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Research Paper

A Holistic Approach Towards Integrated Urban Water Management

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ABSTRACT: *Water cannot be created but can be managed according to the needs. Therefore it becomes difficult to do a proper water management to the areas facing severe scarcity of water. It is very much clear that if the water environment is justified properly then only social & economic aspects would also be justified leading to balanced situation over the nation. In India & Maharashtra as well agriculture remains an important economic activity, involving a large section of the rural population. More than 80% of available water share is utilized by agriculture sector. Even though the water requirement for drinking, sanitation & other purposes is around 20-25% which is very less compared to other activities but most importantly, its supply & management has become a problem in mere water regions. Government initiatives emphasizing on water conservation, rainwater harvesting & ground water recharge are very helpful to face this challenge. Keeping all this aspects in picture, this paper discusses on self-sufficiency in water demands for water scarce region of Solapur city. This paper tries to prepare an approach towards integrated urban water management of Purva Vibhag, Solapur as a complete unit ranging from Punjal ground to Bhadrawati peth, Solapur.*

KEYWORDS: *water management, challenges, sufficiency, economic aspects, urban, sustainability*.

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I. INTRODUCTION

Water is an important aspect for survival. Quality of life comes when the basic needs are full-fledged with proper management of available resources. Proper management of water resources for all needs in floods, drought like situations is an indigenous phenomenon for every civilization of world. According to the World Water Development report 2006, water scarcity has spread too many large & densely populated Asian countries. In India, around 70% of total land is drought prone as per World Bank report 2010. Nearly 60.53% of land is used for agriculture, out of which 70% of rain is fed with irregular & uneven monsoon. This indicates that majority rural areas & also many cities are facing scarcity of water [1].

In Maharashtra, India about 70% of cities, towns, villages (around 27600 villages), water availability & potable water face these issues according to World Bank report, 2003. But making part of city as a unit & coordinating the various aspects of water management under different schemes is very much necessary to tackle such issues. Under initiatives of government of Smart City Guidelines 2015-16, these issues can be solved. This gained importance to solve the problems of water scarcity at a decentralized level. Also, public awareness & public participation at city level plays an important role in overall water management. Hence, understanding water needs & available resources in the locality of Purva Vibhag is necessary. Below figure.1 showing geographical location of Solapur district in Maharashtra, India [2].

Figure1: Geographical location of Purva Vibhag in Solapur district from Google Earth

Purva Vibhag is an area located in the eastern parts of Solapur. It consists of mixed zone with multi lingual regional people. Majority of Padmashali religion beside, who belong to weaving occupation as their ancestral occupation. Also this area consists of the following amenities which are a part of the water requirement study as stated further:

1. A multispecialty hospital
2. Primary health care center
3. Primary school
4. A library
5. Two shrines
6. Slums up to 1608 tenements

It is very difficult for cities where the water is scarce & main element for livelihood. The growing demand from small scale industries & other commercial spaces is creating pressure on both water & its productive resources, directly hampering the water management due to which the city life gets distracted. Water scarcity imparts hardships, creates unhealthy conditions by degrading the quality of life. Even though there are several provisions for proper & pure water supply in smart city plans for Solapur city, it is not seen as effective due to certain political influence. Therefore, it is relevant as it tries to give the solution for selected part of Solapur city (Purva Vibhag) considering its own requirements & overall conservation measures towards self-sufficiency of water needs. Also, study of detailed topography of various parts of city & topography of dam to city, revision of sewage water of Solapur is added. Figure.2 summarizes the need integrated water management system. While understanding the overall use of existing water management system, focus is given to following points:

1. Available existing water resources.
2. Water requirement.
3. Analyzing the existing data.
4. Study of standard water management methods.
5. Selecting options for particular projects.
6. Solutions for construction purposes.

