Water Smart Dwelling- Answer to Water Scarcity

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ABSTRACT

Water scarcity! It is indeed a big issue in contemporary context. It is evident that earth surface is covered with 71 percent of water; still surface water is inadequate to meet our demand, since only 3 percent of water is considered to be fit for human consumption. Out of which less than 0.3 percent of water is available as surface water, and we have to depend on ground water for our various needs. Because of rapid growth and urbanization, percolation of rain water into the sub-soil has decreased drastically and recharging of ground water has decreased which results into urban flooding and scarcity of ground water. Water smart house design provides an alternate to the traditional conveyance approach towards rainwater management. The paper focus on reuse of water as a measure to decrease the dependency on ground water, at the same time comparison of foregoing water saving practice with advance planning strategy, and the new water usage scheme will be amalgamated.

The proposed strategy will help in reducing dependency on ground water, replenishing water table, and will aid in resolving problem of water scarcity. The argument selected will help in bringing social awareness along with the proposed solution to overcome water shortage.

Keywords: Water scarcity, Water conservation Practice, Rain water harvesting, Water demand, Reuse of water, Sustainable, Urban flooding

1. INTRODUCTION

Water a prime source for live hood. We cannot think of our life without water. Although it seems water is available in abundance on earth surface, still we face scarcity of water every summer. When we look globally, 70 percent of earth's surface is covered with water. Out of which 97 percent of water is saline water available in form of sea and ocean. Only 3 percent of water is considered to be fit for human consumption, out of which 2 percentage of water is in form of polar ice caps and glaciers. Only less than one percent of water is fresh water, which is considered to be fit for human consumption.

Water is a renewable resource. It can be replenished by water cycle, the process gifted by nature. Being responsible citizen it is our moral duty to come up with solutions which will adhere to the same. This can be achieved by intelligent planning of surrounding, and efficient water

management. This will not only help in maintaining water balance but will help in resolving the problem of water shortage.

2. WATER SMART DWELLING

Water smart dwelling is a built mass which is designed to reduce the disturbance in natural water cycle by amalgamating landscape as a design tool. It also respects site and it's surrounding such as contour, water source, water quality and the like. Water smart dwelling focuses on optimum utilization of water with reuse strategies for non potable use.

3. NEED

Figure 1: Urban flooding, (Source: Urban flooding http://www.indiawaterportal.org/articles/basic-guidelines-about-floods-causes-consequences-precautionary-steps-and-some-dos-and)

Water smart dwelling takes care of negative impact of urbanization on natural water cycle. Due to the results of rapid urbanization, fast growth, and unmanaged planning, all the rainwater is dissipated as waste water. The central collection system collects all the rain water or storm water or excess water and is discharged as waste water. Whereas this is not the appropriate practice to consider precipitation as waste water, since it is the part of natural water cycle. This mind setup results in disturbance of natural water cycle and shortage of water. The following benefits can be achieved by:

- Reduction in hard/ non-porous area.
- Proper drainage system.
- Reduction in urban flooding because of impounded water in non porous surface.

- Recharging of ground water table.
- Effective utilization of water resource.

4. HAND DOWN PRACTICE

We think water conservation is a new practice, but it's footprints are dated long back in history since Indus valley civilization which is justified with the ruins of Great bath of Mohenjo-daro, step well, water storage tanks of Dholavira. Our ancestors did understand the importance of water and the knowledge of hydrology is rooted deep in the scientific findings of ancient India.

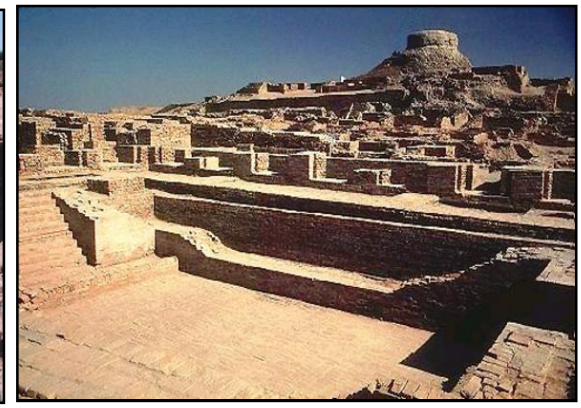

Image2: Dholavira Sophisticated Water Reservoir. Image3: Great Bath, Mohenjo-daro.

