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COST BENEFIT ANALYSIS OF ADOPTING RECYCLED RAIN WATER AND SEWAGE TREATMENT SYSTEM FOR HOUSING PROJECT IN AMBERNATH

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Abstract:
Water scarcity was listed in 2019 by the World Economic Forum as one of the largest global risks in terms of potential impact over the next decade. India trails the world in water availability with 4% share of global water resources, 132 rank in water availability, 122 rank in water quality and per capita availability of 1545 cubic metre. In this scenario Sewage treatment and Recycled rain water system can manage water resources and also reduce the volume of mains water which means more is left to benefit the ecosystem. This paper explains the cost benefit of adopting Sewage treatment and Recycled rain water system.

Key words – Sewage treatment plant, recycled rain water, cost analysis

INTRODUCTION

50% of world population is going to be under high water scarcity according to World Water Development report (United Nations). Countries of Africa and Asia like Cambodia, Bangladesh, China, and India which are still classified as developing are likely to face water scarcity more. It is expected that in 2050, 70% of population will be living in Urban areas of India. With shrinking of water reservoirs, low rainfall, etc it is hard to feed and provide resources like water, electricity to such high population. Using Sewage treatment system and Recycled rain water system, water resources can be managed and be saved for future generations.

Ambarnath is small Central Suburban city in the District of Thane of state Maharashtra with a current population of 2.53 Lakhs (Census 2011).The population is expected to rise due to cheap property rates as compared to the Mumbai metropolitan area and its better connectivity to Navi Mumbai and Mumbai metropolitan region. The city currently faces a water scarcity crisis due to poorly managed water distribution system and heavy pipeline losses due to unexpected pipeline outbursts and irregular rainfall pattern during the Monsoon season.

Also the upcoming construction sites and the existing housing societies lack sewage treatment and recycled rain water technologies. Recycling water can help to overcome challenges.

AIM –

To study cost benefit analysis of adopting Recycled rain water and Sewage treatment system for housing project in Ambernath.

OBEJTIVES –

1) Promote the use of Sewage treatment plant and recycled rain water for current water challenges

2) Cost effective analysis of Water Management for housing project using following parameters-

- Recycle rainwater system.
- Sewage treatment plant.

LIMITATION –

The research will be restrained to study the impact on cost factor of adapting Sewage treatment system and recycled rain water system for residential project.

LITERATURE REVIEW

In the past several researchers have studied, the importance of water management using sewage treatment system and recycle rain water system.

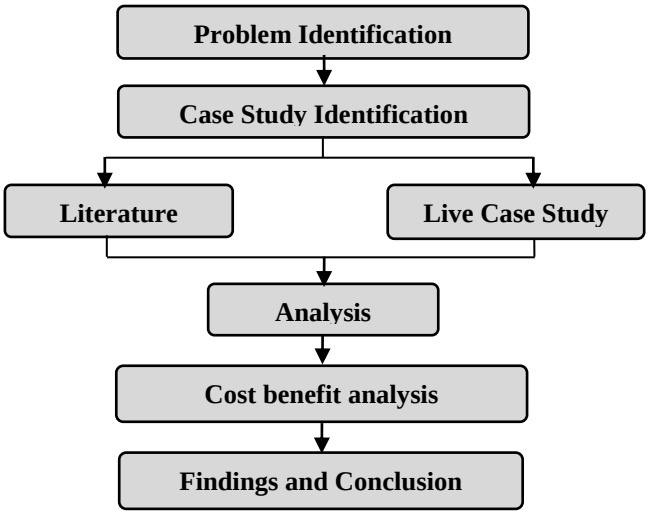
A paper by Yashodhan Arvind Jagtap - **Rain water harvesting for residential project daulat heights in Saswad**, (Novateur publications- April 2018) - M.TECH, Construction Management, MIT College of Management, Pune. Water scarcity is becoming the biggest problem in front of the world now. Many developing and developed countries few areas are affected by water scarcity. Many researchers have already made a point saying the biggest problem of is excessive exploitation of ground water and deterioration of surface water resources. Few water resources conventionally used are river and reservoirs which are not sufficient to feed the water demand, the major reason behind this is the irregular rainfall. Worldwide, rainwater harvesting systems are considered as a new water source. This paper explains how to make efficient use of rainwater and adoption of newly launched concepts of nature conservation. The system is actually built in saswad city, Maharashtra state of India. The cost of total project is Rs. 48060 and it can harvest 129600 liters of water.

