



Rain water harvesting emerged as a viable alternative for sustainable development - Mumbai Suburban

***Pravin Shinde & **Dr Snehal S Donde**

*Ph.D student AMET University, ** Principal Wada College of Management and Science

*Corresponding author: shindepravin2003@yahoo.com

Abstract

Mumbai city and suburban's population is continues increase that will effect on city's fresh water demand. As per Brihan Mumbai Municipal Corporation information the city's demand is 4,200 million liters water daily (MLD) but the BMC supplies 3,400 MLD, a shortfall of 800 MLD for the city's 13 million people. The population is projected to grow 16 million by 2021, therefore the water demand will expected to rise 5400 MLD (as per hydraulic expert Madhav Chitale). For future water source, dam's construction is one of the ways to come out from this situation, but it will show some adverse effect on natural and environmental components as well. Rainwater Harvesting emerged as a viable alternative for sustainable development. Rain Water harvesting is a technology used to collect, convey and store rain for later use from relatively clean surfaces such as a roof, land surface or rock catchments. Municipal Corporation established RWH cell in 2006 to ensure implementation of RWH policy for new constructions. As per this policy NOC & occupational certificate are issue to those societies who implemented rainwater harvesting system. Unfortunately RWH plan are maintain on paper and never implement it, but occupational certificate is issued despite of non compliance of norms. As per study, Mumbai suburban's policies success ratio was found 10 %. Thus it's clear that, there is no serious effort or mechanism to ensure implementation of policies by officials. This study try to attempt to explore the efficacy of RWH policy implementation and conducted descriptive survey in Mumbai suburban buildings constructed between 2010 to 2015. The findings of the study revealed that except for few cases the idea never succeeded to any great success. The study recommends serious social and environmental assessment before approving dam projects and strict monitoring mechanism for efficient RWH policy implementation.

Keywords: water source, rain water harvesting, policy efficacy.

I. Introduction

The Mumbai city has seven major water sources for fulfillment of fresh water demand. The Vihar, Tulsi, Tansa, ModakSagar, Upper Vaitarna and Bhatsa water body were supplies approximate 3,400 MLD water to Mumbai city. As per Mumbai Municipal Corporation, the city's demand is 4,200 million liters water per day (MLD) but the BMC can supplies only 3,400 MLD, therefore everyday approx 800 MLD water shortfalls for the 13 million people. As per censes department Mumbai city population is projected to grow up to 16 million by 2021 (censes 2011), so water sources for future have to be identified.

The fresh water demand is increasing day by day therefore fresh water scarcity is becoming critical problem. Dam construction is one of the ways to out come from this situation, but it will affect so many natural and environmental components as well. As per observations, secondary literatures and Government records it is prove that dam construction activity submerge acres of fertile land, villages & natural flora – fauna.

Rainwater Harvesting practice is another feasible alternative for the situation. This practice is most

effective methods of water conservation and water management. Under this system water will be collect and storage at surface or in sub-surface aquifer, before it is lost as surface run off. Therefore improved water resource can be harvested in the time of need. According to meteorology department Mumbai city average rainfall is 2,146.6 mm, & 2,457 mm in the suburbs, with an area of 437 sq km. Therefore the city has the potential to harvest 2394.52 MLD of water. (Source: Centre for Science and Environment).

Mumbai city pre monsoon ground water levels are between 2 and 5 m bgl in southern part, whereas 5 to 10m bgl are observed in northern part. The post monsoon water levels is < 2 m bgl are observed in southern part, whereas 5 to 10 m bgl are observed in north central part (central ground water board report 2011). South Mumbai and suburban's region ground water level is very high. Therefore to avoid mixing of saline water, this area usually recommended surface storage tank for RWH practice.

On 1st Oct. 2002 government of Maharashtra has issued official G R. for insisting provision for Rain Water Harvesting. Municipal Corporation (BMC) also established RWH cell in 2006 to ensure implementation of RWH policy in all city. But still there are no serious efforts or mechanism to ensure implementation of policies by officials.

The present research study attempted to explore the efficacy of RWH policy implementation so conducted a descriptive survey in Mumbai suburbans. In this survey approximate 84 buildings were covered which was constructed between 2006 to 2014 and implementation of RWH practice was observed.