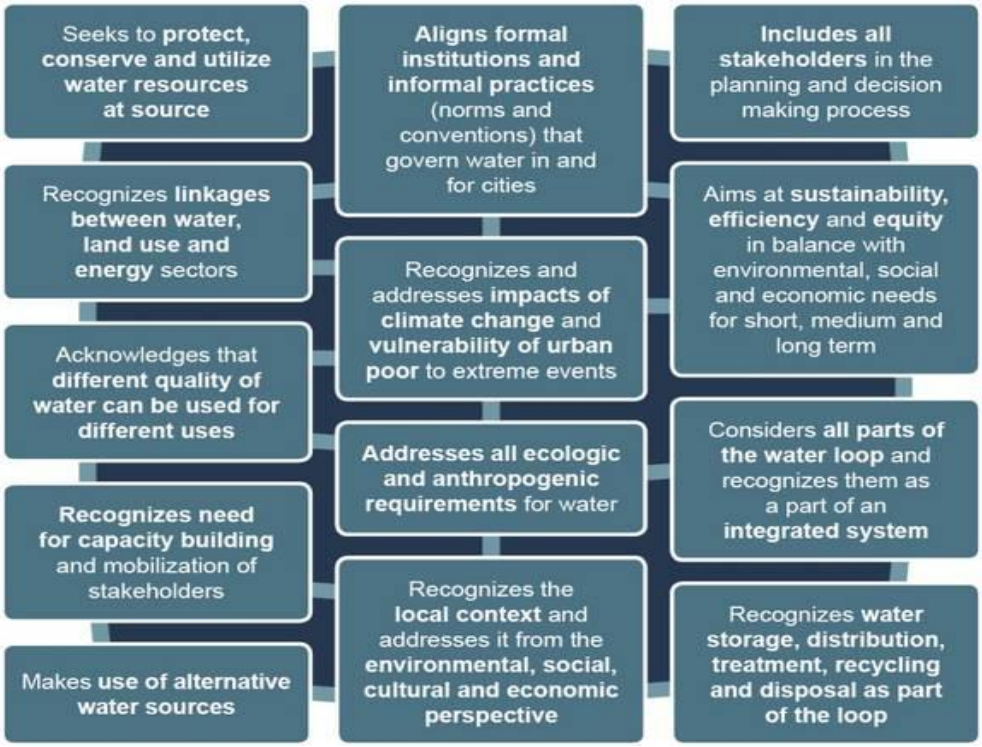

Figure2: Summary of integrated water management system

II. METHODOLOGY

This includes detailed study of mixed zone that is Purva Vibag, collecting data for water requirement, suggesting various solutions like water recharging pits, recycling, etc. As this will be pilot project for only Purva Vibhag it will be first practiced on trial basis after working properly or revised again as per the circumstances of other parts of the city, its utilization on discussing with Solapur Muncipal Corporation (SMC).

- The first step is to understand the basic concept of water management of water scarce areas. This will help in identifying the scope & the requirements of project.
- The next step is to identify practical applications of theory.
- Collecting data for selected site included consultation with various organizations which are relative sources for records. The main source of data was Solapur Municipal Corporation. It also includes surveys, meetings with the users concerned.
- Analysis is very important in further process. Analyzing the available data in understanding concepts for formulation of guidelines for project proposal.
- The last step is providing appropriate solution which leads towards the proper water management of selected area of Purva Vibhag, Solapur. The table. Below provides some statistical data of Purva Vibhag, Solapur.

Table. 1 Statistical data of Purva Vibhag

Population (Purva Vibhag)	28,587
Total number of houses	1686
Total number of families	5290 (including children)

Water management at local level for water scarce area mainly includes structural, operational, watershed, demand management, conservation, scarcity scheduling efficient technologies, water pollution control measures. The principles of this act are as follows:

1. General- Water sources, flood plains & dependent ecosystems (including ground water, wetlands) should be protected, restored & should not be degraded. Habitat animals, plants that benefit from water should be protected. Water quality should be enhanced. Cumulative impacts of water management, licenses, approvals & other activities should be minimized. Geographical, cultural, heritage, spiritual significance should be protected. Social, economic benefits of community should

be maximized. Principles of adaptive management should be applied which is responsible for monitoring, improving ecological water requirements.

