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ANALYZING THE WATER MANAGEMENT FOR A TOWNSHIP BY INSTALLATION OF SEWAGE TREATMENT PLANT AT KOLHAPUR.

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Abstract: Rainwater is only source of fresh water on earth and considered as primary source. Rivers, lakes, ponds are the secondary sources. Hence, it is duty of each individual to conserve quality and quantity of water. Untreated water is directly mixed in fresh water resource that results contamination of fresh water resources available. Due to migration from rural to urban area there is increase in population in cities this has led to rise in number of societies and residential apartments. The living style, urbanization, irrigation pattern has increased the demand for fresh water. This paper analysis the demand for fresh water, discharge of sewage water for a society, compares decrease in fresh water by installation of sewage treatment plant and calculates the percentage of usage of treated water. It is suggested that installing such systems can help to lessen fresh water demand by 50%.

Index Terms **– Sewage Treatment Plant, re-use of water, water management**

I. INTRODUCTION

Treated water from Sewage treatment Plant can be used for all non-potable activities such as to water plants, flushing, floor cleaning, car washing etc. Reusing treated water can help in improving health of environment by not polluting natural resources. 70 % to 80 % of untreated water is disposed in natural water bodies. The water treating system is known for last 12,000 year ago these toilets were connected to trees, stone fresh and water waste water system.

The water demand per capita is 135 L/day/capita. The breakdown of water usage is 30% is used for flushing, 35 % of shower and bath, 20% for laundry, 10% is used in kitchen, 5% is used for cleaning. It can be considered that 75 to 80 % of domestic used water can be considered as wastewater [2]. The Bio chemical oxygen demand (BOD) and suspended solid should be of accepted standards.

II. LITERATURE REVIEW

The basic process of treating water are preliminary, Primary, Secondary and Tertiary Treatment. The advantages of installation of sewage treatment plant are as follows [3] Sewage Treatment Plant system leads to treat the water and then relieved in nature. This helps in improving the quality and hygienic condition of life, it helps in preserving natural environment, tertiary effluent are reused for agriculture purpose and the water can also be reused ,it helps in developing sustainable development, they help restore groundwater balance, curb diseases and stop degradation and pollution of the environment [1], in housing societies. Also the treated water can be used for non-potable purposes such as gardening, washing cars, construction, irrigation and toilet flushing. [1]

There are different technologies adopted in these modern days for treating wastewater and are mentioned as follows:

Activates sludge process: In this aerobic treatment, the oxygen is enforced in the sewage to create essential bacteria. The organic content in the sewage is reduces by this floc. The biological oxygen demand (BOD), all suspended solids and biological nitrification and denitrification of wastewater is removed by conventional Activates sludge process (ASP) method.

Extended aeration: This is process where extended aeration time helps in digesting the biological mass bio-endogenous respiration. This method emphasis the generation of stable .neutral organic material and implies the disposal of gasses produce as end products in to the atmosphere.

Tricking filter: The use of support media that generates a bed made up of stone ,pebbles ,gravels and wooden slats for holding microbial film(layer)which is used to breakdown organic matter present in sewage.

Karnal technology: This method involves tree plantation on scale of 1 M X 50CM long ridges where furrow are generated for the fumigation of the dumped untreated sewage for soil absorption within 18 to 24 hours with no leftover water between trenches .This method helps in regulating the supply of nutrients for the plantation.

Up-flow anaerobic sludge blanket: This method is used to breakdown soluble particulate matter without use of any energy to generate high calorific value gasses as by-product.

Oxidation pond: In this case, use of bacterial consortium in treatment pond is done as part of basic secondary sewage treatment that leads to the development of cell components and minerals which in-turn lead to the growth of algae that decomposes sewage or organic matter by oxidation.

Waste stabilization ponds: In this method a series of stabilization ponds that are divided as per their different, function. Anaerobic pond performs the action of removing suspended soil and bio particles from sewage at primary stage. Remaining BOD is removed in secondary stage through algae and development of bio-components. The pathogens are removed in tertiary treatment in maturation pond.

Aerated Lagoon: In this process earthen basin are used where inlet and outlet is provided to make sewage flow through the basin. The oxygen is provided mechanically to settle down organic matter in the end of the basin.

