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# STUDY ON WATER SCARCITY AND DESIGN OF WATER TREATMENT PLANT FOR VEEYAPURAM PANCHAYAT

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**Abstract -** Water sources both in surface and ground levels are depleted day by day due to human and natural activities. So, it is needed to preserve and recycle waste water for the future generation of the world to avoid such conflicts related to water. This project involves the study and designing of a water treatment plant for a Panchayat called 'Veeyapuram', near Haripad. The water from the nearby rivers in the locality is collected and tested for their physical, chemical and biological properties. Population forecast is done by using the census of the recent year and also the water demand is calculated based on the census data. By knowing the population and quantity of water required in that locality, suitable treatment plant can be designed. The reclaimed water is to be used for domestic and other purposes. Even though more than two rivers cross over veeyapuram panchayat people in that village are facing water scarcity problem. It is because of this we have chosen Veeyapuram Panchayat as our project area. So, the treatment of water and a treatment plant is to be designed for solving the water scarcity issue.

**Keywords:** Population forecasting, Treatment Plant, Water Demand, Rivers

## 1. INTRODUCTION

Water is one of the most important requirements for the existence of human life. It is available in various forms such as rivers, lakes, streams etc. The importance of water in human life is so much that the development of any city of the world has practically near some source of water supply. The availability of a reliable and clean supply of water is one of the most determinants of our health. Water is the principal raw material for food production and for many uses outside and inside in a home. The shortage of water will lead to the decline of farm production.

The urban population would be around four hundred million by that time. This means a very large demand on the civic amenities including water supply for domestic purposes and in addition more water would be needed for purposes such as irrigation, industry etc. which have to keep space with the increasing demands of rising population. Therefore, identification of sources of water supply, their conservation and optimal utilization is of at most importance.

### 1.1 AIM

To study water scarcity in Veeyapuram panchayat and to design a water treatment plant for implementing a water supply scheme in this area.

### 1.2 OBJECTIVES

- To collect water samples from selected rivers in Veeyapuram panchayat and To check the physical, chemical properties of water samples collected to check which treatment has to be adopted.
- To obtain the present population from census data to calculate the population forecasting To calculate the water demand. to design a water treatment plant as a permanent solution for water scarcity problem.

### 1.3 SCOPE OF STUDY

- An effort to reduce the water scarcity over a rural area.
- Due to dissolved minerals, water is not suitable for domestic purpose.

## 2. METHODOLOGY

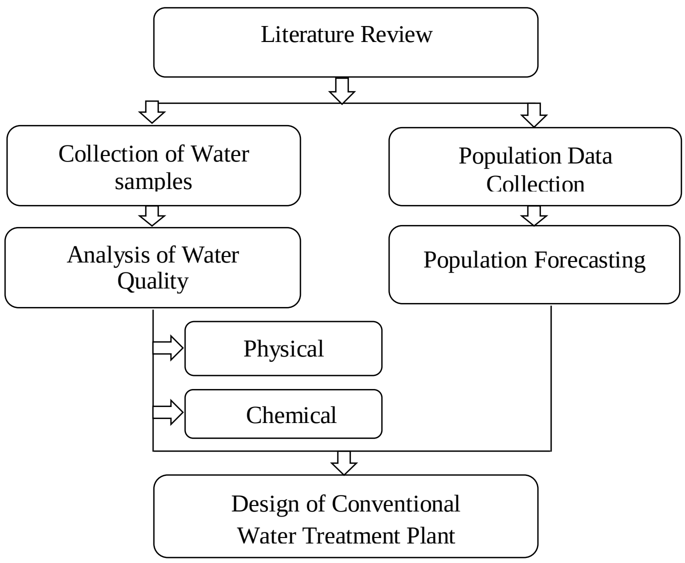


**Fig 1: Flow chart of methodology**

## 5. SAMPLE COLLECTION

Water samples are collected from various sources in Veeyapuram panchayath such as Achancovil river and Pamba river. These samples are tested in laboratory for determining various characteristics

