

Rain Water Collection for Domestic Use: A Solution for Water Supply to Urban Low Income Communities

Salma A. Shafi

Architect Planner

ABSTRACT

In recent years public authorities, NGOs and various donor agencies have been trying to provide basic social and physical services to the urban poor through community and organized slum upgrading techniques. Health, education, credit schemes etc. are now provided with cooperation of these agencies to a high number of low income communities in urban areas all over the country. The EPI program, primary health and education, micro credit schemes for women etc. are some of the successful programs bringing relief to the poor. Low cost sanitation has made very good progress in such communities. Water supply is still a problem area and efforts are being made to tackle the need for water both for drinking and domestic use.

In the back drop of such a situation it is the opportune moment now to introduce rain water collection as a source of safe water for domestic uses. In Bangladesh there is record of rainfall for almost half of the year. Rain water can serve as a source for domestic tasks such as washing, cleaning and personal hygiene. It may even be used for cooking purposes. During floods rain water may also be used as a source of drinking water.

For the low income communities living in kutcha and semi-pucca (tin roof/thatch roof) structures in urban slums and squatter areas, water sources are normally street hydrants or shared tube wells. Many people resort to buying water and this is common in Dhaka and some big cities. The amount of water accessed per household is mostly inadequate to cover their needs. If a scheme of rain water collection can be introduced in these areas households can use rain water for domestic purposes such as washing dishes and clothes, house cleaning and personal hygienic such as bathing, toilet use etc.

Micro credit schemes are already operating in many low income communities. To these schemes credit for house improvement along with rain water collection can be added for health and sanitation improvement. A lending program to small land owners and private slum owners will go a long way in providing basic needs in health and sanitation improvement.

For the urban squatter population of Bangladesh who live in temporary shelters in most cases it is not possible to collect rain water at the household level. The possibility is to provide a community collection system whereby rain water will be collected in commonly used structures such as schools, mosques, community centers etc. Community toilets and wash areas as well as public toilets everywhere can use rainwater for sanitation purposes.

These structures are widely available in all urban areas. The method of rain water collection and use in these centers has to be introduced. This will be worked out in cooperation with agencies that are already providing social services in these areas. The sharing and use of water by households will be worked out by the communities themselves.

A. INTRODUCTION

In recent years public authorities, NGOs and various donor agencies have been trying to provide basic social and physical services to the urban poor through community and organized slum upgrading techniques.

Rainwater Harvesting and storage is not a new technology. It has been used for domestic, agricultural uses for a long time in different parts of the world. However, rainwater harvesting is not a common practice in Bangladesh. Only 35.5 percent households have been found to use rainwater as a source of drinking water during the rainy seasons in coastal areas those having high salinity problems. In the backdrop of arsenic contamination in groundwater of Bangladesh, rainwater can be considered as a potential source of arsenic free water.

In this article the author has explored the possibility of rain water collection and use in the slum and squatter areas of Dhaka and other cities. Recent data on the climate conditions of Dhaka region are:

Average temperature, rainfall data for Dhaka

Normal Maximum Temperature (°C)												
St Name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Dhaka	25.4	28.1	32.5	33.7	32.9	32.1	31.4	31.6	31.8	31.6	29.6	26.4

Normal Minimum Temperature (°C)												
St Name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Dhaka	12.7	15.5	20.4	23.6	24.5	26.1	26.2	26.3	25.9	23.8	19.2	14.1

Average Normal Rainfall in mm												
St Name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Dhaka	7.7	28.9	65.8	156.3	339.4	340.4	373.1	316.5	300.4	172.3	34.4	12.8

Source: Bangladesh Meteorological Department, 2012.

Roofing Materials in Bangladesh

Different types of roofing materials are used in Bangladesh. These include cement concrete, tiles, C.I./metal sheet, and straw with or without polythene covering, bamboo with polythene covering. According to the Bangladesh Bureau of Statistics (1995), about 48% households in the urban area have tiles, C.I./metal sheet as roofing materials. These roofing materials are suitable for rainwater catchment. However, others can be used with some modifications such as use with polythene covering for straw roofing. These should be introduced without delay in all high density low increase areas. The opportunity to start the system of rain water collection in these centers should be introduced. The method of construction and use will have to be worked out in cooperation with agencies that are already providing social services. The use of the water by individuals or families would be worked out by the community.

