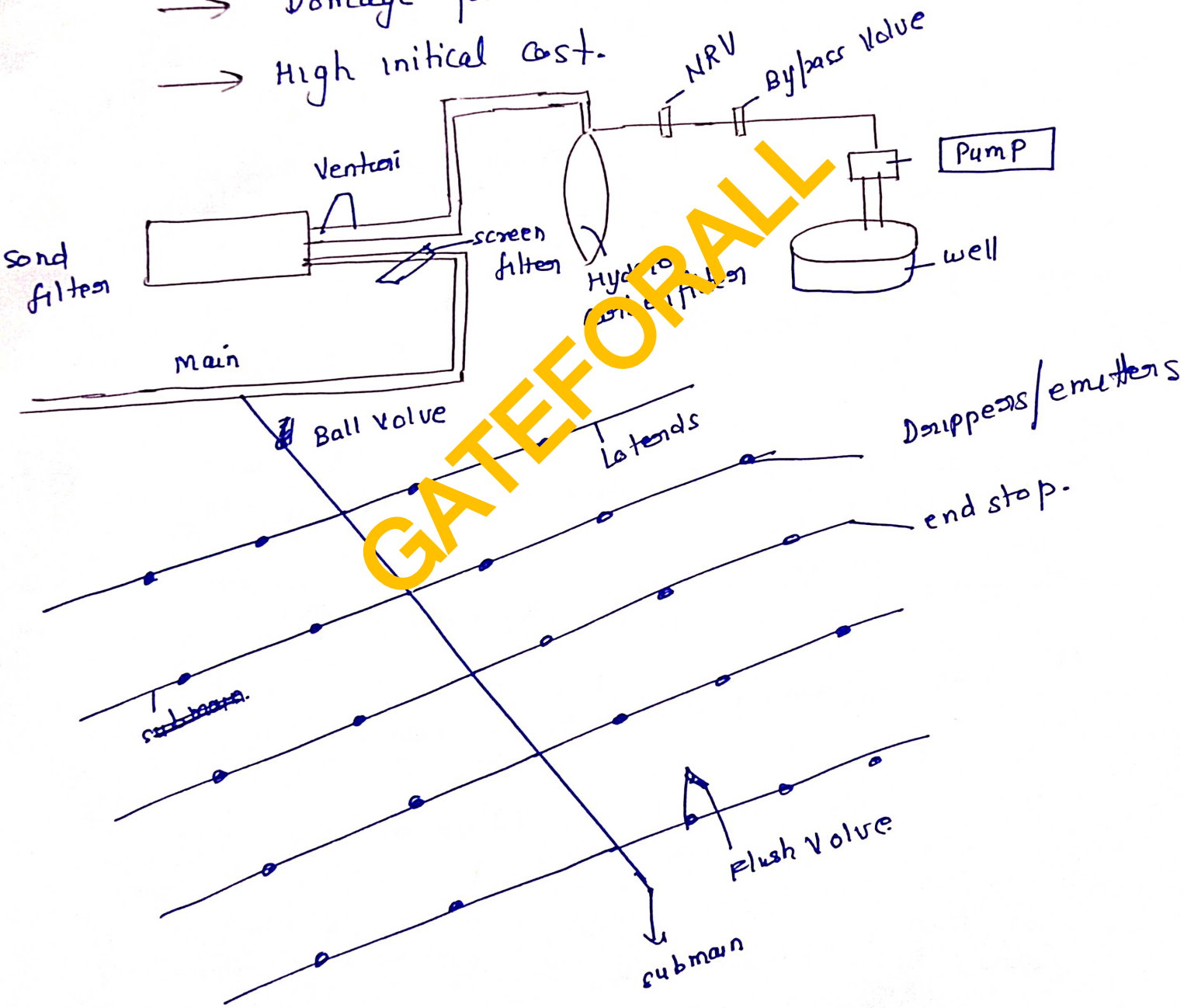
→ clogging of emitters

→ Root developement is partial (Restricted)

→ salt accumulation in root zone.