Shrirang Vrushali and Chatterjee Kaustav- **Sewage treatment and reuse - a step towards water conservation** (2014 DAMA International) – Under this research paper, a cut to suit treatment technology has been developed to treat sewage. Treatment technologies adopted are activated sludge process, chlorination & filtration. The results were very encouraging. The treatment system achieved 96.8% BOD, 92.5% COD and 95% TSS & 99% Total coliform removal respectively. The treated sewage can be reused for various purpose like cooling water make up, gardening , landscape development , toilet flushing, road washing etc. thus leading towards water conservation.

Rakesh Singh Asiwal, Dr. Santosh Kumar , Shweta Singh and Megha Sahu - **Wastewater Treatment by Effluent Treatment Plants** (SSRG International Journal - December 2016)- Most of the river basins are closing or closed to severe water shortages, brought on by the simultaneous effects of agricultural growth, industrialization and urbanization. Performance of state owned sewage treatment plants, for treating municipal waste water, and common effluent treatment plants, for treating effluent from small scale industries, is also not complying with prescribed standards. Thus, effluent from the treatment plants, often, not suitable for household purpose and reuse of the waste water is mostly restricted to agricultural and industrial purposes. The development of innovative technologies for treatment of wastewaters from various industries is a matter of alarming concern for us. Although many research papers have been reported on wastewater pollution control studies, but a very few research work is carried out for treatment of wastewater of steel industries, especially in reference to development of design of industrial effluent Treatment Plants (ETP) system. Another beneficial aspect of this research work will be recycling, reuse of water and sludge from steel industry.

V Y Bhoye, A B Saner, P D Aher - **Life Cycle Cost Analysis of Sewage Treatment Plants** (IJMTER – April 2016) - Population is increases day by day. As population increase the requirement of Sewage Treatment Plants (STP) also increases. The basic objective of STP isto treat the wastewater as per the given standard and make environment pollution free. During construction of any STP many problems occur like insufficient funds and land, delays in import of equipment's and skilled personal for running and maintaining the plant. Life Cycle Costing (LCC) is used as decision-making tool while constructing any STP. In this paper LCC is carried out for STPs. The total life cycle cost per MLD for Panchak STP is Rs.1, 36, 75,620 and for Tapovan STP is Rs.1,32,64,429.59. From the analysis it is found that the UASB technology is better than the ASP from the cost point of view.

METHODOLOGY



CASE STUDY

Park Landmark - It is a residential project located in Bibvewadi, Pune. It is planned in 6 wings of 12 floors. Total numbers of tementes are 288. All Services are present in basement floor.

For water supply 3 separate lines are given as follows:

- For drinking corporation water is used.
- For washing, bath and cleaning recycled rain water is used.
- For flushing sewage treated water is used.

Sewage Treatment Plant Capacity Calculation
No. Of tenements = (8 x 12) x 3 = 288
No. Of person per tenement – 5 persons
Water required per person – 135lt /day
Total water required – 288 x 5 x 135lt/day = 194.4 KLD
By considering 85 % of the water supplied will be converted in to sewage.
Required capacity of STP = 85% of 194.5 KLD =165.24 KLD
Therefore, 200 KLD Capacity STP is used
73m3 tank for flushing and 30m3 tank for landscape is given.

Cost of 200 kld STP = Rs 16, 35,500
Annual maintenance = Rs 100000 rs

Recycled Rain water system
Rain water is collected and diverted into recharge pit. Underground water is filtered by water softening plant and use for washing, cleaning and for bath. Two 65m3 underground tank are given.

Cost of rain water collection, storage system and filtration unit + Operation cost = Rs 7,52,000
Annual maintenance = Rs 50000

FINDINGS
For residential project of 250- 300 tenement

Sr. no.	System	Capacity required	Cost (Rs)
1	Sewage treatment plant	200 kld	16,50,000
2	Recycled rain water system	130kld	8,00,000