B. FEATURES OF RAIN WATER COLLECTION

The two major components in rain water harvesting system are the catchment and the storage'. Most commonly 'roof tops' are used as the catchment. The rain water from C.I sheet or thatched roof is collected into a suitable storage or tank by means of a gutter system of adequate design. A gutter is a device to work as an inlet structure for collecting the water which runs off the sloped or horizontal surface. Conventional gutters are normally used, and these can be made at low costs with U-shaped lengths of tin sheet or PVC pipe or bamboo cut along the length and clamped to the edge of the roof with wire rope.

Estimated Water Need and Consumption

The need for water, particularly during dry season is estimated as follows for drinking: 2 liters per head per day.

For dry months which are November, December, January, February and March:

The need is 2 lit. x 30 days x 5 months = 300 lit. x 6 persons average per family= 1800 liters.
10% Contingency = 180 liters; Total = 1980 liters or approximately 2000 liters per family.

Storing the collected rain water in one 2000 liters capacity jar or two 1000 liters capacity jars can meet the requirement of a family during dry season.

Cost Details:

Capacity of Containers	Amount in Tk.
1,000 Liters Jar	2,500.00
2,000 Liters Jar	3,000.00
3,200 Liters Tank	6,000.00

Rain water collection from roof

Roof catchment tanks can provide good quality rain water; clean enough for anyone to drink so long as:

- I. A clean impervious roof made from nontoxic material is used (lead paints and asbestos)
- II. Roofs 'should be avoided')
- III. Roofs should also be free from over hanging trees since birds and animals in the trees
- IV. May defecate on the roof.

Accounts of serious illness linked to rain water supplies are reported to be almost nil in countries where this is a common method of water use. So it would appear that slight contamination of roof run-off from an occasional bird dropping on the catchment surface does not represent a major health risk. A study shows that if taps connected to tanks can be kept at least 10cm above the bottom of the tank, allows any debris entering the tank to settle of the bottom, provided it remains undisturbed and thus will not affect the quality of the water. Ideally, tanks should be cleaned annually.

Design and drawings of rain water collection from roof and ground are shown in Annexure 1&2

Details of Construction

The jars for rain water storage can be made for both 1000 liter and 2000 liter capacity. The jars are durable, elegant and cheap, using only materials that are easily available and tools that can be made by almost any craftsman. A skilled craftsman with one assistant can complete the work to set the steel frame and make the jar in two to three days. Un-skilled craftsmen can easily be trained to do this work.

The materials mainly required are cement, sand, wire mesh etc. 8 vertical steel are assembled with 5 circular horizontal steel of varied diameters subject to width from jar mouth to jar bottom. Then vertical steel reinforcement is divided into 24 smaller parts and every contact area of vertical and horizontal steel reinforcement is welded. Each frame segment is reinforced with wire net and finally covered with jute sacks and held with plastic ropes. Accordingly jar mouth and base moulds are also constructed using steel or zinc sheets of varying widths as necessary for different capacity jars. After preparing the moulds, the base, frame segment and mouth of jar are plastered with clay around surface of mould and subsequently reinforced with wire. Faucet and drain pipe are installed conveniently at the final stage.

Economic and Social Consideration

Economic and Social issue is crucial for introduction of water harvesting systems to the both urban and rural Bangladesh. Clearly, up-front payment in cash for storage tank creates a major problem for lower income groups. The change in social habit of using rain water will take some time to develop particularly when communities in urban areas have become used to piped water. The success of rainwater harvesting system program depends on the interest, enthusiasm and active support of the users. Groundwater is the major source of water supply for more than two decades in Bangladesh. People still have a negative attitude about the use of rainwater. The rainwater harvesting program can be implemented only when people have the willingness to use the system. Failure to involve the community in the planning, design, sitting and construction of the rainwater harvesting is learnt as a common cause of failure of the system in many countries.