2. In relation to water sharing- Sharing of water from a water source must protect the water source & its dependent ecosystems. Water from a water source must protect basic landholder rights. Extraction of water under any other right must not prejudice the aforementioned principles.
3. In relation to water use- Water use should be minimized to avoid land degradation, including soil erosion, compaction, geomorphic instability, contamination, acidity, water logging, decline of native vegetation, salinity & promote land habitation. Productivity of land should be maintained to enrich social, economic benefits.
4. In relation to drainage management- Drainage activities should be reduced to avoid land degradation, soil erosion, compaction, geomorphic instability, water logging, and decline of native vegetation. The impacts of drainage activities should be minimized [3].

2.1 Experimental Analysis

- Water is supplied by local authorities after 4-6 days, depending on the water requirement, mechanical failure, absence of operators, festivals, etc.
- 28,10,603 liters is the average water requirement for per day of citizens residing in Purva Vibhag.
- Two water reserves are present in Purva Vibhag. Water holding capacity is 17.5 & 25 lakh liters respectively.
- 108 borewells are there in the vicinity. They hold water reserves up to 42.5 lakh liters.

The borewells are usually hand operated. Electrically operated borewells are scarce. However, they prove a good source of ground water during summers and winters. But the water quality is not to the mark. Only lower class people make use of ground water source. Proper filtration of ground water is needed. This can be done establishing a small RO water purifying system adjoining to the borewells. The number of borewells should also be increased so that water can only be used when required. But due to urbanization, the quantity of ground water source is getting depleted.

2.2 Indian Water Scenario

Table.2 Details showing water resources [4]

Geographical area	329ha	2.45% of the world land area
Population	1.027 billion	16 % of the world population
Water Resources	1869 BCM	4% of the world water resources.
Water availability	Surface water-690 BCM Ground water -432BCM	India is ranked 132 out of 180 nations.
Water Quality		India is ranked 122 out of 10 nations
Annual Rainfall	Minimum 100 mm: western desert .Maximum 11000mm north eastern region, Average 1170mm : all India (4000 trillion litres)	50% rainfall in 15 days.
Total reserves	1853Trillion litres	
Non-Usable Water	777 Trillion Litres	
Usable Water	1076 Trillion litres	Ground 36 % and surface 64%
Usage	Domestic (5%)	

	Industry (6%) Agricultural (89%)	
Wastage and sewage	16.24 trillion litres	
Treated	Water 5.84 Trillion litres	

India receives four spells of annual rainfall as shown in the table. India's annual rainfall is within top six countries of world but do not conserve the rain water.

Table.3 Annual rainfall in India

Pre-monsoon rains	March-May 10.4%
South-west monsoon	June –September 73.3%
North-east monsoon	October-December 13.3%
Winter rains	January-February 3.0%

2.3 Domestic Water Consumption in India

Domestic contribution to the water consumption is projected to increase from 5% in 2000 to 11% by 2050. Domestic consumption of water is expected to triple from 2000 to 2050 per capita water consumption is expected to double from 89 liters/day in 2000 to 167 liters/day by 2050. Water stored in each house- 15, 87,360 liters.

Each family has about 2-3 containers to store water measuring up to 750 liters & 6-8 small vessels of 20 liters.

Total 700 containers are found in Purva Vibhag. Therfore, 750*700*3=15,75,000+8*20=15,75,160 liters/day.