### 5.1 TEST CONDUCTED

**(1) Determination of pH**

- Stir the water sample vigorously using a clean glass stirring rod.
- Pour a 40 mL ± 5 mL sample into the glass beaker using the watch glass for a cover.
- Let the sample stand for a minimum of one hour to allow the temperature to stabilize, stirring it occasionally while waiting. Measure the temperature of the sample and adjust the temperature controller of the pH meter to that of the sample temperature. This adjustment should be done just prior to testing.
- Standardize the pH meter by means of the standard solutions provided. Temperature and adjustments must be performed as stated under
- Immerse the electrode(s) of the pH meter into the water sample and turn the beaker slightly to obtain good contact between the water and the electrode(s).
- The electrode(s) require immersion 30 seconds or longer in the sample before reading to allow the meter to stabilize.
- Read and record the pH value to the nearest tenth of a whole number. If the hundredth place digit is less than 5, leave the tenth place digit as is. If it is greater than 5, round the tenth place digit up one unit. If the hundredth place digit equals 5, round the tenth place digit to the nearest even number.

**(2) Determination of Turbidity**

- Switch on the instrument and keep it on for some time
- Select appropriate range depending upon the expected turbidity of the sample.
- Set zero of the instrument with turbidity free water using a blank solution and adjust 000 with
- set zero knob
- Now in another test tube take standard suspension just prepared as above for 0-200 NTU solution as standard.5. Take its measurements and set the the display to the value of the standard suspension with the caliberate knob
- To determine the turbidity of water sample and note the displayed reading.if water has high turbidity it can be suitably diluted and must be shaken before determination.

**(3) Determination of Hardness**

- Take 20 ml well mixed sample in conical flask
- Add I to 2 ml buffer solution so as to bring the pH to 10.
- Add 2 drops Eriochrome black T indicator solution. The solution turns wine red in colour
- Titrate against standard EDTA till wine red colour just turns blue. Note down the volume (Vi)

**(4) Determination of Chlorides**

- Silver nitrate reacts with chloride to form very slightly soluble white precipitate of AgCl2 at the end point when
- All the chloride get precipitated, free silver ions react with chromate to form silver chromate of reddish brown color.

### 5.2 POPULATION DETAILS

Population details are obtained from previous senses data's and from panchayath records and it is shown in table no: 5.1

**Table-1: Population Details**

| PLACE | 1991 | 2001 | 2011 |
|---|---|---|---|
| Veeyapuram | 12503 | 12003 | 11392 |
| Cheruthana (Ward 2,3,4,5,11) | 5418 | 5378 | 5348 |
| Edathva (Ward 10,11, 12, 14) | 2899 | 2599 | 2349 |
| Thalavadi (Ward 12,13,14) | 4634 | 4429 | 4179 |
| Total | 25454 | 24409 | 23268 |

## 6. RESULT ANALYSIS

Achancovil river some characteristics such as, hardness and chloride content is above the permissible limit. So it is not suitable for drinking purposes. Pamba the hardness is above the permissible limit. So treatment should be required

**Table-2: Report on Analysis of Water from Pamba River And Achancovil River**

| Sl no. | Characteristics | Unit | Desirable limitsas per IS10500:2012 | Permissible limits | Actual contents Sampling points 1 | 2 |
|---|---|---|---|---|---|---|
| 1 | Turbidity (NTU) | NTU | 1 | 5 | 5.38 | 17.04 |
| 2 | pH | | 6.5-8.5 | No relaxation | 6.28 | 6.72 |
| 3 | Total hardness as(CaCO3) | mg/l | 200 | 600 | 670 | 630 |
| 4 | Chloride (Cl) | mg/l | 250 | 1000 | 900 | 2900 |

Sampling points

1. Pamba river water
2. Achancovil River water

### 6.1 POPULATION FORECASTING

Table 5.1 shows that the amount of population decreases year by year. So we select the logistic curve method for population forecasting. We designing the treatment plant for next 30 years and construction period is assumed as 3-4 years.