→ Damage from animals

→ High initial cost.



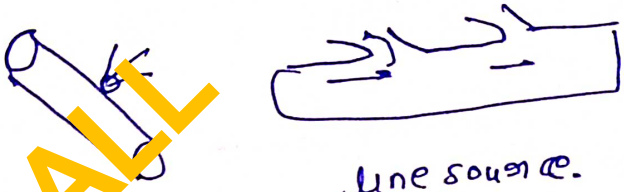
Components –

→ Drippers → installed in Lateral.
(Based on source)

$q = k P^{x}$
(lph) (kPa)

- Point source
  - → Long path ($x=1$)
  - → orifice ($x=0.5$)
  - → Pressure ($x=0$) Compensating
- Line source
  - Pipe and tube

Point source



Line source.

→ Main lines → Transport water from Pump to submain

→ submain → supply water from main to laterals

main and submain
- PVC and HPPE
- Main – 65 mm dia (4–10 kg/cm²)

→ Laterals → on which emitters/drippers are installed.
- → LLDE, PVC
- → P = 2.5 kg/cm².

→ Pipelines/ fittings.

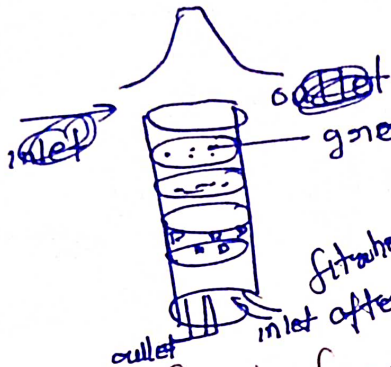
→ Valves
- Air release Valve
- Pressure relief Valve (PRV)
- Non Return Valve (NRV)
- flow Control valve)

→ Filteration system.

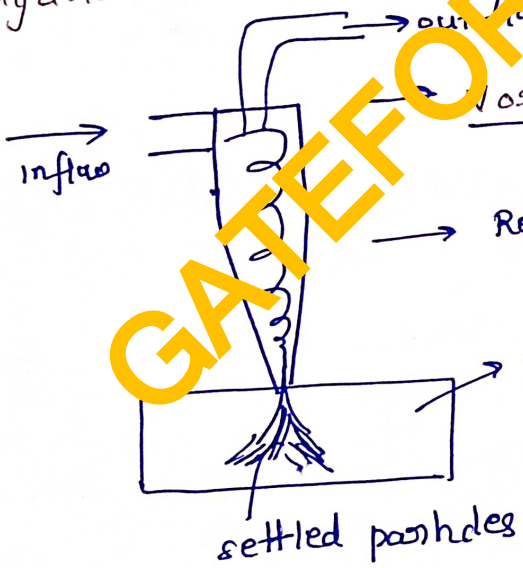
Filteration system

to prevent [clogging] of drippers (due to dirt and large particles], filteration system is [provided].

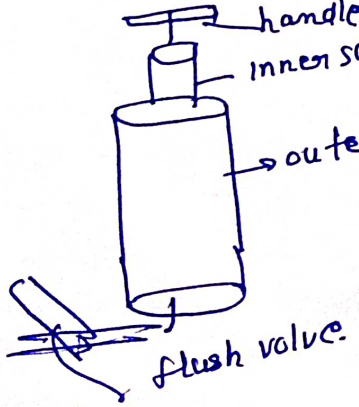
Filters → (a) Disc filter → Algae and organic matter
→ extreme fine particles



(b) Hydro carbon (centrifugal sand seperators)



(c) Screen filters → [fine sand and dust]



→ strainer (screen)
↳ stainless steel, nylon.
→ standard size = 100 microns
→ cleaning → Turbo cleaning
Flushing