The latest method of sewage treatment plant are as follows:

Sequencing batch reactor (SBR): A similar version of the basic ASP is fundamentally an SBR. The process involves treatment in batches combining preliminary settling, aeration, secondary settling and decanting the sewage, which is treated in chronological order in the same basin at timely intervals. The SBR equipment efficiently removes nitrogen and phosphorous along with BOD. It does not necessitate individual secondary clarifiers or sludge pumping stations, etc.

Membrane bioreactor (MBR) Other than its property for the growth of microbes in the reactor through media suspension, it is comparable to ASP. This property increases growth of microbes in the aeration tank as against the conventional process. The MBBR is analogous to the FAB with an exception that unlike the suspended media, media is set to be stationary and fluidized in aeration tank

Membrane bioreactor (MBR):In the MBR, the aeration and secondary clarification process is combined in the same basin by removal of aerated mixed liquids via a diaphragm rather than letting it settle in different downstream tanks. The MBR equipment is efficient in treating sewage with negligible BOD content and suspended solids. Furthermore, it requires less power as it functions with low suction.[9]

Jal Shakti Abhiyan, Swachh Bharat Mission, Atal Mission for Rejuvention and Urban Transformation (AMRUT), Smart Cities Mission and Namami Gange are schemes for wastewater treatment. [8]

Housing Development and Infrastructure limited (HDIL) a residency park in Mumbai having capacity 5000 population has installed STP of 650 KLD(Kilo liters per day). The treated water is odor and color free. This treated water can be used for non-potable activities. In last 7 years treatment of water carried out efficiently TSS (>85%), BOD (>85%) & COD (>85%) [4]

Chennai faces a lot of scarcity of water. A 65 apartment blocks in a housing discharges approximately 45,000 L of sewage .The installation of treatment plant cost Rs.15 Lakh and each household was charges Rs.25000. The treated water can be used for non-potable activities .Conclusion is Rs.1, 00,000 /- is amount required to install STP for treating 1,000 L. [10]

There are various rules by Unified Development Control and Promotion Regulation Maharashtra State 2020, that any area admeasuring 10,000 Sq.m. Should install wastewater treatment plant. For housing societies and multi-storied building having more than 100 or more tenants are mandatory to install grey water treatment plant.[7]

As per IGBC (Indian Green Building Council) 26% are points given to water management and reusing of treating waste water has 2 points and if Sewage Treatment Plant is installed on site then 3 points are allotted.[4]

In GRIHA (Green Rating for Integrated Habitat Assessment) includes 10-section and water management criteria has 16 % in which wastewater treatment consist of 3 points.[1]

III. RESEARCH METHODOLOGY

This is a description of the methodology for selection of the study area, sample, construction of tools for data collection, procedure of data collection and data analysis has been described. The present data was collected in Kolhapur city, Maharashtra state, India. This is an exploratory research design. The scope and limitation are framed according to problem. The approach is to study about the treatment of wastewater within the site and reusing water for non-potable activities.

Primary data: Primary data is collected by visiting townships in Kolhapur city having large number of units. Interview was schedule for builders, government authorities and vendors so that the key information may be achieved. Tools like interviewing authorities, collecting pictures and observations have been recorded.

Case studies: Three case studies have been selected from region of Kolhapur. The criteria to identify case study is township are selected having units minimum 250 and maximum 600.

Observations: Location of STP in Kolhapur city as well as township has been observed. The elements needed to install both the systems and water management system of society has been observed.

Secondary data: Secondary data is collected from by online research on different search engines about water management, depletion of water table, contamination of natural resource, generation of wastewater. Data has been gathered from national, government and non-government bodies of India. Literature review papers are studied for different types of techniques used to reduce usage, water management systems in societies, various programs launched by government for installation of both the systems.

Study Area: Kolhapur current population is 6, 35,000 in 2021 the population in 2018 was 6, 13,000. The overall population of Kolhapur is increasing because of large scale, small-scale industries, good education facilities, hospitals and favorable climate for living. People are attracted towards city life and hence there is increase in housing society. As population and life style and due to urbanization contamination of water, poor air quality, and natural resources are being affected .Hence it is important to conserve, reuse natural resource. Therefore, area of Kolhapur has been selected for this thesis.

IV. CASE STUDY

A township in Kolhapur Hira Shree the project is township in Kolhapur city having capacity of 460 units. The township has 24 twin bungalows and 8 apartment towers. The total net plot area is 26750.00Sq.m.