### Logistic Curve Method

Let P be the population at any time t.It is observed that the amount of population decreases year by year.So we select the logistic curve method and. We designing the treatment plant for next 30 years and construction period is assumed as 3-4 years

The formula for logistic curve method is given by,

$$P = \frac{Ps}{1 + mloge - 1(nt)} \quad \text{... [Eqn1]}$$

$$Ps = \frac{2P0P1P2 - P12(P0 + P2)}{(P0P2 - P12)}$$

where, $m = \frac{(Ps - P0)}{P0}$

$$n = \frac{(2.3)}{(t1)} \times log10 \times \frac{[P0(Ps - P1)]}{[P1(Ps - P0)]}$$

**Table-3: Population Forecasting by Logistic Curve Method**

| | | | |
|---|---|---|---|
| P0 = 25454, t0 = 0 | P1=24409, t1 =1 0 | P2 = 23268, t2 = 20 | $P_s$ = 32641 |
| m = 0.28, | n = 0.0177 | | $P_{2028}$ = 22112<br>$P_{2038}$ = 20812<br>$P_{2048}$ = 19447 |

Ps = Saturation Population
P0 = Total Population in 1998
P1 = Total Population in 2008
P2 = Total Population in 2018
m, n = Constants

### 6.2 WATER DEMAND CALCULATION

Water required in litre per head per day = 135L
Water required for 19447 people per day = 19447 x 135
= 2.4ML/day
Fire demand = 15%
= (15/100) x 2.4ML/day
= 0.36ML/day
Non-revenue water = 20%
= (20/100) x 2.4
= 0.48ML/day
Total water demand = 3.24ML/day
Say total water demand = 3.5ML/day
Assume plant working hours = 16 hours
Plant capacity = 3.5 x (24/16)
= 5.25ML/day
Say = 5.5ML/day

## 7. TREATMENT METHODS

The aim of water treatment is to produce and maintain water that is hygienically safe, aesthetically attractive and palatable, in an economical manner.

### 7.1 AERATION

Aeration is necessary to promote the exchange of gases between the water and the atmosphere.

In water treatment, aeration is practiced for three purposes:

- To add oxygen to water for imparting freshness e.g. water from underground sources evoid of or deficient in oxygen.
- Expulsion of carbon dioxide, hydrogen sulphide and other volatile substances causing taste and odour e.g. water from deeper layers of an impounding reservoir.
- To precipitate impurities like iron and manganese in certain forms e.g. water from some underground sources.

### 7.2 COAGULATION AND FLOCCULATION

The terms coagulation and flocculation are often used indiscriminately to describe the process of removal of turbidity caused by fine suspensions, colloids and organic color. Coagulation describes the effect produced by the addition of a chemical to a colloidal dispersion, resulting in particle destabilization. Operationally, this is achieved by the addition of appropriate chemical and rapid intense mixing for obtaining uniform dispersion of the chemical. Flocculation is the second stage of the formation of settleable particles or flocs from destabilized colloidal sized particles and is achieved by gentle and prolonged mixing. In modern terminology, this combination of mixing(rapid) and stirring or agitation that produces aggregation of particles is designated by the single term flocculation .It is a common practice to provide an initial rapid or flash mixing for dispersal of the coagulant or other chemicals into the water followed by slow mixing where growth of flocs takes place.

### 7.3 RAPID MIXING

Rapid mixing is an operation by which the coagulant is rapidly and uniformly dispersed throughout the volume of water, to create a more or less homogeneous single or multiphase system. This helps in the formation of microflocs and results in proper utilization of chemical coagulant preventing localization of concentration and formation of hydroxides which leads to less effective utilization of the coagulant. The chemical coagulant is normally introduced at some points of high turbulence in the water

### 7.4 FILTRATION

Filtration is a process for separating suspended and colloidal impurities from water by passage through a porous medium or porous media. Filtration, with or without pretreatment, has been employed for treatment of water to effectively remove turbidity (e.g: silt and clay), color, microorganisms, precipitated hardness from chemically softened waters and precipitated iron and manganese from aerated waters. Removal of turbidity is essential not only from the requirement of aesthetic acceptability but also for efficient disinfection which is difficult in the presence of suspended and colloidal impurities that serve as hideouts for the microorganisms.