(Source: http://en.wikipedia.org/wiki/Sanitation_of_the_Indus_Valley_Civilization)

According to the varying geography of India, the different techniques were developed which reflects the intricate detailing according to the region and culture of community.

5. TRADITIONAL WATER HARVESTING METHODS

Few examples of water harvesting techniques categorized by regions are as follows:

Table1: Region wise categorization of water harvesting structure.

S.No.	Water Harvesting Structure	Location in India
1	Paar system, Saza Kuwa, Johad, Kunds, Beris, Tankas, Khadin	Rajasthan
2	Talab/ Bandhis	Bundelkhand region
3	Kundis, Virdas, Bavdi	Gujarat
4	Ahar-pynes	Bihar
5	Kohli Tanks, Bhanadaras	Maharashtra
6	Cheruvu	Andhra Pradesh

7	Kere	Karnataka
8	Zings	Ladakh
9	Kul, Khatri	Himachal Pardesh
10	Naula	Uttaranchal
11	Zabo, Cheo-ozihi	Nagaland
12	Eri, Ooranis	Tamil Nadu
13	Dongs	Assam
14	Apatani	Arunachal Pradesh
15	Katas/ Mundas/ Bandhas	Orissa and Madhya Pradesh
16	Korambus, Surangam	Kerala
17	Bamboo drip irrigation	Meghalaya

All the water harvesting techniques listed above are developed according to the land form and the climate of the region. Hence this gives strong relevance of planning structure according to need. No generalized parameter should be adopted as solution for varying climate and land form.

6. PRECIPITATION ANALYSIS

The average annual rainfall in India is 1250mm. Although having such a good amount of rainfall, India still faces the problem of water crises. Along the length and width of India various climatic conditions prevails and hence their precipitation level also varies according to region and months. Therefore every suggestive built form should come up with a sustaining solution for the defined region. Few of methods to be adopted for water smart dwelling are listed in the paper.

7. METHODS FOR DESIGNING WATER SMART DWELLING:

1. Storage of rain water
2. Recharging of aquifers
3. Reuse of water
4. Drainage design
5. Site planning

1. Storage of rain water

Storage of rain water is one of easiest and age old technique. In older days, big public structures were constructed to store rain water in the form of pond and lake. But due to shortage of land ponds were filled to make multi storey structures to fulfill the housing demand. Therefore, alternate

option for storage of rain water was carried out for individuals. The rain water is stored in RCC or Plastic water tank for all non potable use. This will help in reducing the stress on potable water demand.

2. Recharging of aquifers

To overcome the problem of water storage on the land surface, the solution was suggested to refill the water in aquifers. This can be easily done by recharging structures. The various recharging structures are percolation pit, soak ways, recharge trough, recharge pits, and recharge well. The water smart dwelling comes up with suggestive solution which will be the integrated part of landscape in form of infiltration devices. The infiltration devices are explained as following:

Image7: Porous pavement for pathway. Source:http://www.lastormwater.org/green-la/low-impact-development/residential-solutions/permeable-pavements-or-porous-pavement-systems/

3. Infiltration Trench

Infiltration trench is an excavated linear arrangement made to collect the surface runoff from the nearby surroundings and filled with high permissible soil to allow percolation of water into ground. The soil particles stop pollutants in the form of large particles to enter the ground. The collected organic pollutants are decomposed by microbial bio-films present in the soil. Although the infiltration trench requires periodic maintenance to maintain good porosity of soil, such type of trenches can be adopted in areas where pollutants in the form of silt/ sand are low. This type of arrangement will directly hammer the percolation rate of water into the ground. The position of trench should be decided in such a manner that chemically contaminated water (nearby industry run off) doesn't enter the infiltration trench as it can pollute the water table of region. It should also not be made adjoining any building since it will result in dampness. The infiltration trench helps in

maintaining the ground water table and also reduces the valuable rainfall to be converted into waste water and further helps in decreasing the load on treatment plant.