1. The population is calculated as follows as per tenants given NBC norms.

	Flat type	Total No. of flats	Tenants	Population
1	1BHK	35	04	140
2	2BHK	342	05	1710
3	3BHK	59	06	354
4	Twin Bungalow/3BHK	24	06	144
	Total	**460**		**2348 say 2400**

Figure 1: View of Township
Source: Hira Shree Constructions

2. The water demand is calculated as per consumption of 135 L/ day/capita.

Person per capita per day	Number of people	Per day in litres	Monthly Consumption 30 days in litres	Yearly Consumption 365 days in litres
135 liter per person per day	2400	3,24,000	97,20,000	118,260,000

3. Waste water calculation

The quantity of sewage finding its way into drainage system is about 75 to 80% of the volume of water used for domestic use.

Waste water Generation	Per day in litres	Monthly Consumption 30 days in litres	Yearly Consumption 365 days in litres
Fresh water consumption	3,24,000	97,20,000	118,260,000
80%	2,59,200	77,76,000	9,460,800,000

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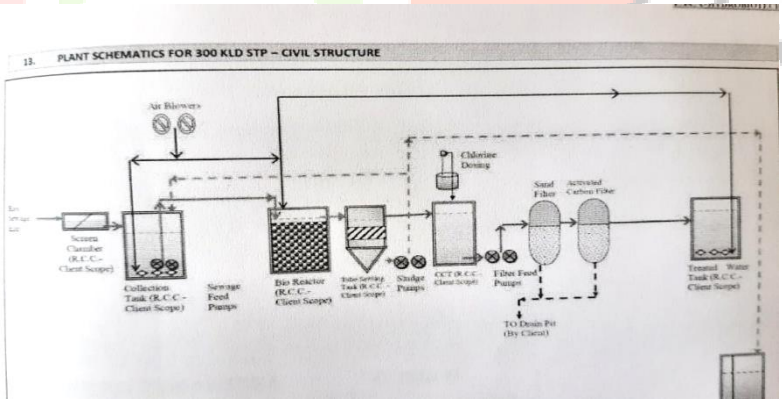

Figure 2: Schematic plant for 300 KLD STP

Source: Hira Shree Constructions

The sewage Treatment plant is based on MBBR (Moving Bed Biofilm Reactor) System. The total sewage generation is 260 KLD (Kilo Litres per day). Capacity of 300-meter cube per day has been provided and 40-meter cube per day STP has been proposed. The location of STP on ground and area consumed by STP is 250 Sq.m.

V. ANALYSIS

Calculating the Water charges as per Kolhapur Municipal Corporation.

Population	Water Consumption per day	KMC Charge Rs. 7 per 1000 per day in Rs.	Monthly Charges (30 days) In Rs.	Yearly Charges (365) In Rs.
2400	3,24,000	2268	68040	8,27,820.00

If it is considered as per NBC norms that 45 L of water is used for flushing and if treated water from STP is used for flushing then the water demand will reduced by 45 L
Hence, calculating the water charge by 90 L,

Population	Water Consumption per day	KMC Charge Rs. 7 per 1000 per day in Rs.	Monthly Charges (30 days) In Rs.	Yearly Charges (365) In Rs.
2400	2,16,000	1512	45,360	5,51,880

Comparison of prices calculated above for 135 L of water and 90 L of water.

Water Consumption per day 135 L/d/capita	Water Consumption per day as per 90L/d/capita	Total water saved In Liters	Yearly Charges worth of Rs. in a year.
3,24,000	2,16,000	108000	275940

Retreated water can be used for gardening and remaining is discharged in sewer as per case study done.

Water treated from STP per day	Area of garden	Water re-used for garden In liters	Amount of water discharged to sewer
2,59,200	2,675	26000	233200

Let us assume that watering plants is done for every 2 days in a week then below is the water requirement needed for gardening monthly and yearly. Simultaneously the cost of water is also calculated.

Water re-used for garden In litres per day	Monthly in litres	Yearly in litres	Total cost In Rs.
26000	2,08,000	24,96,000	17,472

Treated water can be used washing cars and two cars,

4 Wheeler	2 Wheeler	Water needed for 4 wheeler in Liters	Water needed for 2 wheeler in liters	Total water needed For 1 wash In L
296	922	29,600	55,320	84,920

Let us assume that 4 wheeler and 2 wheeler are washed twice a week then it is considered that in month the vehicles is washed for 8 times, water needed monthly, early is mentioned in table below.