Filters can be classified according to:

- The direction of flow
- Types of filter media and beds
- The driving force
- The method of flow rate control
- The filtration rate.

### 7.5 DISINFECTION

Water treatment processes such as storage, coagulation, flocculation, sedimentation, filtration, aeration and water softening are specifically designed to produce waters that are aesthetically acceptable and economical to use. Though these physic – chemical processes assist in removal or killing of microorganism to varying degree, these cannot be relied upon to provide safe water. For utmost safety of water for drinking purposes, disinfection has to be done for killing of disease producing organisms. Bacteria, viruses and amoebic cysts constitute the three main types of human enteric pathogens and effective disinfection is aimed at destruction or inactivation of these and other pathogens such as helminths are responsible for water - borne diseases. The need for disinfection in ensuring protection against transmission of water – borne diseases cannot be overemphasized and its inclusion as one of the water treatment processes is considered necessary.

## 8. DESIGN OF WATER TREATMENT PLANT

From the data's collected such as amount of population, population forecasting and water demand calculation we obtain the output capacity of plant is 5.5MLD.

Output capacity = 5.5Mld
= 229.17 m3/hr
Wastage and loss = 2% of filtered water
Time lost during backwashing
= 25 minutes
= .42 hrs
Time available for filtration
= 23.58 hrs
Design capacity (Dc) = Output capacity x (1+Wastage)x (24/Available time) [Eqn2]
= 5.71 MLD
= 237.98 m3/hr
Say = 238 m3/hr

### 8.1 DESIGN OF CASCADE AERATOR

Out of the different types of aerators, it was decided to provide cascade aerator, because it was found to be more efficient compared to others.

Area required = 0.015 to 0.045 m2/m3/hr
Adopt Area = 0.03 m2/m3/hr
Number of unit = 1 Diameter of shaft
Overload assumed = 20%
Design discharge, Qd = Dc + overload [Eqn3]
= 285.6 m3/hr
Say = 286 m3/hr
Velocity assumed (v) = 0.8 m/s
Diameter of shaft = ((4x Qd)/(3.14 x V))0.5 Eqn4]
= 0.36 m
Diameter of inflow pipe = 40 cm
Area required for bottom most tray, Ar = (Adopted area x Dc / No. of units)
= 7.14 m2
Area = Total area of bottom most tray – Cross sectional area of shaft
Ar = $3.14 X (Da^2 – Ds^2)/4$ Eqn5]
Da = Diameter of bottom most tray
Ds = Diameter of shaft
Diameter of bottom most tray, Da = $( (Ar x 4)/3.14)^{0.5}$
= 3.02 m
Adopting diameter of bottom most tray = 4 m
Area of bottom most tray = $3.14/4 x (4^2 – 0.36^2 )$
= $12.46 m^2$

Assume number of steps = 5

Size of tread =(Total diameter of bottom most tray– Diameter of shaft)/(2 x No.of steps)

= 0.36 m

Providing size of tread = 0.4 m

Assume rise of each step = 0.25 m

Total height of aerator = Number of steps x Rise of step

= 1.25 m

Bottom most tray = 4 m

Second tray = Diameter of bottom most tray – (2 x size of tread)

= 3.2 m

Third tray = 2.4 m

Fourth tray = 1.6 m

Fifth tray = 0.8 m

**(1) Collecting Launder**

It is for the collection of water from aerator and is provided in periphery.