II. Objective of the Study

Dam construction is one of the ways for future water sources, but it will submerge hectors of agriculture land, forest land, villages and cause environmental degradation as well. The rainwater Harvesting is another feasible alternative for sustainable development. Therefore following objectives are studied to understand the status of rainwater harvesting system in Mumbai suburban,

1. Current status of dams construction in Mumbai & suburban's
2. Government policies on rain water harvesting system
3. To identify present status and effectiveness of RWH cell

4. Implementation of Rain water harvesting scheme in the Mumbai city
5. Status of RWH policy in Mumbai Suburban's
6. Recommendations for effective implementation of RWH Policy

III. Materials and Methods

Mumbai Suburban's housing society's survey was conducted on January 2016 to February 2016. Throughout the survey total 300 no. (Male & female)random samplings from Mumbai suburban are covered. For data collection prepared a structured questionnaire which is base on "Rain water harvesting policies and its implementation in Mumbai suburban".

Data collection was followed by informal interactions with local people and other key informants from the study area. The interviews and discussions focused on numerous aspects of the study area i.e. water source, water utilizations, people's understanding of RWH policy & their involvement in conservation activity etc. The collected data were synthesized and the useful data were extracted for study.

Sample & Tool Administered

Sample- 300 residents (male and female adult) were selected randomly in housing society

Tool- Four point rating scale survey, questionnaire & Interview schedule

IV. Findings

To out come from fresh water scarcity problem, Mumbai Municipal Corporation and close proximity other corporations are constructed around 12 water dams. These dams construction submerge more than 22,000 hectares of predominantly tribal land, which includes over 7000 hectares forest and lakhs of trees. The dam construction activity will displace more than one lakh tribals from their homes and livelihoods (Parineeta Dandekar, 2014).

Table: 1. List of water dams in Municipal corporation areas

No.	Municipal corporation	Water dam
1	Bhiwandi-Nizampur Municipal Corporation	Kalu Dam
2	Meera Bhy. Municipal Corporation	Susari Dam, Surya Irrigation project
3	Vasai Virar Municipal Corporation	Susari Dam
4	Kalyan Dombivali Corporation	Barvi dam and Poshir Dam
5	Navi Mumbai Municipal	Balganga Dam

Dam construction is affecting various natural and environmental components; it submerges almost thousand hectares of forest and agricultural land. Due to this activity local people would be displaced as well as they lose their source of income and livelihoods

(HimanshuThakkar,2013).Instead of all these losses still government issued environmental clearance to such type of activities. The on-going and planned water dam's details are given in the table.2

Table: 2.The on-going and planned dams in Mumbai and suburbs area

Water Dam	Submerge Area(Ha)	Forest affected area(Ha)	Population affected	Environmental clearance status
Kalu (Part of Vaitarna)	2100	999 Ha.	3169	Getting Environment clearance from MoEF & cc
Shai	3040	494.1 ha. Land , 43000 trees to be cut	5124	Getting Stage I forest clearance on 2011.
Middle vaitarna	34733	760 (over 100000 trees cut)	8 villages(min. 1600 people)	Submerging part of Tansa wildlife Sanctuary is cleared
Balganga	1240	265 Ha.	8000	Not applied for forest clearance in MoEF, which is illegal.
Gargai (Part of Tansa)	900	750	3000	Affecting part of Tansa wild life sanctuary is cleared
Pinjal	2000	1188	NA	Affecting part of Tansa wild life sanctuary is cleared
Barvi	4442.03	1214 (reports)	3375	Forest clearance in 2000

(Source: MMRDA Regional Plan for Mumbai Metropolitan Region 1996-2011)

Rainwater harvesting system is one of the concepts which can solve water shortage problem up to certain level. Therefore Municipal Corporation are issued some policies on RWH

Government policies on RWH (Source: RWH cell – Mumbai):

Year 2002: Maharashtra Gov. and MCGM made RWH mandatory for buildings of plot more than 1000 sq m and granted water connections of only 90 lpcd as compared to 135 lpcd supplied earlier

Year 2005: Directive by state government made RWH mandatory for all developers

Year 2007: RWH under MCGM was also made mandatory for buildings coming to MCGM for additions/ alterations/ FSI TDR use, & the same provision became mandatory to buildings having a plot area of 300 sqm and above.

As per EIA notification 2006, rainwater harvesting is mandatory for all new construction projects. Municipal Corporation established RWH cell in 2006 to ensure implementation of RWH policy for new constructions. As per this policy NOC & occupational certificate are issue to those societies who implemented rainwater harvesting system. Till June 2009 approximate 900 buildings getting occupational certificate from RWH cell (Source: Rain water harvesting cell – Mumbai).

