IMPORTANCE OF RAINWATER HARVESTING AND SEWAGE TREATMENT PLANT FOR RESIDENTIAL BUILDING

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ABSTRACT

Water is important and vital factor for humans and urban workability. Rainwater is only source of getting fresh water. Hence, if rainwater collected, stored and wisely utilized can help in saving water. Due to increase in population, change in lifestyle, agriculture the demand of water has increased and many countries face scarcity of water every month. India is one of the water stressed country. Rainwater harvesting system should be installed in residential campus as it reduces fresh water demand saves electricity and energy. The natural water resources contaminates because wastewater without any treatment is mixed with natural water bodies. Sewage treatment plants or wastewater treatment plants should be mandatory installed in campuses. This treated water can be used for gardening, washing vehicles, flushing and other non-potable activities. This research focuses on underlying the importance of installation of Rainwater Harvesting System and Sewage Treatment Plant for residential building.

Keywords: Rainwater harvesting, wastewater treatment, water scarcity, importance of water.

1. INTRODUCTION

Fresh water demand reduces by installation of Rainwater harvesting system and sewage treatment plant or wastewater treatment plant in campus. Collecting rainwater benefits a society by using it for irrigational use, indoor domestic used and non-potable activities. In addition, harvesting water is helpful for recharging ground water. Sewage treatment plant helps in treating wastewater and people can use treated water for flushing, flooring cleaning, car washing, watering plants and recharging ground water .As the water can be stored by various means it can reduce dependency on any local body for fresh water demand and saves water ,energy, water bills and electricity usage .

1.1. Typical Breakdown of water usage in India

The average water used for flushing is 30%, water used for shower and bath is 35%, for laundry is 20%, kitchen is 10%.cleaning 5%.The utilization of water reduces by installation of water efficient fixtures and efficient systems like rainwater harvesting and sewage treatment plant in a residential campus. Installation of efficient fixture for flushing can reduce the usage of water from 1.60 gallons to 1.28 gallons per water flush. As per water sense program, every household can save program 300 KW of use of electricity. Hence, to save water and create healthy environment consumption of less water is beneficial
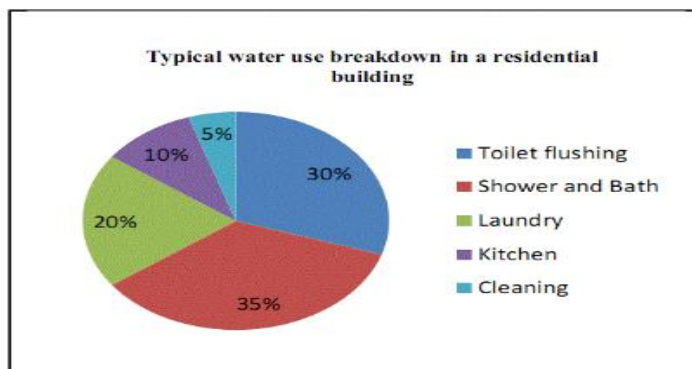

Figure 1: Typical water use breakdown in a residential building

Source: (Kurle Prajwal, 2018)

1.2. Importance of Rainwater harvesting system

Rainwater is primary source of water and rivers, lakes; streams are secondary source of water as per (G.O.I., 2016).This is the oldest system used in India and other parts of the world. It dated around 3000 B.C. in Middle East and 2000 B.C. in some parts of Asia.

The advantages of rainwater water are as follows:

1. Give independent to the water supply of a structure or a user.

2. Reduces the expenses for pumping of ground water.

3. Provides soft water having high quality and low material.

4. Reduces soil erosion in urban areas.

5. The rooftop RWH can be installed with minimum skilled labor and cost effective.

6. RWH systems can be adopted by singe family to multiple family use.

7. Rooftop RWH framework are not difficult to develop, work and maintain.

Following activities take place when natural ground water is recharged with rainwater:

1. It recharging the aquifer and improves ground water quality through dilution and fresh water.

2. Diminishes the saltiness in water and sub-soil further developing its water quality.

3. Increment yield of ground water supplies like nearby lakes, lakes, wells and bore wells.

4. Rainwater is not chargeable and can be collected, stored for usage anywhere

5. Forestalls acquision of water over significant distances.

An RWH system is aimed at fulfilling the following need to (S.G.Deolalikar, 2016)