Flow in launder, Ql = Dc x 1.2/2 [Eqn6]

= 142.8 $m^3$/hr

Velocity assumed = 1 m/s

Area required = (Ql/ V) = 0.1 $m^2$

Width assumed = 0.3 m

Height of water = (Area/Width) = .33 m

Free board = 30 cm

Depth of launder = 0.63 m

Collecting tray = Diameter of bottom most tray + (2 x width) [Eqn7]

= 4.6 m

Free fall in collecting launder = Rise of step, = 0.25 m

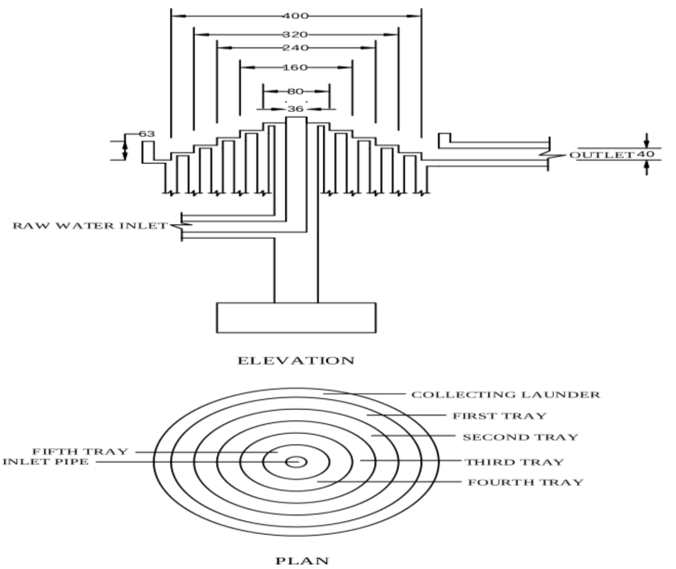


**Fig 2: The elevation and plan of cascade aerator.**

**(2) Design of Raw Water Channel**

It is the channel from aerator to flash mixer.

Quantity of flow = 238$m^3$/hr = 0.066$m^3$/s

Assume overload = 20%

Quantity of flow = 0.066 x 1.2

= 0.079$m^3$/s

Assume velocity = 1m/s

Area of raw water channel required,

A $= \frac{\text{Quantity of flow}}{\text{Velocity}}$ [Eqn8]

= 0.079$m^2$

Assume width of the channel = 0.8m

Water depth = 0.079/0.8 = 0.098m

Provide freeboard of 0.3m

So, Provide total depth = 0.098+0.3 = 0.398 ≈ **0.4m**

Length of the channel **= 10m**

**(3) Design of Measuring Weir**

Triangular weir or V notch is proposed with a channel of 5m length to give a steady and uniform flow over the weir

**8.2 DESIGN OF CLARIFLOCCULATOR**

A clariflocculator consists of an inlet pipe, flocculator unit, clarifier and collecting channel.

**(1) Inlet Pipe**

Channel for water from flash mixer to flocculator.

Flow = 238$m^3$/hr

Assume velocity = 0.5 m/s

Area of pipe = flow/velocity

= 0.066/0.5 = 0.132 $m^2$ = 0.066/0.5 = 0.132 $m^2$

Diameter $= \sqrt{\frac{0.132\times4}{\pi}}$ …[Eqn9]

= 0.409 m = 0.41 m

Assume height of central shaft = 5 m

**(2) Flocculator Unit**

It is a dewatering device, in which the colloids come out of suspension in the form of flocs.

Detention time (Dt) = 30 minutes

Number of units proposed = 2

Volume required = (flow x Dt)/number of units

= (0.066 x 1800)/2, = 59.4 $m^3$

Provide water depth = 3 m

Area required = 59.4/3

= 19.8 $m^2$

Diameter required $= \sqrt{(19.8 \times 4) \div \pi}$ …[Eqn10]

= 5.02 m = 5.1 m

Provide diameter

Actual volume provided = ($\pi$/4) x (5.1)2 x 3,= 61.28 m3

**(3) Clarifier**

Clarifiers are settling tanks used to remove suspented solids from liquid for clarification

Detention time = 2.5 hr

Number of units proposed = 2

Volume required = (flow x Dt)/ number of units

= (238 x 2.5)/2, = 297.5 $m^3$

Area of clarifier required = (volume of Flocculator + volume of clarifier) / water depth …[Eqn11]