The BMC has recently made an amendment in the municipal act whereby it has stated that all future residential and commercial complexes above 5,000 sq

meters should install water harvesting mechanisms. The Rain water harvesting policies status are given in the Table.3

Table: 3. Rain water harvesting scheme is implemented in the Mumbai city

No	RWH scenario in Mumbai	Status
1	1 st Oct. 2002 to 31 st July 2013	Total environmental clearance granted 3277 building <ul style="list-style-type: none"> City area: 47 no. East suburban: 630 no. West suburban: 2600 no.
2	From 2007 to 2013 (Seven years since the rule)	<ul style="list-style-type: none"> New buildings: 6855 no. RWH system installed: 3008 no.(successful ration 44 %)
3	Total RWH started in old building	400 no
4	RWH available in BMC school (Mumbai)	<ul style="list-style-type: none"> BMC school: 144 no. Available RWH facility: 70 no.(successful ration 49 %)
5	Bld. Plot area more than 1000 sq.m	RWH implementation ratio 44 %
6	Bld. Plot area more than 300 sq.m	RWH implementation ratio 43 %
Violations more rampant in the eastern suburbs than western suburbs		

(Source: Rain water harvesting cell – Mumbai)

Rain water harvesting survey in Mumbai suburbans:

The Mumbai suburban areas rain water harvesting survey and data collection was done to estimate the implementation of RWH policy. Data was collected through informal interactions with local people and

other key informants from the study area. During this survey study areas new and old construction societies are consider knowing the status of RWH system, and interacts with local people to checks the awareness about the policies. As per study total survey areas and their RWH implementation ratio is given in table no.4

Table: 4. Mumbai suburban’s RWH implementation ratio during 2010 to 2015

No.	Suburban area	Survey areas	Total survey buildings (no.)	Implementation of RWH system
1	Bhayandar (W):	Uttan village	18	Nil
2	Naigaon (E):	Juichandra	15	6 (storage tank)
3	Vasai (E):	Sativali village	10	2 (storage tank)
4	Nalasopara (E) & (W):	Unauthorized (load bearing) buildings	25	Nil
5	Virar:	Kargilnagar, Manvelpada	16	Nil
Total			84	8
Successful ration 10 %				

During survey total 84 buildings and approximate 300 residents (male and female adult) were selected for personal interaction. On basis of survey & people perception total 10 % of implementation ratio was observed. As per field observation it’s clear that,

RWH policy is not reasonably formulated, as a result policy implementation ration is very low. Graphical RWH police success ratio is shown in the figure 1 and 2.

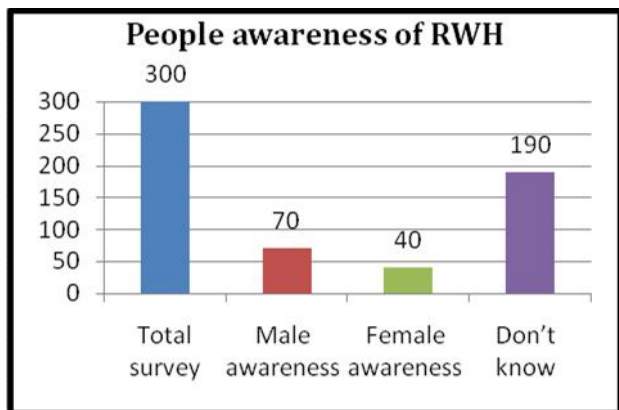


Fig. 1 People awareness of RWH polices

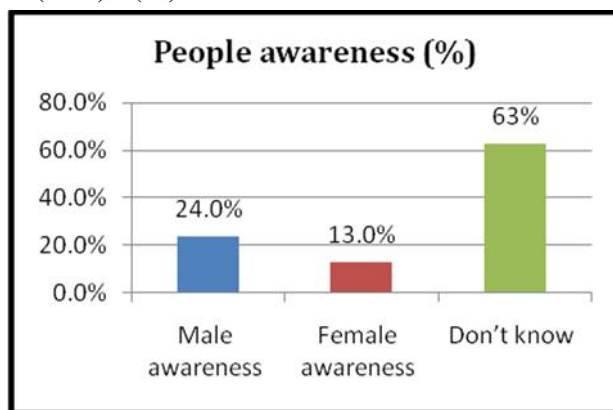


Fig. 2 RWH polices awareness percentage

V. Results and Discussion

Water dam is one of the future water sources for growing population. But concern with other losses, the dam construction is not feasible option on water scarcity. Rainwater harvesting system is one of the viable alternatives on dam construction and effective methods of water conservation (Pravin & Dr. Donde, 2015). In 2002 Municipal Corporation has established rain water harvesting policies & amended these policies on 2005 & 2007 respectively, but unfortunately there is least effort by authorities to explore alternative sources.