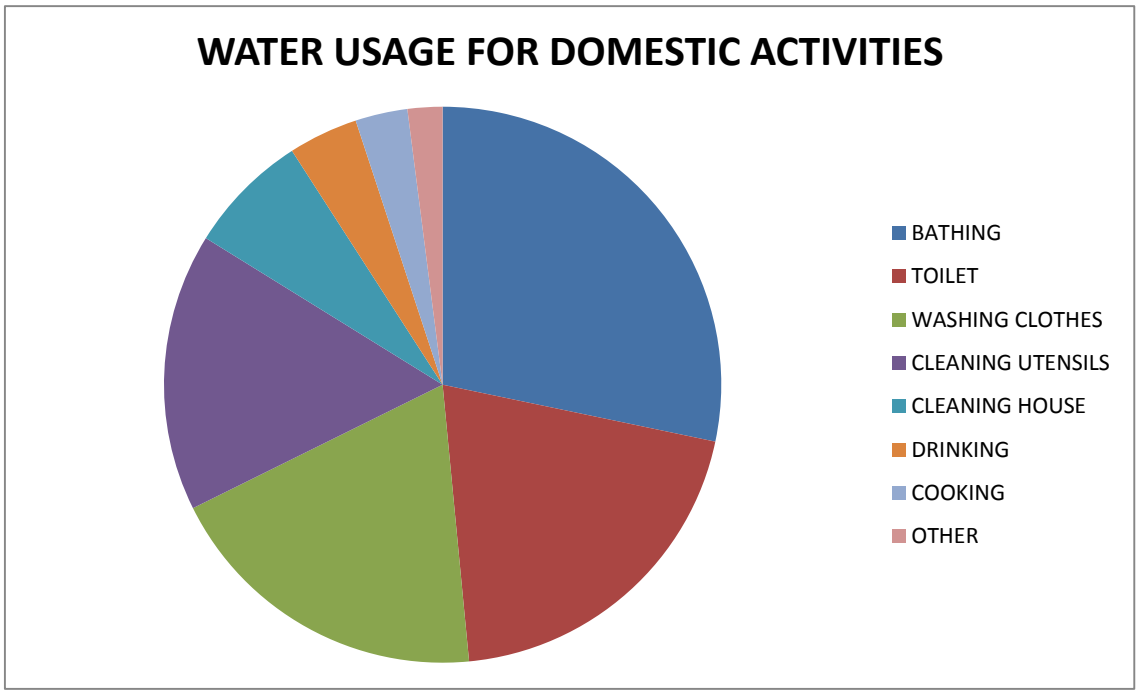

Figure3 Water consumption for daily activities

2.4 Issues regarding water quality in India

Access to safe drinking water remains an urgent necessity 30% of urban & 90% of rural households still depend completely on untreated surface ground water. Below figure.4 indicates urban & rural household dependent on untreated surface or ground water.