= (61.28 + 297.5) / 3

= 119.59 $m^2$

Diameter of clarifier required =((119.5x4)/$\pi$).5 …[Eqn12]

= 12.34 m

Provide diameter = 12.5 m

Assume depth of sludge storage = 10%

= (10/100) x 3 = 0.3 m

Depth of outer wall = 3 m

Floor slope = 1/12

Check for surface loading:-

Actual area of clarifier - Flocculator unit = (($\pi$/4) x ($12.5^2$)) – (($\pi$/4) x (5.12))

= 102.29 m

Surface loading = flow / area

Criteria 25 to 40 $m^3/m^2$/day, Hence ok

= (24 x 238) /(102.29 x 2)

= 28 m3/m2/day

**(4) Collecting Channel Around Clarifier**

Velocity of flow = 0.5m/s

Total flow = 238 $m^3$/hr

Flow taken by half portion of clarifier = 119 m3/hr = 0.033 m3/s

Area required = 0.033/0.5 = 0.066 $m^2$

Provide a width of 0.5 m

Volume = 0.066 x 0.5 = 0.033 m

Water depth = 0.033/0.066 = 0.5 m

Allow a free fall = 0.15 m

Total depth of channel = 0.65 m

Provide total depth = 0.7 m

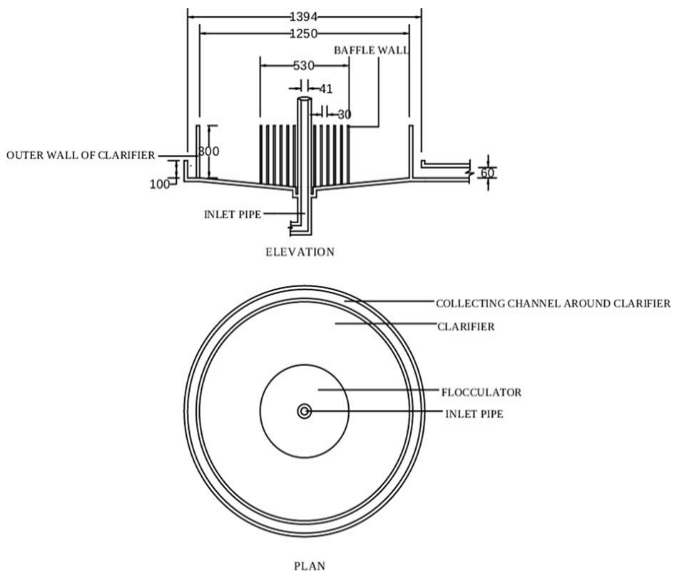


**Fig 3: Elevation and Plan of Clariflocculator**

**(5) Design of Outlet Channel from Clariflocculator**

Outlet flow per clariflocculator

= 238 $m^3$/hr

Overload assumed = 20 %

Flow through channel = 238 x 1.2

= 285.6$m^3$/hr =0.079$m^3$/sec

Assume velocity = 1m/s

Assume width of channel = 0.5m

Area = Flow/Velocity = 0.079$m^2$

Volume = Area x Width

= 0.079 x 0.5 = 0.0395$m^3$

Water depth = Volume / Area

= 0.0395/0.079 = 0.5m

Freeboard = 0.1m

Therefore, total depth of channel

= 0.6m

## 8.3 DESIGN OF RAPID SAND FILTER

Out of the two filters, it was decided to provide rapid sand filter. It has higher flow rate and less sensitive to changes in raw water quality.

Maximum daily demand = 5.5 ml/day

Let us assume an average filtration rate of 4500 litres per hour per $m^2$ of filter area.

Therefore area of filter = 5.5 x $10^6$ / 4500 x 24

= 50.9 $m^2$

Let the size of each filter unit be 9m x 5m Therefore number of units required

= 50.9/(9 x 5), = 1.13

Say = **2**

Keeping one unit as standby, provide a total 3 units.