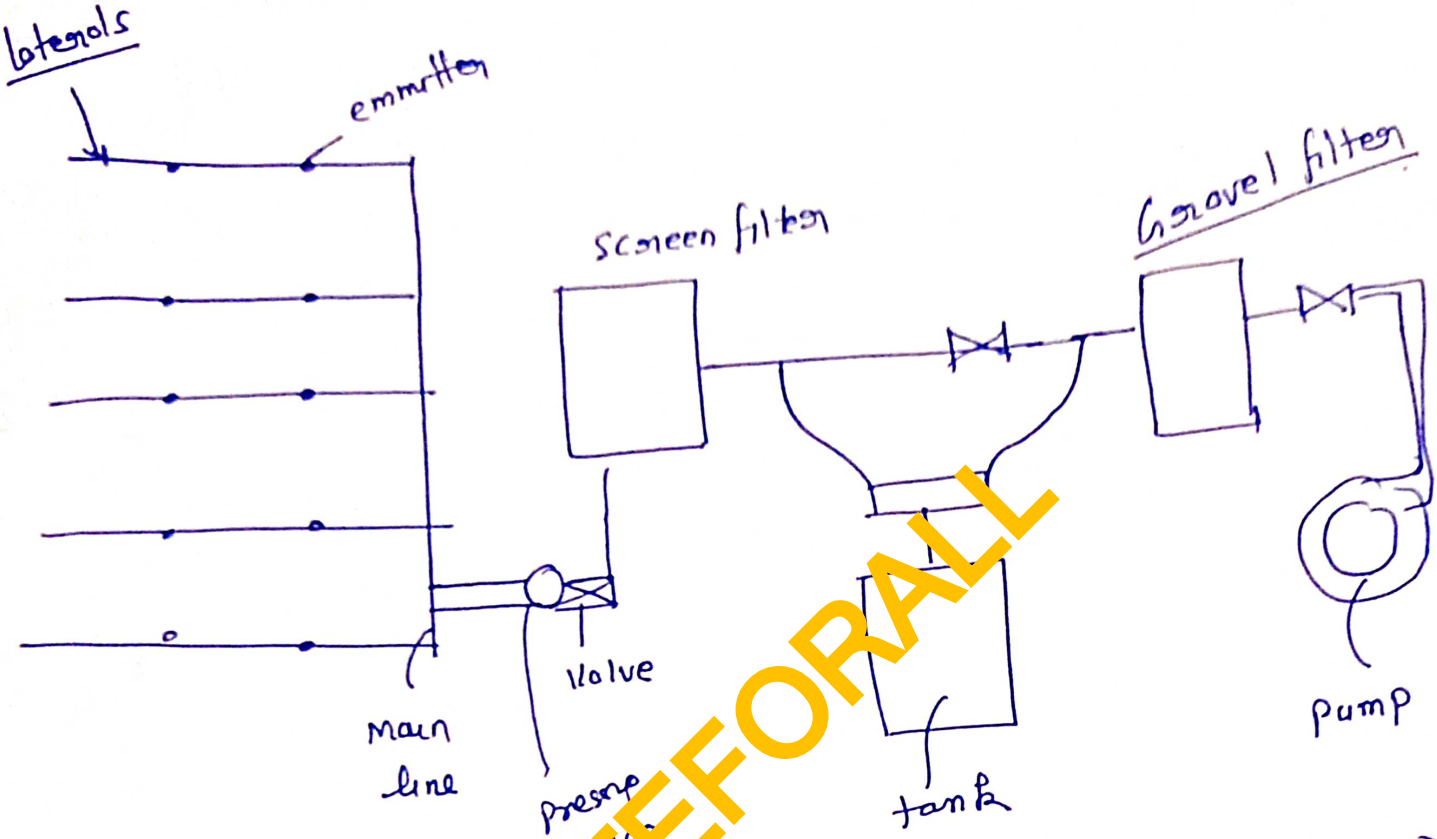
Gravel sand / media filter →

Primary filteration / low cost sand filters

do not remove very fine

setting basin → Pond / Reservoir / stream.
(not preferred in drip irrigation.