1. Fullfils the need of increasing demand of water.

2. Lessen the run-off, which over-burdens and some of the time blocks storm drains.

3. Flooding of road can be avoided.

4. Reduces the ground water contamination.

5. Ground water quality is improved.

6. Reduce soil erosion.

7. Supplement domestic water requirement during summer, drought and water shortage situation.

1.2.1 Case study for installation of Rainwater harvesting system

As per (Singh Shishu Pal, 2018) the rainwater harvesting system is simple and easiest method to install in houses and buildings. Family water need is achived by installation of RWHS. The city of Bangalore in India, the residential buildings store rainwater can use for both dry and wet seasons. The advantages explained are it is easy to maintain, reduces water bills, it is suitable for irrigation, Reduces demand on ground water, can be used for various non drinking purpose .the disadvantages are rainfall are sometimes unpredictable sometimes there is more rainfall or no rainfall, the initial installation of cost is high, it needs regular maintenance, typology of roof may result in seeping of chemical and animal dropping and there is limitation for storage.

Figure 1: Rainwater harvesting system.

Source: (Singh Shishu Pal, 2018)

1.3.   Importance of Sewage Treatment plant

It is risky to release sewage without treatment into regular water bodies.70 to 80 % of untreated sewage is discarded in nature. Sewage treatment plants process is only treating wastewater and sewage in clean emanating that can be discarded in safe and eco-accommodating structure without hurting the nature.

As per (Mygate, 2020), the advantages of sewage treatment plant are as follows

1. Sewage Treatment Plant framework prompts treat the water and afterward feeling better in nature. These aides in working on the quality and sterile state of life.

2. It aides in saving common habitat.

3. Tertiary emanating are reused for agriculture reason and the water can likewise be reused

4. It aides in creating sustainable development.

1.3.1. **Case study for installation of Sewage Treatment Plant**

(TNN, 2019)Chennai faces shortage of water and individuals are tracking down different sources to save, moderate and reuse of water. Sewage treatment plant was introduced in the public eye of Medavakkam which is 65 condo block .Approximately around 45,000 liters of sewage is created in loft .A vigorous treatment was utilized where the soil was isolated and gathered at the lower part of assortment tank and microorganisms are utilized for treatment of waste water. This water is dealt with and utilized additionally utilized for cultivating and flushing reason. The complete expense for establishment of tank is Rs.15 lakh, which charged around Rs.25, 000 for every family. This report likewise says assuming that autonomous introduces STP it might cost Rs. 1 lakh for regarding 1,000 liters according to TOI.

2. METHODOLOGY

This research aims to underline importance of installation of rainwater harvesting system and sewage treatment plant for residential building.

2.1. Primary data is collected by visiting municipalities in Kolhapur city having population more than 100 people living in a building. Importance of both the systems is known by collecting data from manufacturers, government specialists and sellers so the key data might be accomplished. Instruments like talking to specialists, gathering pictures and perceptions is recorded.

Case studies- visited local buildings and interviewed own those who have installed RWHS and STP as well as those who have not installed RWHS, STP.

2.2. Secondary data is studied and collected by online research on different search engines about water management, depletion of water table, contamination of natural resource, generation of wastewater. Data is gathered from national, government and non-government bodies of India. Literature review papers is 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.

3. ANALYSIS

Considering the area from Kolhapur having average rainfall 1025 mm and having terrace area of 1000 Sq.m. the following calculations are calculated

3.1. As per NBC rule, the water required per capita is 135 l/day/person

If water consumption for 300 people is considered

The water consumption as per 135 L/ day /capita = 300 X 135 =40,500 L of water can be consumed per day by one building.

As it rains from June to September in India that is for 100 days the average collection of rainwater is 9, 44,537.50 L for one building reference. If assuming rainfall of 1025 mm and charge from local bodies

Therefore, assuming heavy rainfall for 100 days

So 944537.50 ÷100 days =9,445.375 L per day

Hence, the rainwater collected per day is 9,44,5375 L per day say 9500 L per day

As mentioned above the fresh water need for one tower is 40,500 L/day

Therefore the fresh water needed after reducing harvested rainwater is 40500- 9500 =31,000 L per day.