Maximum water demand

= **5.5 ml/day**

### (1) Design of Filter Units

Let us assume that 3 % of filtered water is used for washing of the filter every day Therefore filtered water requirements per day = 1.03 x 5.5 = 5.7m /day

Again let us assume that 30 minutes are lost every day in washing the filter. The quantity of filtered water required per hour = 5.7/ (24 – 0.5)
= 0.242 ml / hour

Again let us assume an average filtration rate of 5000 $l/hr/m^2$ of filter area.

Filter area,A = $(0.242 \times 10^6)/5000$
= 48.4 $m^2$

Let L = 4/3 B, and let there are two filter units, two being the minimum number to be provided.

Then 2 x (B x (4/3)B) = 48.4 $m^2$
From which B = 4.26m
Say = **4.5m**

Keep **B = 4.5m** and **L = 6m**, for each filter unit, giving total area **= 2 x 4.5 x 6 = 54m2**

### (2) Design of Under Drainage System

Let us keep the total area of perforations in the under-drainage system to the entire filter area as 0.003 (i.e. 0.3%).

Total area of perforations = 0.003 x 4.5 x 6
= 0.081 $m^2$ = 810 cm.

Let us use 12 mm diameter perforations, for which the desired total cross-sectional area of laterals is kept equal to twice the total area of perforations.

Total area of manifold to be twice the total area of laterals;

Area of manifold = 2 x 0.162
= 0.324 $m^2$

Therefore, diameter of manifold = ((0.324x 4)/3.14)=0.64m.

Let us provide 65 cm diameter manifold, laid along the length of the filter unit. Let us place the laterals at a spacing of 15 cm.

Hence number of laterals = (5.7 x 100)/15 = 38

Hence provide 38 laterals on either side of the central manifold, thus requiring 38 x 2
= 76 laterals in each filter unit.

Length of each lateral = (4.5 – 0.65)/2
= 1.9m

Let n be the total number of perforations, each of 12mm diameter, in all the 76 laterals.

Then we have n x (3.14/4) x $12^2$ = 0.018 x $1000^2$
From which, n = 716

Number of perforations in each lateral = 716/76 = 9.4

Hence provide 10 perforations per lateral.

Area of perforations per lateral = 10 x (3.14/4) x $12^2$
= 1130.9 $mm^2$.

Area of each lateral = 2 x area of perforations per lateral
= 2 x 1130.9=2261.8$mm^2$.

Diameter of lateral = (2261.8 x 4)/3.14
= **54 mm**.

Hence provide 55mm diameter laterals, at each 15cm center to Centre each having 10 perforations of 12mm diameter.

Check;

Length of lateral/Diameter of lateral = (1.9 x 1000)/55
= 34.5 < 60.

Also spacing of perforations = (1.9 x 100)/10= **19cm**.

### (3) Wash Water Discharge and Velocity

Let the rate of washing be equivalent to a rate of 60cm/min. This will give a wash water rate equal to 0.6 x 60 x 1 = $36m^3/hr/m^2$.

Wash water discharge in one filter = 36 x 4.5 x 6
= 972 $m^3/hr$ = $0.27m^3/sec$.

Velocity of flow of wash water in laterals = $0.27/(76 \times (3.14/4x(55/1000)^2))$
= 1.495m/sec.

Velocity of flow of wash water in the manifold = $0.27/((3.14/4)x0.65^2)$
= 0.81m/sec.

Permissible velocity = **1.8m/sec**.

### (4) Design of Wash Water Trough

Let us provide three troughs in a width of 4m so that of troughs = 4/3, = 1.33m.

These troughs will run parallel to the longer dimension of the filter unit.

Therefore discharge per trough = 0.27/3,
=$0.09m^3/sec$.

Let us keep width (b) of the trough = 40cm =0.4m.

From equation Q = $1.376 b x y^{1.5}$,

The water depth at upper end is given by 0.09 = $1.376 \times 0.4 y^{1.5}$

From which, y = 0.233m = 30 cm.

Keeping a freeboard of 10cm, depth of trough is 40cm.