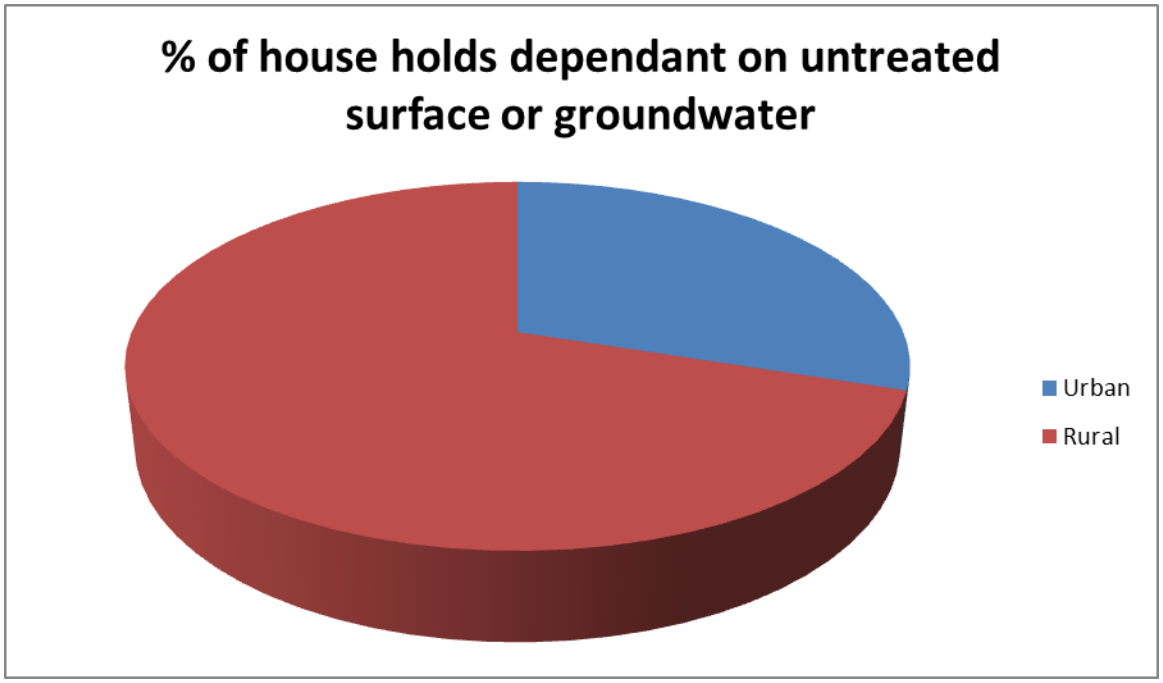

Figure4 Urban & rural household dependent on untreated surface or ground water

While access to drinking water in India has increased over the past decade, adverse impact of unsafe water on health continues. It is estimated that about 21% of communicable diseases in India are water related. Population in rural India is mainly dependent on ground water as a source of drinking water. The quality concern of ground water is often contaminated & also includes microbial contamination. In past years, Fluorosis has emerged as major public health issue in rural India. Certain agencies promote use of Chlorine Bleach (bleaching powder) as a disinfectant of water sources.

2.5 Tentative Model Approach

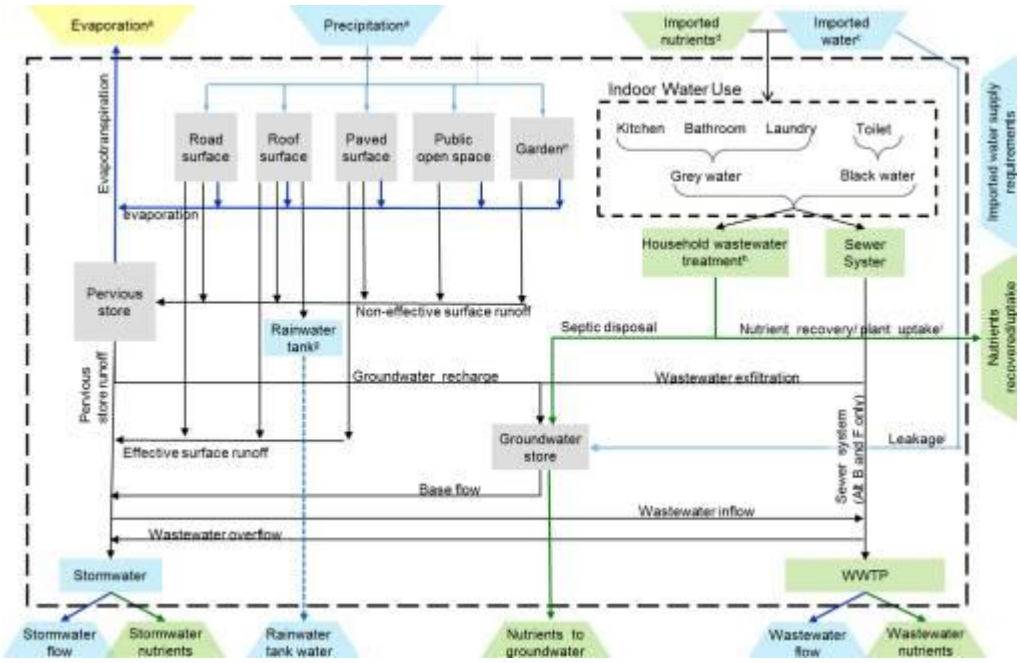

Figure5 Model of drinking and waste water management & its storage

The diagram above gives a prospective approach on how to implement proper water management & make efficient use of waste water. Though in Solapur there is water purifying plant, there is no water purification of grey water, chemical composition water. This model is an integration of water management & waste water recycling. Taking into consideration of water requirement clusters can be built which will directly depend on population & water requirement. This approach is optimistic & will certainly help in developing cities to conserve water & its reusage [5].

2.6 Industrial water consumption & wastewater discharge in India

Industrialization & infrastructure growth are projected to drive water consumption & lead to increased discharge of untreated wastewater. Industrial water consumption is expected to quadruple between 2000-2050. By 2050 industrial water consumption will reach 18 % of total annual water consumption from 6% in 2000.