As per local body water, charge for fresh water demand will be 31,000 ÷1000 X Rs.7.00

= Rs. 217.00/-

Water charge per month for rainy season in one building = 217.00 X 100 days =Rs. 21,700.00/-

3.2. Comparison of installing and using rainwater-harvesting system for 100 days

Table 1: Cost saving for installation of RWHS for 300 people

Population For 1 water	Without storing rainwater (135 L X 300)	K.M.C charges for 1 day in Rs.	K.M.C charges for 100 days in Rs.	Harve--sted water	Water payable	K.M.C charges for 1 day in Rs.	K.M.C charges for 100 days in Rs.	Total cost after saving Rs.
For 300	40,500	283.5	28,350	9500	31,000	217	21,700	6,650

3.2. Calculation of Waste water discharge

Sewage Treatment Plant capacity is usually calculated by size of population and how many people it caters. The quantity of sewage finding its way into drainage system is about 75 to 80% of the volume of water used for domestic use. (S.G.Deolalikar, 2016)

Hence Total water consumption is 40500L and 80 % of consumed water is 32,400 L per day.

Total waste water generated per month = 32,400 X 30 =9, 72,000 L

Total waste water generated per year= 9, 72,000 X 12 = 1, 16, 64,000 L

By using sewage treatment plant considering 10 % loss while treating the wastewater then 10, 47,600 L of water can be reused.

4. RESULTS AND DISCUSSION

For a society having 300 people consuming 40,500 L of fresh water can harvest 10,500 L of water and used for domestic use. Installation of Rainwater harvesting system for a building having 300 people can save Rs.6,650 of water bill .The fresh water demand can reduced by 9500 L per day in rainy season.

Installation of Sewage treatment plant in residential building can help in reusing the average water that can be reused for non-potable activities. The total amount of water that can be reused is 1,16,6400 L the cost of this water is as per corporation is Rs.8164.80.

The total water required each day is 40,500 L the yearly amount spent on consuming fresh water is equal to

= (40500 X 365) = 1, 47, 82,500 L

Therefore, as per corporation charges (1, 47, 82,500 L÷1000) X Rs.7.00

=Rs. 1, 03,477.50/- per year

If RWHS is installed then Rs. 1, 03,477.50 – Rs. 21,700.00) = Rs. 81,777.50/-

If STP is installed then demand for 1, 16, 64,000 L will be reduced, hence treated water can be reused for non-potable activities and also recharge ground water.

5. CONCLUSION

It can be concluded that Rainwater harvesting system, Sewage treatment plant should be installed in every building for both residential and non-residential buildings because it can reduce our fresh water demand by 50 %. Saving water helps in saving our water bills, less consumption of electricity. The overflow of water can also be directed to recharge the ground water table.

This is not going to help at individual level but it is going to create impact on environment. It is very important at individual and global level to safe water.

REFERENCES

[1] G.O.I. (2016). RAIN WATER HARVESTING POTENTIAL FOR DIFFERENT LOCATIONS IN THE STATE OF MAHARASHTRA. Pune: INDIA METEOROLOGICAL DEPARTMENT.

[2] Mygate, T. (2020, June 10). Sewage Treatment Plants (STP) and their Maintenance in Apartment Complexes. Retrieved from Sewage Treatment Plants (STP) and their Maintenance in Apartment Complexes: https://mygate.com/blog/housing-society-sewage-treatment-plants/#:~:text=They%20help%20restore%20groundwater%20balance,construction%2C%20irrigation%20and%20toilet%20flushing.

[3] S.G.Deolalikar. (2016). Plumbing Design and Practice. Chennai: Mc Graw Hill Education (India) Private Limited.

[4] Singh Shishu Pal, M. P. (2018). Rainwater Harvesting:Aneco--Friendly Technique of Conserve the Water. International Journal of Trend in Scientific Research and Development (IJTSRD).

[5] TNN. (2019, June 24). Times of India . Retrieved from Housing complex sets example in water recycling: https://timesofindia.indiatimes.com/city/chennai/housing-complex-sets-example-in-water-recycling/articleshow/69921699.cms