4. Infiltration Basin

Infiltration basin is recession in ground surface to receive storm water runoff from non permeable catchment area and is similar to a planter in landscaping. It is one of the landscape elements which filters surface runoff and also provide opportunity for infiltration of storm water. It should be taken into consideration that when storm water is diverted into infiltration basin some entry disrupter should be used to reduce down the velocity of flowing water which may cause soil erosion. It requires periodic maintenance for removal of pollutants collected and to check the growth of vegetation.

5. Wetlands

Wetland is a shallow depression created or exists in the site where water is impounded either seasonally or permanently. It is unique from other type of water body as it contains aquatic plants. It contributes to the landscape along with the balancing of ecology. Water impounding helps in recharging the aquifers. It can only be adopted if the site area has ample open space for such landscaping.

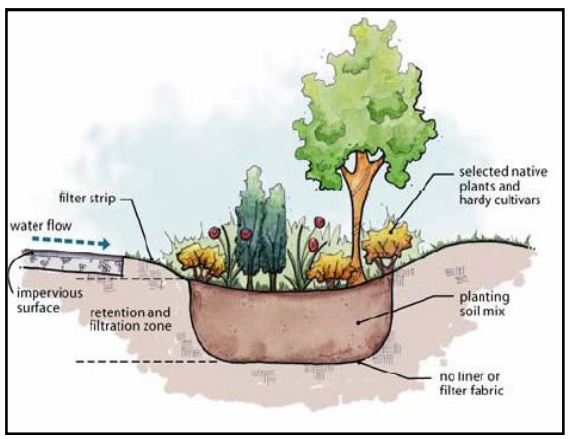

Image5: Infiltration basin. Source: www.abettercity.org **Image6: Wetland.** Source: Inhabitat.com

8. POROUS PAVEMENTS

Porous pavements are permeable surfaces with storm drain/ temporary reservoir underneath, from where water can be diverted to recharge pit or soak pit. The drain or reservoir can be provided with porous pipe. This enhances the water percolation during transmission and can directly contribute in the recharging process. This type of technique helps in decentralizing the rainwater and prevents it from converting into waste water. Porous pavement reduces the quantum of surface runoff to be

converted into waste. This type of pavement system requires periodic maintenance to maintain the porosity of pavement. It is not preferred in an area with high water table or near water source.

3. Reuse of water: Recycling of gray water:

The waste water which can be reused is known as gray water. Grey water is collected from sinks, wash basin, bath room shower area, washing area etc. It can be directly used on site for irrigation of landscape area. To protect landscape, low sodium soap and other products should be used to make the system efficient. The grey water can also be used for all non-potable purposes such as toilet flushing, gardening, washing of streets etc. In order to make this practice successful, plumbing system should be designed in such a manner that, there should be separate plumbing work for potable and non-potable water. For conservation of urban water supply, the buildings should have twin water supply system, one for potable use and other for non-potable use.

4. Drainage design:

The plumbing system should be designed in such a way that grey water from bathing area, washing area and the like should be carried out separately and black water from toilets should be directly diverted into sewer line. The grey water can be directly used on the site as discussed above. The rain water from roof tops, landscape area, and paved area should be collected separately since it is pure form of water which does not require any treatment to be used for non-potable purpose. This will also helps in reducing the load on treatment plant as rain water, grey water and black water are conveyed separately.