Total water needed For 1 wash In L	Monthly water needed for washing vehicles	Yearly water needed for washing vehicles	Cost of water For yearly In Rs.
84,920	6,79,360	8152320	57,066.24

If wastewater is used for flushing, gardening and washing vehicles the below tables express the total water and cost of water saving yearly.

Total treated water per day	Yearly Treated water in liters	Total water used for flushing (a)	Total water used for washing vehicles (b)	Total water used for gardening (c)
2,59,200	9,46,08,000	3,94,20,000	8152320	24,96,000

Cost analysis of re using treated water

Yearly Treated water in liters	Total treated water used (a+b+c)	Total water remaining	Total cost of useable treated water in Rs.
9,46,08,000	5,00,68,320	4,45,39,680	3,50,478.24

Analyzing the fresh water demand and waste water

The total yearly water consumption is 118260000 L and treated water from STP is 94608000 L. The water used for flushing is 39420000 L, for gardening is 8152320 L and for car, washing is 2496000 L

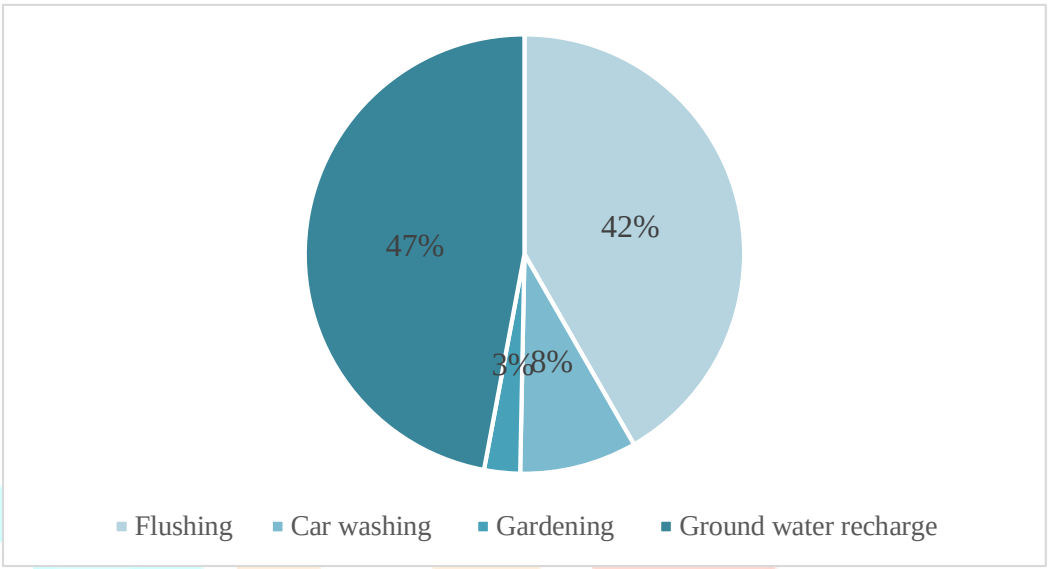

Figure 3: Wastewater utilization

VI. RESULTS

Here we can calculate the total fresh water demand and reusable water and hence its charges and total cost saved yearly.

Yearly Water Consumption in L	Water charges as per KMC	Re use of waste water from STP	Water charges as per KMC	Total fresh water required yearly	Cost saved
118260000	8,27,820	5,00,68,320	3,50,478.24	6,81,91,680	4,77,341.76

Hence, the payback period considering the cost of installation of STP and used treated water is as follows,
The payback period for installation of STP of 300 KLD is 12 years.
It is also concluded that we 52 to 53 % of treated wastewater can be used for non-potable activities and 48 to 49% remaining water can be used for recharging the ground water.

VII. Conclusion

It is very important for every individual to save water .It should be made mandatory for every commercial and residential buildings to install Sewage Treatment Plant. The main objective of re-using wastewater is not only saving water and re-using water but recharging ground water. This can help in solving the problem of scarcity of water, conserving the natural resources, lessening the water pollution because water is treated and reused within the campus. Hence it is proved that efficient water management for a township can be achieved by installation of Sewage Treatment Plant at Kolhapur region.

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