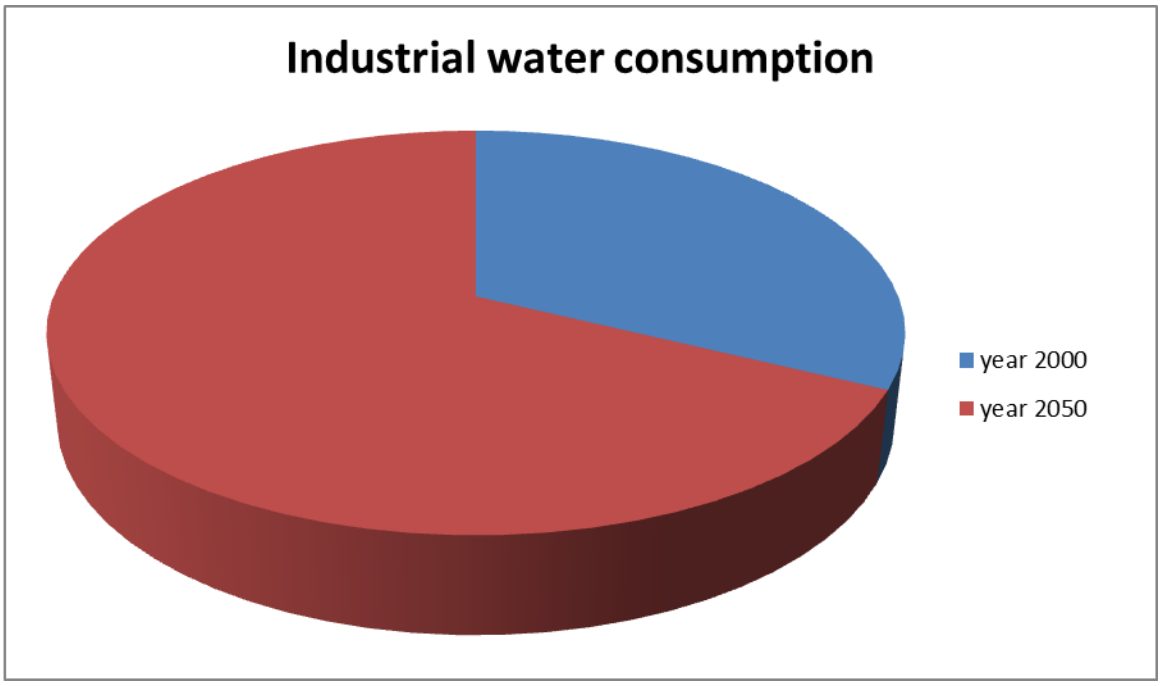

Figure6 Consumption of Industrial water

Expected water discharge causes pollution & reduces available fresh water reserves. Around 6.2 billion liters of untreated industrial waste water is generated every day. Thermal power plants & steel plants are highest contributors to annual industrial waste water discharge. In the City/Urban areas, the roof top rainwater harvesting for artificial recharge should be made mandatory. So that the available resources for drinking water supply should remain sustainable. The issue related with ground water development, augmentation and management indicates that there is need of scientific and multi-sectorial approach for making the future plan. However all the aspect related to conjunctive use, ground water legislation, involvement of NGO'S, women and community participation, mass awareness, adoption of advanced irrigation system etc. will play an important role in conserving and developing the precious water resources.

III. RESULTS & DISCUSSIONS

1. The population of the area should be carefully analysed and according to that water management should be fore casted.
2. The overall water need, its waste & how to reuse it should be studied.
3. Rainfall in the particular area should be studied & decision should be made depending on that whether to rainwater harvesting should be implemented in that area or not.
4. Ground water reserves also should be assessed. Factors such as whether there are enough ground water reserves or need to increase the number of reserves, how much capacities can it store should be calculated.

IV. CONCLUSION

1. There should be integration of water & wastewater services which will promote minimal water usage and facilitate reusing water.

2. Proper channelization of waste water and drinking water should be made.

3. Supply line of drinking water should be adopted so that water is supplied daily and there is no need for storage of water.

4. Rainwater harvesting should be implemented on household basis. Mass awareness should be started by local authorities.

5. Water management should be used based on model proposed as aforementioned.

V. FUTURE SCOPE

i. Dual water pipeline should be constructed to reduce evaporation & enhance consistent supply of water.

ii. Distributaries must be restricted depending on the people living in that area.

iii. Heavy fine should be imposed for violating water usage. Careful monitoring should be done to manage proper as per requirement.

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