During experimental survey total 84 buildings and approximate 300 residents (male and female adult) were selected for observation. Out of 84 buildings only 8 no. of buildings implement RWH policy. Empirical findings show that only 10% RWH scheme is implemented in the Mumbai suburban's between 2010-2015. Subsequently out of 300 surveyors 24% male & 13% females are aware and 63% are not aware about the policy. Construction builders maintain RWH plan on paper but never implement it, as occupational certificate is issued despite of non-compliance of norms. Hence it's clear that, there is no a serious effort or mechanism to ensure implementation of policies by officials. Municipal Corporation must ensure optimal use of every option for water resource before approving any dam project. Rainwater harvesting system is best feasible alternative for water conservation, therefore Corporation must study and identify type of RWH system suitable in context to Mumbai city and suburban areas and accordingly help in installation. Most of the builders maintain RWH plan on paper and never implement it, therefore Municipal Corporation issue NOC or completion certificate to new constructions only after inspection of installation

RWH plant. State level environment committee (SEAC / SEIA) should make some strict criteria for RWH before issue environment clearance to the new construction project.

References

1. A real-time urban Rainfall monitoring and flood warning System for disaster Management in Mumbai (Dr. Kapil Gupta IIT Mumbai - 2006)
2. Concept & practices for Rain water harvesting Central pollution control board (Oct.2001)
3. Dams in tribal belt of Western Ghats for the Mumbai Metropolitan Region: Unjustified Projects – Better options exist (South Asia Network on Dams, Rivers & People – Dec.2013)
4. Efficacy study of mandatory rain water harvesting policy implementation by BMC as an alternative water resource facility for Mumbai city (Pravin Shinde & Dr. Donde - 2015).
5. Ground water scenario in major city of India, Central ground water body – Gov. of India (2011).
6. "Importance of Rain Water Harvesting in Current Scenario". (S. R. Asati, Deshpande- 2006)
7. Mumbai's Water Supply MMRDA Regional Plan for Mumbai Metropolitan Region (1996- 2011).
8. Mumbai city development plan (2005 – 2025)
9. Potential Roof Rain Water Harvesting In Pirwadi Village Of Kolhapur District, Maharashtra (India) - A Geospatial Approach (V.S. Pawar, Sagar Mali - 2013).
10. "Rain Water Harvesting, Conservation and Management Strategies for Urban and Rural Sectors." (Dr. R. K. Sivanappan - Nov. 2006)
11. Rain Water Harvesting in Mumbai, India (Prakash M Apte Urban Development Consultant)

12. Rainwater Harvesting as an Alternative Water Supply in the Future (Che-Ani A.I, Shaari N 2009)
13. "The Scope of Rainwater Harvesting in Urban Areas." (Sandip. H. Deshmukh Prof. R. B. Magar - Nov. 2006)
14. Why is there a drought of rainwater harvesting in Mumbai? (Rishi Aggarwal & JankiPandya)
2. Rainwater harvesting a joke in Mumbai finds studies -TNN - Mar 23, 2013,
3. Times of India: Much of MMR has unmetered water supply, demand to double in 15 years (14 July 2016).
4. Times of India: 7 years on, BMC yet to harvest rain from much-touted scheme (Jul 3, 2014,).
5. Govt. moves slow on rainwater harvesting (May 6, 2015, TIO Delhi)
6. Rainwater harvesting gains ground, residents launch awareness drive (Jun 29, 2016)
7. Rainwater harvesting policy before monsoon (Neha Lalchandani - TNN - May 25, 2016

News paper articles:

1. Times of India: Rainwater Harvesting as an Alternative Water Supply in the Future (2013)

Access this Article in Online	
	Website: www.ijarbs.com
	Subject: Rainwater harvesting
Quick Response Code	
DOI:10.22192/ijarbs.2016.03.11.005	

How to cite this article:

Pravin Shinde & Snehal S Donde. (2016). Rain water harvesting emerged as a viable alternative for sustainable development - Mumbai suburban. Int. J. Adv. Res. Biol. Sci. 3(11): 47-52.

DOI: <http://dx.doi.org/10.22192/ijarbs.2016.03.11.005>