

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

Study of Water Treatment Plant Jalgaon

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ABSTRACT: Water is the basic need of human beings and it is very important to get pure form of water for human requirements. This paper deals with brief survey study of Water Treatment Plant of Jalgaon which is operated by Jalgaon Municipal Corporation. Also the paper deals with the design components of water treatment plant, the modification required in water treatment plant.

KEYWORDS: Water treatment plant, brief analytical study, design components of water treatment plant, modification required.

I. INTRODUCTION

Water is one of the basic needs for all living beings to survive on earth. However it is equally important to get pure form of water for drinking, washing and other basic means related to water use. Thus with the aim of supplying more acceptable form of water for a specific end use the water treatment plants were set up. This water treatment plants removes the contaminants & unacceptable components or reduce their concentration in water to acceptable limits through various water cleaning process. The main aim of these departments is to convert the unacceptable water into acceptable water and to preserve their acceptable limit till it reaches to the consumer.

The water treatment process is been divided into several steps and every step involves various Equipments. Therefore it is very important to have a brief study of these equipments to design a safe water treatment plant. Thus this paper deals with the study of the water treatment plant equipments.

II. LITERATURE SURVEY

- Endah Angreni presented a review paper on “Review on Optimization of Conventional Drinking Water Treatment Plant”, and concluded that,

Water treatment is a process which consists of several sub process which works on the motto of converting the non drinkable form of water in to drinkable form. Conventional drinking water treatment plant consists of coagulation, flocculation, sedimentation, filtration and disinfection units. Depending on water quality influent, each unit can be optimized to achieve the desired water quality effluent, both in design and operation stages. A typical water treatment plant has the combination of processes needed to treat the contaminants in the source water treated by the facility. The presence of unacceptable organic or mineral substances causes some problems in obtaining drinking water. Understanding these phenomena requires taking into account the physical and chemical natures of the water to be treated. Optimization of conventional drinking water treatment plant means “to attain the most efficient or effective use” of your water treatment plant regarding some principles, there are: achievement of consistently high quality finished water on a continuous basis and the importance to focus on overall plant performance, instead of focusing too much on individual processes. The paper presents a review on optimization of conventional drinking water treatment plant that eventually proposing a method to

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Vol. 7, Issue 4, April 2018

maximize process efficiency with less risk. Overall optimization was carried out by dynamic programming to meet drinking water quality standard.

- **Mudassir M Inamdar & Salman sheikh presented a research paper on “Performance of Drinking water treatment Plant” and concluded that,**

To implement performance assessment, it is necessary to develop adequate and representative performance indicators. Good performance indicators can specify the measurable evidence that is necessary to document the achievement of a goal. To provide the higher quality and stable water to the customers, the water utilities themselves should establish the proper maintenance and management programs to enhance the availability of plant facilities and equipments in the water treatment plant. With the appropriate performance indicators, the objectives and/or targets of the business plan can be evaluated quantitatively. The aim of this research work is to set up the performance evaluation system. After the establishment of performance indicators seven in this research, the corresponding evaluation items and their relative weights were revealed throughout forum discussion and questionnaire survey and based on the comprehensive performance evaluation technique.

The objective of a public protected water supply system is to supply safe and clean water in adequate quantity, conveniently and as economically as possible. The water supply projects formulated by the various state authorities and local bodies at present do not contain all the essential elements for appraisal and when projects are assessed for their cost benefit ratio and for institutional or other funding, they are not amenable for comparative study and appraisal. Therefore, on Water Supply & Treatment specify appropriate standards, planning, and to avoid empirical approach. For providing continuous and good quality of water to all the regions in Maharashtra throughout the year, Govt. of Maharashtra has constructed new water treatment plant. The Physic-chemical analysis is proposed to be conducted to investigate water quality. The conclusion drawn from the study will outline the importance of accurate engineering design and need for continuous monitoring and analysis of each unit performance

III.OBJECTIVE

The basic objective of the water treatment plant is to supply safe and adequate amount of water to the human society in economical form. To attend this it is very important to have installation of safe guard instruments as well as safe guard monitoring system for plant operations. The water treatment plant of Jalgaon is operated by Municipal Corporation of Jalgaon. The plant has the capacity to treat 132MLD water per day and supplies water to Jalgaon city with a population of 6 laths (approx) the intake source of water treatment plant is from waghur dam located 6 km away from the plant.