Although the capital cost of rainwater harvesting is high, this cost in some extent is offset by their negligible recurrent costs. The average life expectancy of a storage tank is considered about 10-15 years. The cost of the system is also reduces when the free labor is available from the user. Implementation of rainwater harvesting in rural Bangladesh requires the external support. Government or other supporting organization can provide promotion through subsidy and establish revolving funds for the capital cost of the system.

Another promising option for financing is through micro-credit schemes. Rainwater harvesting can be coupled with other income generating activities and the cost can be recovered with a low interest rate.

Technical Consideration

The rainwater harvesting system for long term use is a new technology in Bangladesh. The system requires to incorporate materials, skill and construction procedures that are compatible with the local conditions. Extensive training and demonstration program is essential for the construction procedure and operation and maintenance of the system.

Segmental Tank

The segmental tank has a cylindrical shape. It is built by an assembly of precast cement segments composed of a mixture of cement and sand. Its inner and outer side is cement paved and its lid is cement precast. The tank is much easier to assemble than that of steel frame and can be built in a large quantity at a time. It costs about Tk. 6,000.00 and the storage capacity is about 3200 liters.

C. A STRATEGY TO INTRODUCE RAIN WATER COLLECTION AMONG THE URBAN POOR, CASE OF DHAKA CITY

Dhaka has a critical water supply problem, one of the worst for a South Asian city. According to a study by the Institute of Water Modeling based in Bangladesh's capital city, its groundwater level is falling by three meters per year. Groundwater has already receded by fifty meters in the past 40 years, bringing the current level to sixty meters below ground. The supply-demand gap is approximately 500m liters per day. The situation is so problematic that in the summer of 2010, the Government of Bangladesh deployed troops to manage water distribution in Dhaka.

Since 1963, the population of Dhaka has grown by thirteen times. When Bangladesh gained its independence in 1971, Dhaka faced a growing influx of rural-to-urban migration. The city expanded into the low-lying marshlands at its borders. Historically, most of Dhaka's water supply comes from its two rivers, the Buriganga and the Shitalakhya. But as population has increased and industry has expanded, river water has become contaminated with industrial waste. Today, groundwater is expected to satisfy over 80% of the city's water supply.

Infrastructure in Dhaka is not robust enough to sufficiently recharge groundwater. In a recent seminar, international NGO Water Aid and Bangladesh's Institute of Engineers concluded that rainwater harvesting needs to be included in establishing the country's bylaws. In 2008, it was recommended that 40-50% of building premises should remain unpaved and that half of that area should be under "green" cover to allow for natural recharge of aquifers. The caveat though is that 65% of Dhaka is already paved and the remaining 35% does not ensure natural recharge of aquifers because top soil in most of these locales consists of clay.

Rainwater harvesting, low-cost systems that collect and store rainwater for year-round use, offers a cost-effective and practical solution to ease Dhaka's water crisis. It is estimated that rainwater harvesting (RWH) systems could supply more than 15% of Dhaka's requirements. Since 1997, one thousand RWS have been installed in Bangladesh, mostly in rural areas. The systems' capacities vary from 500L to 3,200L, at costs in the range of US\$50-150. If RWH is undertaken as a serious investment, it could help conserve groundwater and recharge the water table. About 150bn liters of rainwater could be harvested during the monsoon season alone. Water can be stored for four to five months without bacterial contamination – an important fact given that 110,000 children in Bangladesh die of waterborne illnesses every year.

People can construct storage reservoirs so that they can use rainwater during the entire rainy season and about 2-4 months of the dry period. The capacity and the construction materials of the reservoir and its maintenance depend on the socio-economic condition, population, educational background and awareness of the habitants of the area. There is a great need to find new sources of water specially drinking water in developing countries like Bangladesh. The reality that we are facing in the cities is that, there is no short term possibility of providing even the most basic of services to the large number of urban poor.

Yet strategies must be taken to develop low cost technologies and sustainable means for survival and improvement of the environment. Of these access to safe and adequate water is one of the primary requisites. The information from various surveys and studies on urban low income shows that already the supply of water is inadequate and unsafe. In such circumstances the introduction of Rain Water Collection and use can go a long way to meet the water needs of the urban poor.