Drip irrigation with fertilizer



Methods → Fertilizer application with volute pump (suction)

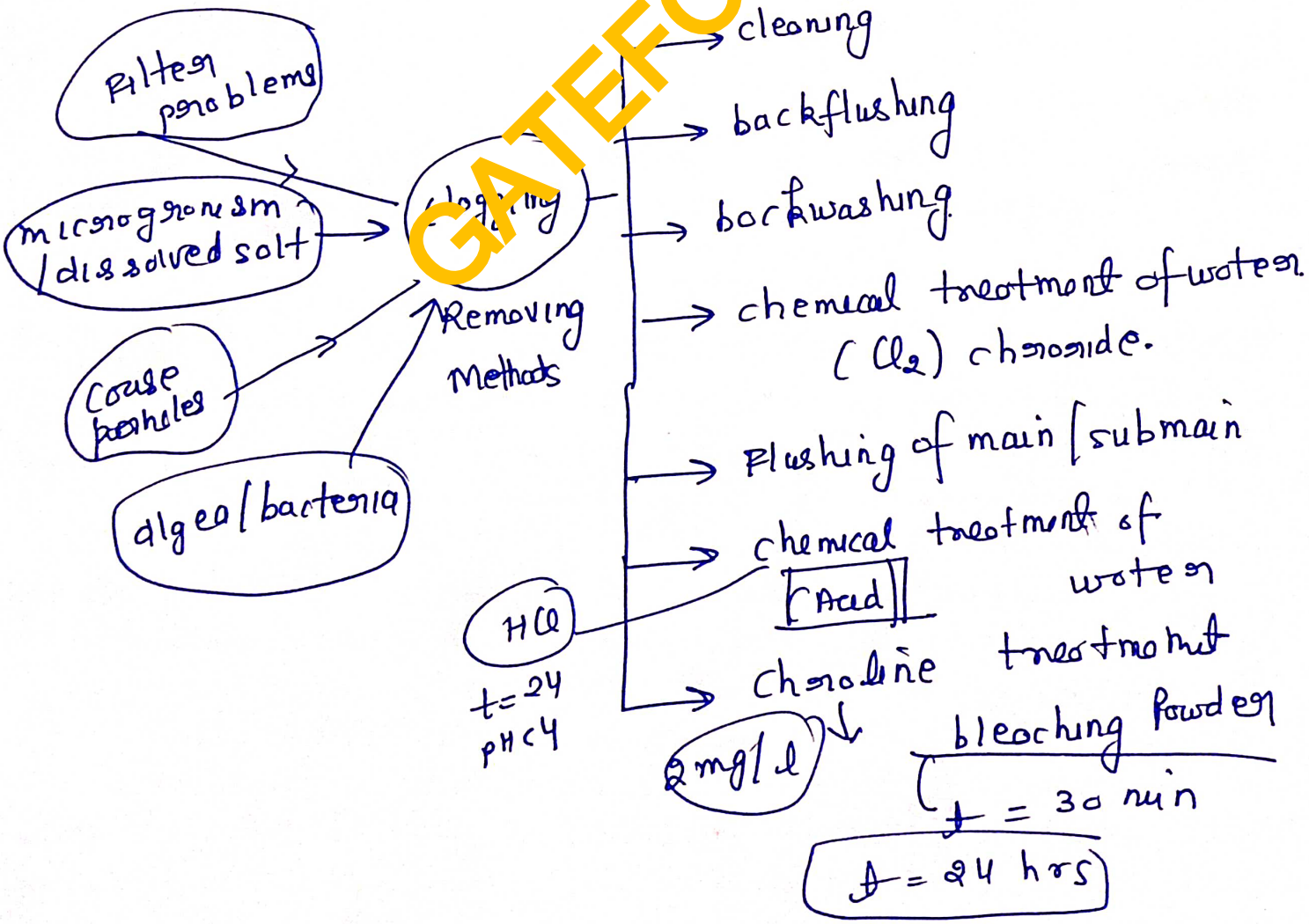
Fertilizer injection pump system

Fertilizer pressure difference

Venturi type.