The objective of this paper is to have a brief study of the working efficiency of water treatment plant. The main focus of the study is to survey the brief specifications of the equipments used in the water treatment plant. The paper will also contribute to identify the solutions for better efficiency of water treatment plant.

IV. PLANT SURVEY

The water treatment plant of Jalgaon has a capacity of 132 MLD (i.e. Millions Litres per Day) and is operated by Municipal Corporation of Jalgaon. The Intake source of water of this plant is from waghur dam situated at a distance of 6km from plant.

Laboratory Test: After the water is taken from the intake source the water is given for sampling in laboratory for conducting different test. This is the first process brought under action after the water is taken from intake source. The test conducted is 1) Turbidity Test, 2) Bacterial Test, 3) pH determination Test. 4) Hardness Test. This test are conducted to determine the amount of turbidity, Pathogenic bacteria and to determine the amount of coagulants to be added in water.

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Figure 1 Laboratory of Water Treatment Plant Jalgaon

Aeration Unit: After the laboratory test is being conducted the water is send to the aeration unit where the oxygen level of the water is been increased and the other gases are emitted out in the atmosphere. The Cascade type aerator is used in most of the water treatment plant and even in Jalgaon Water Treatment plant.



Figure 2 Cascade Aerator

Clariflocculator Unit: This is the third treatment process. In this process as the water contains negatively charged particles whose amount of charge is been calculated and same amount of positively charged particles are added to water which results in the formation of large molecules of positive and negative charge particles due to process of attraction and these particles then settled down in sedimentation zone under the action of gravity. From these zones these particles are easily removed.



Figure 3 Sedimentation Tank

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Chlorination Unit: In this unit chlorine is added to the water within the acceptable limits so as to keep water healthy till it reaches to the consumer. Chlorine helps to kill the disease causing bacteria and helps to maintain healthy water for long time. Chlorination is the most popular disinfection method used worldwide. However there are other methods like UV rays method available but are too costly to operate. The Chlorine Cylinders are shown below in figure.

Filtration Unit: During this process the water enters through upper valve, moves down towards the filter bed, after passing through filter bed and underdrainage system it flows out through lower valve. The unit used to measure the filtration rate is inflow rate (m^3/hr) divided by filtration area (m^2).



Figure 4 Chlorine Cylinder Use for Disinfection Process.

V. DESIGN RESULTS

A) Capacity Calculations & Sizing of Water Treatment Plant:

Intermediate Stage Population	5,41,000
Daily water requirement at T.P inlet	108.2 MLD
Rate of Pumping	20 Hours
Designed Daily Discharge	129.20 MLD
Capacity of Proposed Treatment Plant	132 D

B) Capacity & Sizing of Various Components of Plant Part 1:

b.1) Aeration Fountain (Cascade Type Aerator)-

The Ultimate Stage Requirement in the year 2030	175.34 MLD
Overload of 20%	53.04 MLD
Re-circulation flow of wash water	5.40 MLD
Total Capacity of Aeration Fountain	215.80 MLD

b.2) Inlet pipe- (adopting 2m diameter MS pipe)-

Area of Pipe	3.14 sq.m
Velocity of water through inlet pipe	2.50/3.14

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b.3) Cascades - The flowing rating should be more than 0.65 sq m/MLD

Cascade Area - $.7854 \times D^2 = 215.80 \times 0.65 = 13.36$

Hence adopt $D = 13.40$.

b.4) Risers - 5 Nos x 0.20m each.

b.5) Height of Cascade- 5 Nos x 0.20m = 1 metre

b.6) Treads- 4 Nos x 1.3875 metre

C) Capacity & Sizing of Various Components of Plant Part 2:

C. 1) Venturiflume-

Designed Flow	8990 Cum/hr = 2.5 Cum/sec
Water Area Required	3.5 sq m

C.2) Flash Mixer-

Designed Discharge	$5540 \text{ m}^3/\text{hr} = 1.54 \text{ m}^3/\text{sec}$
Detention Time	60 Sec
Volume of Container	92.40 Cu. M (assumed 4.5 meters in height)
Area Required	20.25 m^2

Provide – 4.5x4.5x4.5 metres. The flash mixer to comprise of single inlet chambers with 2 outlet chambers in view of 2 clarifiers.