The main problems concerning rain water collection in the urban low income settlement areas are;

As there is no organized housing area there is lack of services for the poor. The slums are temporary structures in high density conditions whereas squatters are mainly on the low land areas and on public land such as embankments, railway sides, road sides. Water is usually collected by the women from nearby sources i.e. drinking water is collected from tube wells or house supplies. For other purposes water normally is used from ponds, ditches etc. The overall use of unsafe and inadequate water renders these large segments of population victims to wide variety of diseases and the women and children are the worst sufferers.

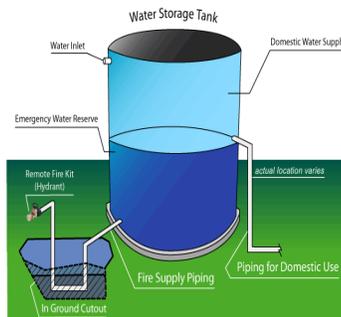
Providing jars for individual collection by families in the slum and squatter communities will go a long way in meeting individual household needs. This has been a common practice in the slums and low income areas of Bangkok city for decades. Such practice in our country will simplify the domestic works for the women who can devote time to income generating activities.

In this situation rain water collection and use must be carried out through collection from community used buildings i.e. schools, clinics, mosques and community centers.

Use of rainwater as a component of sanitation through supply of water to the domestic and public toilets will go a long way if this is taken up as a municipal policy immediately.

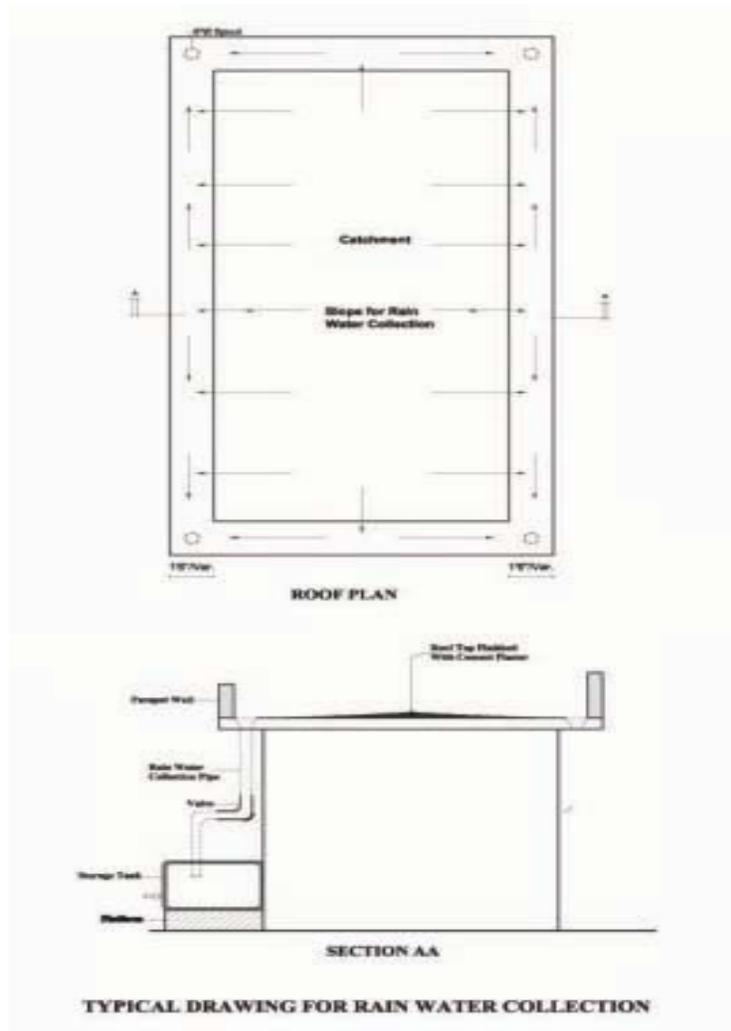


Rain Water Collection for C.I. Roof



Rain Water Collection Jar

Source: bluegranola.com, sherwoodinstitute.org, wateraid.org



Source: Buildtech (Unicef Project)