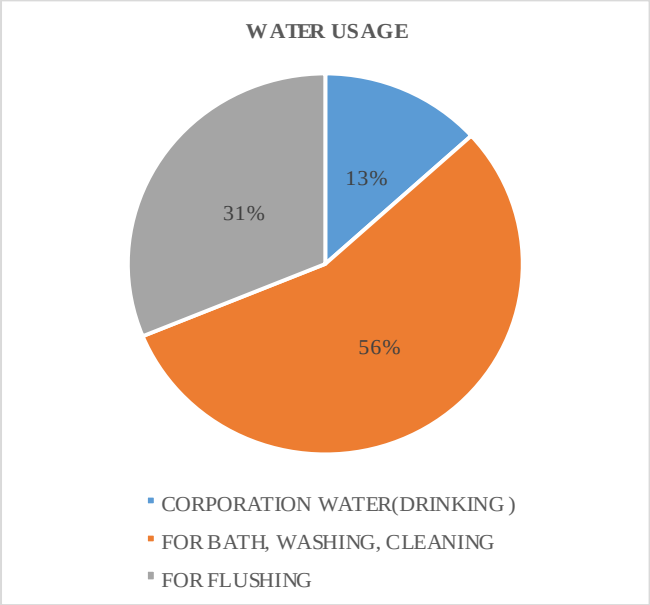


Figure – 1 Water usage in percentage

PROPOSAL

For the purposes of evaluation we have considered a residential project of Panvelkar Gardens in Ambernath west.

About the project
Panvelkar Gardens is located in Khoj gaon naka,Ambernath. It is having 6 wings and 4 row houses. 5 building having 7 floors and 1 building having 4 floors. Total no. of tenement 228.

Water required

No. Of tenements = 228
No. Of person per tenement – 5 persons
Water required per person – 135lt /day
Total water required per day = 228 x 5 x 135lt/day
= 153.9 kld ~ 154 kld
They required 3 water tanker of 15000 ltr daily
Therefore **45kld** water shortage is there.
Cost of 1 Tanker = 1500
Total tankers required per month = 3 x 30 = 90
Total cost of tanker per month = 90 x Rs 1500 = Rs.135000

Sewage treatment plant required
Total water required – 228 x 5 x 135lt/day = 154kld
By considering 85 % of the water supplied will be converted in to sewage.
Required capacity of STP = 85% of 154 KLD = 130 kld
Therefore, 150 kld Capacity STP is required.

Cost of 150 kld STP – Rs. 12,25,500

After sewage treatment we get 60% of treated water , ie 78 kld
Treated water distribution
30% for landscaping and 70 % for flushing.
For landscape – 23 kld
For flushing – 55 kld

Recycled rain water system
UGT required for boring water – 55% of 153.9 kld – 85 kld

Cost of rain water collection, storage system and filtration unit + operation cost = Rs. 6,50,000

Total cost required = STP cost + RW system cost
= 12,25,500 + 6,50,000 = Rs 18,75,500

Total no. tenements – 228
One time Cost per tenement – Rs 8226
Current expenduture on water = Rs 135000 per month
Pay back period = 1 Yr 2 Months

CONCLUSION

Existing		Proposed	
Water Required	154 kld	Water Required	154 kld
Water Supplied (Corporation line)	109 kld	Recycled water	140 kld
		Corporation water Required	14kld
Extra Water Required	45 kld	Extra water required	0
Cost (Annual)	**1620000**	Cost of system	1875500
		Annual maintenance	**150000**

Using Sewage treatment and Rain water system we get an optimize solution as concern to water saving.

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REFERENCES

1. Green Energy Foundation, 2012, *Cost of Harvesting Structures: Approximate Cost of Recharge Structures from Harvesting Rain Water to Meet the Water Shortage in Pune.*

2. Chatterjee K.M and Bhagwat R.C. (2003). Sewage Reuse-A case study.8 th Int. conf. on Water Conservation and Reuse of Waste Water

3. Jungle S.K., Chatterjee K.M. and Narkehede S.D. (2009). Treatment of Industrial Waste Water by Activated Sludge Process, Proc.Nat. Conf. Recent Trends in Biosci., Institute of Science, Nagpur, India

4. V Y Bhoye, A B Saner, P D Aher - Life Cycle Cost Analysis of Sewage Treatment Plants IJMTER – April 2016

5. Bhardwaj RM. 2005. Status of Wastewater Generation and Treatment in India, IWG-Env Joint Work Session on Water Statistics, Vienna, 20-22 June 2005.

6. Rakesh Singh Asiwal, Dr. Santosh Kumar , Shweta Singh and Megha Sahu (2016) - Wastewater Treatment by Effluent Treatment Plants, SSRG International Journal