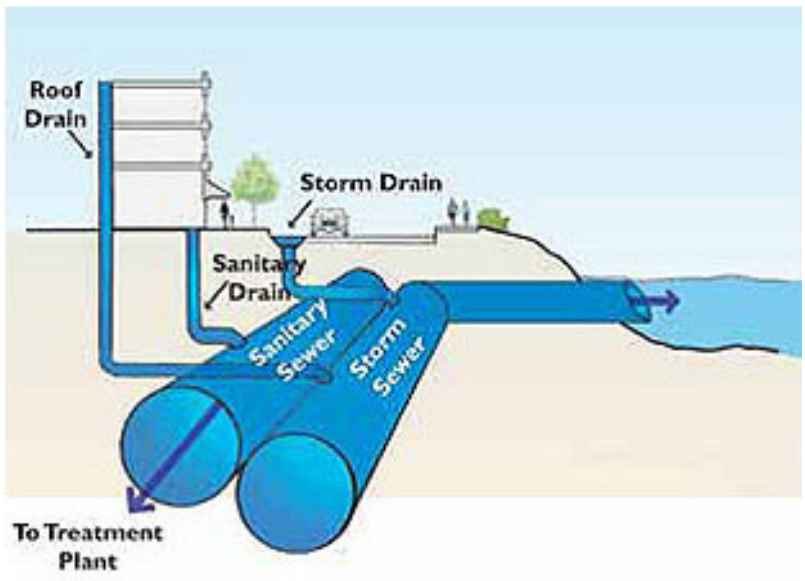

Image8: Separate drainage system. **Source:www.sfbetterstreets.org**

5. Site planning:

During the site planning existing site conditions should be respected. The depression or low lying area within the site can be used as rain water harvesting structure, which can store the rainwater and partially contributes in recharging aquifers. Such type of water body also contributes in maintaining micro climate. Depending upon the site soil conditions vegetation species should be selected which require watering. This helps in reducing the velocity of surface runoff. The built mass proposed should take care of reducing hard area (non-porous area). The soft or porous area should be uniformly distributed on the site so that runoff water can be decentralized and direct recharging or storage is possible. This will reduce the wastage during transmission. The non-porous area within the site can be curtailed down, when intelligent planning is done.

9. CONCLUSION

Because of rapid growth and urbanization, percolation of rain water into the sub-soil has decreased drastically and recharging of ground water has decreased which results into urban flooding and depletion of ground water. Water smart house design provides an alternate to the traditional conveyance approach towards rainwater management. The implementation of discussed measures will help in reducing the main water demand. To have effective result these should be designed as integrated part of site planning. Adaptation of water smart measure helps to maintain over all natural water balance, overcome problems like urban flooding and soil erosion. Use of such measures in urban areas may help to overcome shortage of water during summer, and can reduce the cost required for water transportation. Water smart dwelling is a strong measure towards sustainable architecture it should be explored and practiced further.

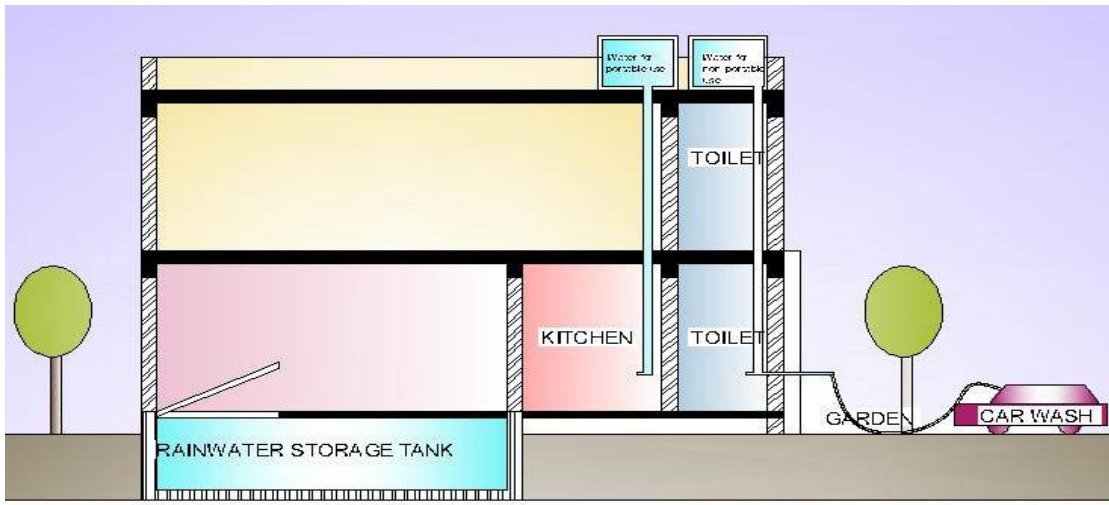

Image8: Schematic diagram of proposed water supply Source: Courtesy of the author

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