C.3) Circular Clariflocculator-

Designed Discharge for each unit	$2770 \text{ m}^3/\text{hr} = 1.54 \text{ m}^3/\text{sec}$
Detention Time	30 min
Volume of each flocculator	1385 m^3 approx 1390 m^3

C.4) Wash Water Tank-

Rate of back wash	600 litres/ m^2 /minute- max
Washing Time	10 min max
Considering two beds cleaning	$46.5 \times 2 = 93 \text{ m}^2$
Wash water quantity required	560 cu.m

C.5) Re-circulation Sump

Capacity Required	560 cu.m
Adopting depth	3m
Diameter Square	$560/(0.785 \times 3) = 237.8 \text{ m}$
Diameter	15.5m

C.6) Pure Water G.S.R

Population in Intermediate Stage: 5, 41,000 souls

Storage Capacity for its requirement: 2,60,00,000

Adopting depth width of Sump:

$$\begin{aligned} 2,60,00,000 &= (5 \times B \times 2B) \\ B^2 &= 2.600 \text{ m}^2 \end{aligned}$$

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B = 50.99 m
Width = 51.00 m
Length = 102.0 m

Provide 20 Compartments with 5m ht x 0.3 m width diaphragm walls.

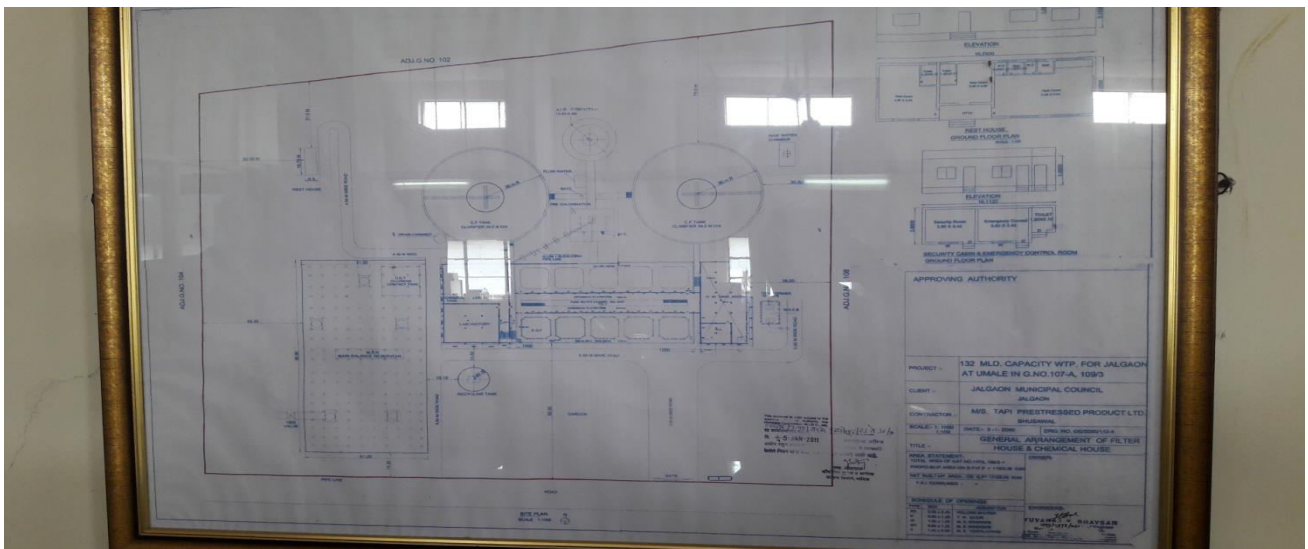


Figure 5 Layout Plan of Water Treatment Plant Jalgaon

VI. CONCLUSIONS

The water treatment plant of Jalgaon needs some changes in their working process for providing better and safe water treatment for Jalgaon city.

- 1] The current workers and officers working in water treatment plant are quite less and should be increase to required level.
- 2] The Security Systems of the plant should be updated.
- 3] The SCADA (Supervisory Control & Data Acquisition) System should be implemented in plant.
- 4] The need of water will be 175.4 MLD in 2030 therefore certain measures should be taken to increase the capacity of plant or it should come with one more secondary plant.
- 5] The pipeline in area of Baliram peth and Shanipeth should be repaired and uniform diameter pipes should be placed to avoid head loss.
- 6] Currently the operation of manhole is done manually at plant. This should be operated by a definite system automatically.
- 7] The maintenance of components at water treatment plant should be updated.

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ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

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