Hence provide wash water trough of size **40cm x 40cm**.

### (5) Determination of Depth of Sand

Let us assume 60cm of sand having effective size of 0.5mm.

Let us use an equation for computing minimum depth so that flocs do not break through sand bed.

Qd3h/l = B1 x 29323

Here, Q = rate of filtration = 5000 x 2 = 10000 litres/hr/m2 = 10 m2/hr/m2

Assuming 100% overloading under emergent conditions.

d = 0.6mm, assumed as mean diameter.

h = terminal head loss

= 2.5m (assumed) l = depth of sand in meters

B1 = 4 x 104 (assumed),

For poor response of filtration

and average degree of pretreatment.

(10 x 0.63 x 2.5)/l = 4 x 10-4 x 29323

From which, we get l = 0.46m ,= 46cm.

Hence the assumed depth 60cm will be adequate to avoid break trough of floc.

**(6) Size of Gradation of Gravel**

Let the size gradation of gravel be 2mm at top to 40mm at bottom. The requisite depth

(L) cm of a component gravel layer of size d (mm) is computed from equation

L = 2.54 x k x (log d)

Taking k = 12, we have

L = 2.54 x 12 log d = 30.48 log d

When d = 2mm,

L = 30.48 log (2) = 9.2cm.

Provide a gravel depth of 50cm.

**(7) Determination of Total Depth of Filter Tank**

The total depth of filter tank = depth of under drains + depth of gravel + depth of sand + water depth + free board

Providing a water depth of 1.2m and a free board of 0.3m.

Total depth = 0.65 + 0.5 + 0.6 + 1.2 +0.3 ,= **3.25m**.

Hence each filter tank will have a size **4.5m x 6m x 3.25m**.

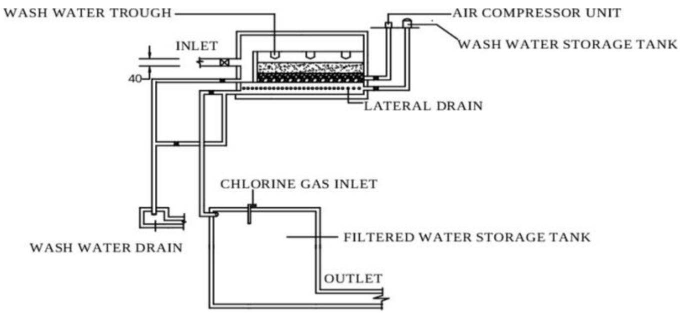


**Fig 4: Typical Section of Rapid Gravity Filter**

### 8.4 DESIGN OF SLUMP TANK

The sump tank is considered as disinfection unit. Chlorine gas is used for disinfection.

Flow = 238 $m^3$/hr = 0.066 $m^3$/s

Assume detention time = 1 hr = 3600 s Volume of the slump tank

= flow x Dt

= 0.066 x 3600 = 237 6 $m^3$

Assume height = 5 m

Area = 237.6/5 = 47.52 $m^2$

Length of the tank = 47.52/5 = **9.5 m**

B = 237.6/ (5 x 9.5) = **5 m**

Provide a free board of 0.15 m

New height = **5.15 m**

Size of slump tank = **9.5 x 5 x 5.15 m**

## 9. CONCLUSIONS

Water scarcity is the burning issue faced by people in Veeyapuram panchayath and surrounding areas. Main sources of water here are Pamba river and Achancovil river. Water in these sources contains mineral impurities and dissolved salts and hence it can't be consumed for domestic as well as drinking purposes. The present water supply to this area is through tankers, which is not at all economical and is insufficient. The people here are facing water scarcity as they are not able to utilize the available water sources in a proper way.In order to solve the water scarcity issue in this area we designed a water treatment plant for a design period of 30 years. In a water treatment plant, the water is purified through different units like aerator, flash mixer, clariflocculator, rapid sand filter and disinfection unit. We hope that the water scarcity in this region can be solved by the execution of this water treatment plant.

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