clogging Problem

① Gravel / sand media filters	backwashing and cleaning (Flushes clean water through a filter in reverse direction)
② screen filters	Turbo clean
③ Hydro cyclones / Centrifugal sand seperators	
④ Disc filters	back flushing

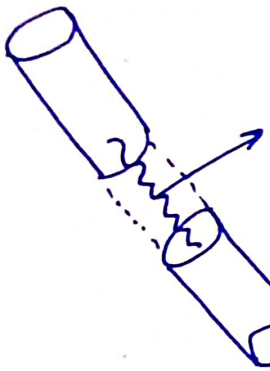


Drip system

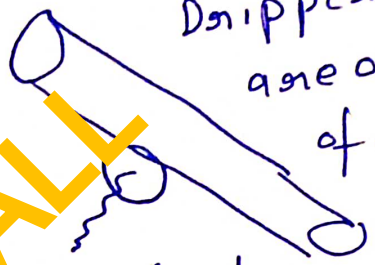
In-line

In-line Drip system
(Emitting pipe)

On-line drip system



Drippers are inside the lateral



Drippers are outside of lateral.

externally fixed

→ Drip spacing can not be changed.

→ orchard [Groundnut crop]

Drip spacing can be changed anytime according to requirement

Horticultural crop (Mango, orange)

Design of Drip Irrigation system

① → Inventory of Resources

② emitter selections

a) $EU = 100\left[1 - \frac{1.27\,CV}{\sqrt{N}}\right]\frac{q_{min}}{q_{avg}}$ → min discharge

(avg discharge)

EU > 90 %

point source = (85-95) %.

line source = (75-90) %.

b) $CV = \frac{\sigma}{\mu} \times 100$ (σ: deviation in discharge; μ: Avg discharge)

=

point: < 0.05 excellent

line source: < 0.10 good

Pressure Vs discharge

③ $q = kp^{x}$

x = 0 (Pressure Compensating) (exponent)

x = 0.5 [orifice and turbulent].

x = 1 [long path and laminar]

④ Irrigation water Requirement

$V_m = A \times E_p \times k_c \times k_p \times C_c$

(k_c: crop coff; k_p: pan evap; C_c: canopy; E_p: monthly evaporation.)

$V_{daily} = \frac{V_m}{T}$

⑤ find Q (Capacity of drip irrigation)

$$Q = \frac{Vd}{t \times Ea}$$

Vd → Volume

Ea → application efficiency

C

time (hrs per day)

⑥ Number of laterals

crop	Number of lateral
vegetable	1/crop
orchard	(1-2)/crop

⑦ Number of drippers / emitters spacing

$$= \frac{\text{Area per tree} \; (\text{spacing b/w tree} \times \text{spacing b/w laterals}) \times (\% \text{ wetted area})}{\text{q single drip}}$$

$$A_{\text{wetting drip}} = FD_{\text{diameter}} \times d_{\text{root}}$$

Correction factor = 0.8 for line emitters.

Lateral design

⑧

$$H_f = \frac{K L Q^{1.75}}{D^{4.75}}$$

L → length (m)

Q → lit/sec

D → (mm)

H_f → friction loss (m)

$K = 7.89 \times 10^5$

pressure variation = 10%

$$\Delta h = 2.5 (h_{avg} - h_{min})$$

Δh → pressure variation

(9) Size of Pumping unit

(P) $hp = \frac{Q \times H}{75 \times \eta_p \times \eta_m}$

Q — lit/sec

H — Total Head loss.

η_p — pump eff

η_m — motor eff

$H_{total} = H_l \times \eta_l + H_{submain} + H_{main} + H_{fittings} +$

$H_s +$ oper ob